# Sydney Metro West
# Eastern Creek Precast Facility

## Review of Environmental Factors Determination Report

March 2021

Cover: A precast facility used on the Sydney Metro City & Southwest project.

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# 1. Introduction

## 1.1. Sydney Metro West

Sydney Metro West will be Sydney's next underground railway connecting Greater Parramatta and the Sydney CBD. This once-in-a-century infrastructure investment will transform Sydney for generations to come, doubling rail capacity between the two CBDs, linking new communities to rail services and supporting employment growth and housing supply.

The new metro rail will become the easiest and fastest journey between Parramatta and the Sydney CBD, with a travel time target between the two centres of about 20 minutes.

Sydney Metro West involves the construction and operation of about 24 kilometres of underground metro rail between Westmead and Sydney CBD. Stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Sydney CBD. Construction of the project is already underway.

## 1.2. Background

The proposed work as outlined in the Eastern Creek Precast Facilities – Review of Environmental Factors (REF) includes the construction and operation of two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The proposal is located on Lenore Drive, Eastern Creek, within the Blacktown City Council local government area (the proposal site). The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other.

The increased precast production capacity at the proposal site would provide the ability to align the production of precast segments with the delivery strategy of Sydney Metro West, while supporting multiple tunnelling contract packages concurrently.

The precast facilities do not form part of the Sydney Metro West Critical State Significant Infrastructure planning application (SSI-10038), which is being assessed and determined separately. However, Sydney Metro West is considered to be related development as the construction and operation of the precast facilities (this proposal) would support the delivery of Sydney Metro West. Chapter 7 of the REF provides an overview of the Sydney Metro West project and a summary of the potential environmental impacts associated with carrying out the work for that project.

Sydney Metro, a NSW Government agency, is the proponent and a determining authority for this proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Eastern Creek Precast Facilities REF was prepared to describe the proposal, document potential impacts of the proposal on the environment and detail the mitigation measures to be implemented. The REF was publicly exhibited from 16 November 2020 to 4 December 2020 to allow stakeholders, including members of the community, to provide feedback on the proposal for consideration in the assessment and determination process.

# 2. Proposal

The proposal, as described in the REF would comprise the following key features and activities:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate and adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
    - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
    - Boiler, aggregate bins and consumables
    - Office facilities
    - On-site parking for up to 60 light vehicles
- Internal roads (one lane in each direction) with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate assessment and determination). Sydney Metro is working with Transport for NSW to provide access to the proposal site from Lenore Drive, via a new section of Archbold Road and a Western Access Road between the northern and southern precast sites. An Addendum to the Archbold Road Upgrade and Extension REF (Transport for NSW, 2017) details this work and is subject to determination by Transport for NSW. As a result, the proposal does not include any external road works. Further extensions to Archbold Road would be completed at a later stage
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The proposal would be temporary, operating for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West.

# 3. Amendments to the proposal

Following the exhibition of the REF, further hydraulic assessment and drainage modelling for the proposal has been undertaken to inform the detailed design of the water management infrastructure required to manage surface water and stormwater runoff across the proposal site, as described in Chapter 5 of the REF.

Hydraulic assessment and drainage modelling was undertaken to identify the appropriate size and location of water management infrastructure required during construction and operation of the proposal. As a result of this detailed assessment, amendments have been made to the exhibited proposal to include sufficient area for two basins to manage the modelled stormwater and surface water runoff.

An area to the north of the proposal site consists of a farm dam that would be reconstructed to the required size to capture surface water and stormwater runoff. This location was identified because the natural fall of the northern precast site drains north towards the existing dam. Locating the two basins to the north would therefore minimise the volume of

earthworks and grading required elsewhere throughout the proposal site and provide an opportunity to utilise the existing farm dam.
The proposal site and the proposed basins to the north would form an amended proposal site boundary, hereafter referred to as the amended proposal site.

The two basins proposed to manage surface water and stormwater impacts include:

- A detention basin to manage stormwater flows across the amended proposal site
- A bioretention basin to manage water quality of surface water and stormwater runoff.

The design of the amended proposal has been based on the objectives and principles of Water Sensitive Urban Design, to meet stringent pollutant reduction targets.

The amended proposal site boundary is shown in Figure 3-1.

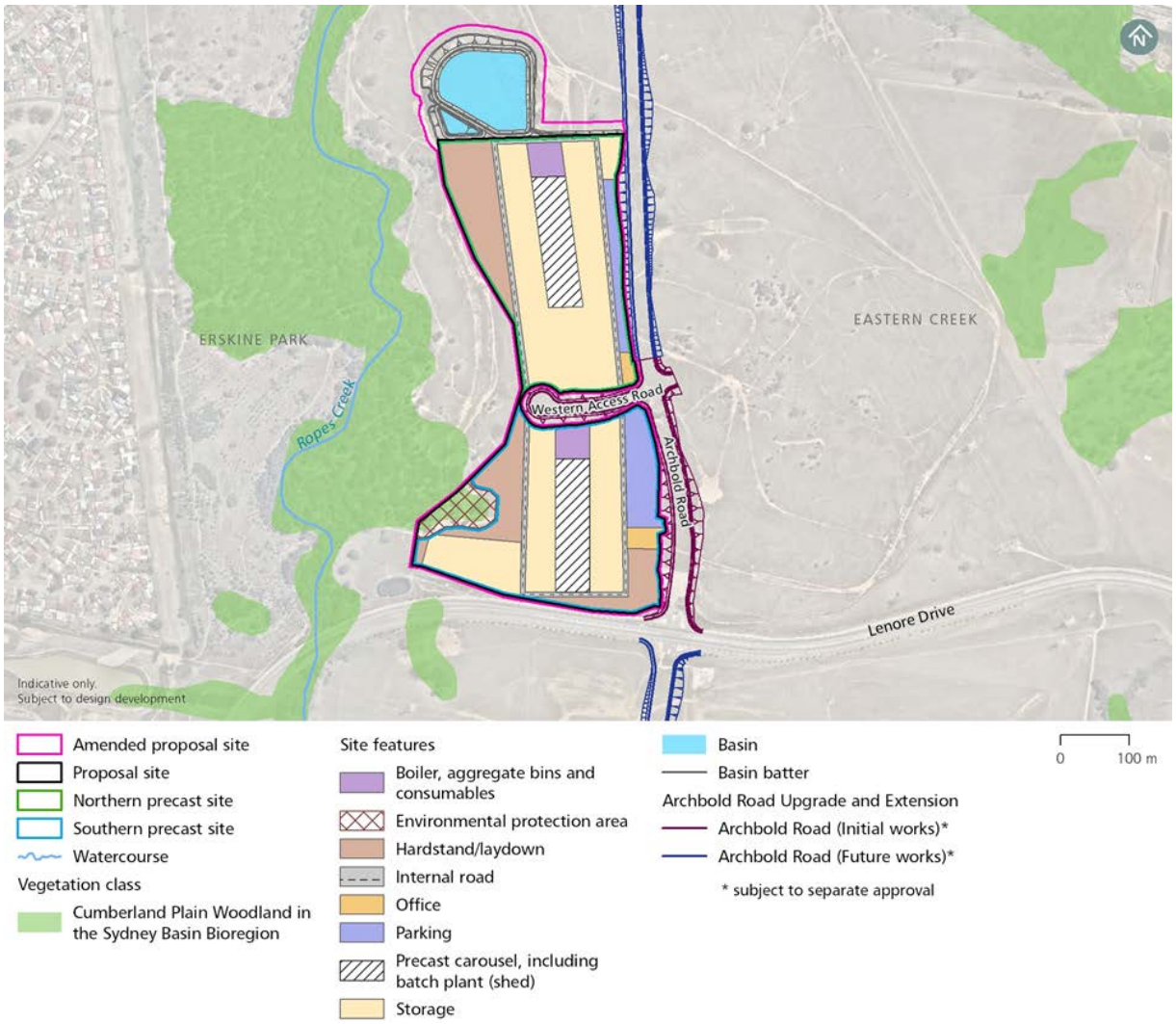



**Figure 3-1: The amended proposal site layout**

Consideration of each environmental issue, as assessed in the exhibited REF, was carried out to determine the potential for change to the impacts and, where required, further assessment of the potential impacts of the amended proposal undertaken. Further information on the design, construction activities, and assessment of the relevant environmental issues for the amended proposal are provided in an Addendum Report (Appendix B of this Determination Report).

# 4. Review of Environmental Factors

An assessment of relevant environmental issues of the proposal is provided in Section 8 (Environmental impact assessment) of the exhibited REF. The exhibited REF is included as Appendix A to this Determination Report.

An assessment of the relevant environmental issues of the amended proposal (to include the two proposed basins) is provided in the Addendum Report (Appendix B to this Determination Report).

The following key potential environmental impacts were identified for the proposal as exhibited in the REF and assessed as part of the Addendum Report.

## 4.1. Aboriginal heritage

The preparation of an Aboriginal Heritage Impact Permit (AHIP), supported by test excavation and comprehensive Aboriginal stakeholder consultation, would be completed to manage potential impacts to Aboriginal heritage. This would be undertaken in accordance with Sydney Metro's Construction Environmental Management Framework, which includes heritage management objectives to minimise impacts on items or places of heritage value, avoid accidental impacts on heritage items, and maximise workers' awareness of Aboriginal heritage.

The proposal as identified in the exhibited REF would result in the partial to total loss of value of 10 Aboriginal sites. The overall archaeological significance of seven of these sites has been assessed as low. One site, RCAS 09 (AHIMS ID 45-5-5355) has been assessed as having moderate overall significance and two sites (AHIMS ID 45-3-3159 and AHIMS ID 45-5-0559) having high overall significance. One of the sites, AIF-06 (AHIMS ID 45-5-4599) is also within the boundary of the planned Archbold Road upgrade and extension.

The assessment has since been revised to reflect amendments to the proposal. Based on the revised construction footprint, the amended proposal would result in the partial to total loss of value of an additional three sites, therefore the amended proposal would impact a total of 13 sites. Of these additional sites within the northern part of the amended proposal site, two sites have been assessed as having low overall significance and site RCAS 13 (AHIMS ID 45-5-5441) has been assessed as having moderate overall significance. A portion of one previously recorded AHIMS site (Blacktown Southwest 7 - AHIMS ID 45-5-0559) is also located within the northern part of the amended proposal site, which has been assessed as having high overall significance. This is outlined in Section 3.5 and Appendix B of the Addendum Report.

Sydney Metro and the relevant parts of Transport for NSW would coordinate any future Aboriginal Cultural Heritage Assessment Report(s) and AHIP application(s).

## 4.2. Non-Aboriginal Heritage

There are no listed heritage items or potential heritage items identified within the amended proposal site and immediate surrounds. As such, there would be no physical or visual impacts to known heritage items as a result of the amended proposal and no impacts from vibration or settlement.

The amended proposal site is located within the development of the Chatsworth Estate (mid-19th century – mid-20th century), which has been assessed as having moderate potential to contain intact archaeological remains. Should intact artefact bearing deposits associated with the Chatsworth Estate be identified, these would be considered locally significant archaeological 'relics' and protected under the relics provision of the *Heritage Act 1977*. All other archaeological remains within the amended proposal site are unlikely to meet the threshold for local significance.

Excavation works would aim to avoid the area of moderate potential for locally significant archaeological relics associated with the Chatsworth Estate where possible. Should excavation works in this area be unavoidable, a program of archaeological monitoring would be implemented. If necessary, a s140 Excavation Permit granted under section 141 of the *Heritage Act 1977* would be obtained from Heritage NSW prior to the commencement of excavation works.

Non-Aboriginal heritage impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework.

## 4.3. Biodiversity

The proposal has sought to minimise impacts to biodiversity, including through establishing an environmental protection area to retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Construction of the proposal as exhibited in the REF would require clearing of about 1.92 hectares of native vegetation, a subset of which included the following Threatened Ecological Communities (TEC) at the time of assessment:

- 1.74 hectares of Cumberland Plain Woodland in the Sydney Basin Bioregion (*Biodiversity Conservation Act 2016* (BC Act): listed as critically endangered)
- 0.07 hectares of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)
- <0.001 hectares of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 hectares of the associated BC Act listed Cumberland Plain Woodland community.

This vegetation provides habitat (or has the potential to support) other protected threatened species.

The amended proposal to include the basins to the north of the exhibited proposal area would result in the removal of a further 1.06 hectares of native vegetation, including River-Flat Eucalypt Forest and Cumberland Plain Woodlands, which are listed under the BC Act as an endangered and critically endangered community, respectively. Following exhibition of the REF, the River-Flat Eucalypt Forest was listed as critically endangered under the EPBC Act, as River-Flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria (effective 15 December 2020). Therefore, the vegetation in the northern part

of the amended proposal site was subject to assessment under the new EPBC Act listing. As discussed in the Addendum Biodiversity Assessment Report (Addendum BAR) (Appendix C of the Addendum Report), the extent of the River-Flat Eucalypt Forest in the northern part of the amended proposal site does not meet the minimum condition thresholds listed in the conservation advice and therefore is not eligible for inclusion under the EPBC Act.

The additional proposal area increases the total amended proposal impacts to 2.98 hectares of native vegetation. The amended proposal would also include the removal of 49 *Grevillea juniperina subsp. juniperina* plants (listed as vulnerable under the BC Act), and opportunities for translocation would be further investigated. The biodiversity impacts of the amended proposal do not change the overall findings of the exhibited REF. Therefore, no offsets are required for the amended proposal under the BC Act or the EPBC Act.

Assessments of significance have been undertaken for threatened species under the BC Act and Matters of National Environmental Significance under the EPBC Act based on the amended proposal. In summary, the amended proposal is unlikely to result in a significant impact to any Matter of National Significance or BC Act species considered to have a moderate or high likelihood of occurring in the amended proposal site. The amended proposal site is also unlikely to significantly change the assessment of indirect construction impacts that are documented in the exhibited REF.

Biodiversity impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework. The Construction Environmental Framework includes biodiversity management objectives to maximise workers' awareness of biodiversity values and avoid or minimise potential impacts to biodiversity, and requirements for pre-clearing surveys to be completed prior to native vegetation clearing.

## 4.4. Cumulative construction impact

Co-ordination and consultation with relevant stakeholders (including the relevant parts of Transport for NSW) would occur where required to manage the interface of projects under construction at the same time. Potential temporary cumulative impacts with other projects, on noise and vibration, traffic and transport, Aboriginal heritage, non-Aboriginal heritage flooding and biodiversity, may occur given the potential overlap with other projects including the planned Archbold upgrade and extension.

Further detailed construction planning and coordination with stakeholders would be undertaken to manage potential cumulative impacts.

# 5. Clarifications on the Review of Environmental Factors

Since the exhibition of the REF, Sydney Metro has identified some parts of the REF that would benefit from further explanation or clarification. These are identified in Table 5-1.

Table 5-1 Clarifications on the REF

| Relevant section of the REF | Explanation / Clarification |
|---|---|
| 2.1 – Need for the Proposal | The proposal is required as the precast facility at the Clyde stabling and maintenance facility construction site proposed as part of the Sydney Metro West project would not provide sufficient space or be able to meet the productivity requirements to support the Sydney Metro West delivery strategy. The REF states that while tunnelling works are still underway, the precast facility at Clyde would need to be decommissioned for the land to support future construction activities, including fit out of the tunnels.<br>The benefit of having additional precast facilities (subject of the proposal) is that it provides greater flexibility to support the delivery strategy and could enable the land for the precast facility at Clyde to be repurposed when required to support other construction activities.<br>The Eastern Creek precast site would be able to be used over the entire duration of Sydney Metro West tunnelling works, improving construction efficiencies. |
| 3 – Options Development and selection | Option 3 as described in Section 3.1.3 of the REF is to establish additional precast facilities at a new location.<br>Sites that were considered during the options assessment were required to have sufficient size to establish two separate precast facilities, to meet the precast segment production requirements for Sydney Metro West.<br>The tunnel works for the construction of Sydney Metro West have been split into multiple tunnelling packages with each to be completed by separate construction contractors. The requirement for two separate precast facilities is therefore necessary to improve construction programming outcomes, by allowing the operation of two separate facilities simultaneously by different construction contractors (responsible for the separate tunnelling packages).<br>Based on the above requirements, the option of one precast facility was not considered in the options assessment as it would not provide the required operational outcomes to support construction of Sydney Metro West. |
| 8.8.3 – Potential Impacts – Construction visual amenity impacts | The REF states: “During construction at night there would be a negligible temporary visual impact. Works would generally be scheduled during standard construction hours and any minor lighting associated with the proposal would be absorbed into the broader industrial setting, resulting in no perceived reduction in the amenity of views in the local area, which has a moderate sensitivity level.”<br>To further explain, construction works would generally be scheduled during standard construction hours. However, there are a number of activities that may be carried out outside of the standard day time construction hours which would include:<br>• Work determined to comply with the relevant noise management level at the nearest sensitive receiver<br>• The delivery of materials outside approved hours as required by the NSW Police or other authorities for safety reasons<br>• Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm<br>• Situations where agreement is reached with affected receivers.<br>As such, the Landscape and Visual Impact Assessment undertaken for the REF included an assessment of potential night-time visual impact during construction and operation, including the assumptions that construction would generally occur during standard construction hours and that the proposal would operate 24 hours a day, seven days a week. The Landscape and Visual Impact Assessment as provided in Appendix D of the REF concluded that during night-time construction there would generally be low-level security lighting within the proposal site at night, however as this is a location of medium district brightness and of low sensitivity, this would result in a negligible visual impact at night.<br>Lighting of the sites would be orientated to minimise glare and light spill impacts on adjacent receivers in accordance with AS4282:2019.<br>If out-of-hours works are required during construction, Sydney Metro would obtain any necessary approvals. |

<table>
<tr><th>Relevant section of the REF</th><th>Explanation / Clarification</th></tr>
<tr><td>8.16.2 – Cumulative impacts – Aboriginal heritage</td><td>
The REF includes an assessment of the cumulative impact to Aboriginal heritage, considering the Transport for NSW Archbold Road Upgrade and Extension adjacent to the proposal site, which is expected to begin construction in early 2021.<br><br>
The Aboriginal Cultural Heritage Assessment Report undertaken by Kelleher Nightingale (2017) for the planned Archbold Road Upgrade and Extension concludes the project would directly impact on ten Aboriginal heritage sites (one of which overlaps with the Eastern Creek Precast Facilities proposal site). Six of these Aboriginal heritage sites were covered by existing/pending Aboriginal Heritage Impact Permits (AHIPs) at the time of the assessment (2017), allowing for their recording and removal. The four remaining Aboriginal heritage sites would result in partial or total loss as a result of the development.<br><br>
As discussed in Section 8.5 (Aboriginal heritage) of the REF, construction of the proposal would result in the partial or total loss of ten identified Aboriginal sites, one of which overlaps the Archbold Road Upgrade and Extension boundary. This Aboriginal site that overlaps the two project boundaries would be directly impacted by the planned Archbold Road Upgrade and Extension.<br><br>
Assessment of the cumulative impacts in Section 8.16.2 of the REF stated that construction on the proposal site and the planned Archbold Road upgrade and extension footprint would impact on fifteen identified Aboriginal heritage sites in total. Following further review, an inconsistency in the total impacted sites has been identified which resulted in a greater cumulative impact being presented. The planned Archbold Road Upgrade and Extension would directly impact on eight (previously assessed as ten) Aboriginal heritage sites (one of which overlaps with the Eastern Creek Precast Facilities proposal site). Four (previously assessed as six) of these Aboriginal heritage sites are covered by existing/pending Aboriginal Heritage Impact Permits (AHIPs) allowing for their recording and removal.<br><br>
As identified in the Addendum Report (Appendix B of this Determination Report), based on the revised construction footprint, the amended proposal would result in the partial to total loss of value of an additional three sites, therefore the amended proposal would impact a total of 13 sites. Of these additional sites within the northern part of the amended proposal site, two sites have been assessed as having low overall significance and site RCAS 13 (AHIMS ID 45-5-5441) has been assessed as having moderate overall significance. A portion of one previously recorded AHIMS site (Blacktown Southwest 7 - AHIMS ID 45-5-0559) is also located within the northern part of the amended proposal site, which has been assessed as having high overall significance.<br><br>
Construction of the amended proposal and the planned Archbold Road Upgrade and Extension footprint would impact on 20 identified Aboriginal heritage sites in total, reducing the Aboriginal archaeological potential and values of the region. This clarification and assessment of the cumulative impacts on Aboriginal Heritage is tabulated below:
<table>
<tr><th>Project</th><th>Aboriginal heritage sites impacted</th><th>Aboriginal sites covered under an existing AHIP (allowing for recording and removal)</th></tr>
<tr><td>Archbold Road Upgrade and Extension</td><td>8 (noting 1 site overlaps with the construction footprint of the proposal)</td><td>4 sites are covered under an existing AHIP</td></tr>
<tr><td>Eastern Creek Precast Facilities (exhibited REF)</td><td>10 (noting 1 site overlaps with the construction footprint of the Archbold Road Upgrade and Extension)</td><td>0</td></tr>
<tr><td>Eastern Creek Precast Facilities basins (northern portion of the amended proposal site)</td><td>4 (noting 1 site overlaps with the construction footprint of the exhibited REF)</td><td>0</td></tr>
<tr><td>Total</td><td>20 sites in total are impacted <u>(16 of which are not covered under an existing AHIP)</u></td><td>4 sites are covered under an existing AHIP</td></tr>
</table>
Based on this assessment, cumulative impacts would be appropriately managed through the mitigation measures as outlined in the Addendum Report and exhibited REF. Sydney Metro
</td></tr>
</table>

| Relevant section of the REF | Explanation / Clarification |
|---|---|
| | would continue to work with Transport for NSW so that impacts to Aboriginal heritage are managed and minimised where possible. |

# 6. Consultation

## 6.1. Public exhibition of the Review of Environmental Factors documentation

The REF was placed on public exhibition from 16 November 2020 to 4 December 2020 and the community and stakeholders were invited to provide their feedback on the REF. Due to the minor nature of the amendment to the proposal and since the potential impacts associated with the amended proposal can be appropriately managed in accordance with the mitigation measures outlined in the Addendum Report and exhibited REF, the amended proposal was not placed on further public exhibition.

Table 6-1 lists the consultation activities undertaken to engage with the community and stakeholders during the public exhibition of the REF. The REF for the proposal was made available online via the Sydney Metro website and interactive portal. As the project progresses, activities will be carried out in line with the requirements of the Sydney Metro Overarching Community Communications Strategy.

**Table 6-1 Consultation activities**

| Engagement tool | Activity |
|---|---|
| Proposal website and interactive portal | Project information and the REF were available for download via the Sydney Metro website and the Sydney Metro West interactive portal throughout the public exhibition period. |
| REF display | Copies of the REF were distributed to St Claire Library and Blacktown City Council. |
| REF newsletter | A REF newsletter providing an overview of the proposal was made available on the Sydney Metro website. The newsletter was also distributed via letterbox drop to about 1,200 residential properties and 360 businesses within about 1 to 3 km of the proposal site.<br>The newsletter notified the community and local businesses about the proposal, provided information about the works and likely impacts and how to make a submission. |
| Place Manager | A dedicated Sydney Metro Place Manager personally contacted nearby community and businesses to share details of the REF and provided details of how they could comment and make a submission. The Place Manager also responded to community members seeking more information on the REF and the project. |
| Stakeholder briefings | A briefing was provided to Local Member of Parliament, Ms Tanya Davies MP and the NSW Office of Strategic Lands.<br>Information was emailed to Blacktown City Council and Penrith City Council, and briefings were offered. |
| Electronic direct mail | An email was sent to a targeted email distribution list. |
| Community information session | No community information sessions were held due to social distancing requirements. |

| Engagement tool | Activity |
|---|---|
| Contact mechanisms | The following were public communication channels established prior to the public exhibition of the REF:<br>Enquiries phone line: 1800 171 386<br>Email: sydneymetro@transport.nsw.gov.au<br>Interactive portal: sydneymetro.info/metrowest<br>Postal address: Sydney Metro, PO Box K659, Haymarket NSW 1240 |
| Advertisements | No adverts placed as no local papers were being printed. |

## 6.2. Submissions

One submission on the REF was received from Blacktown City Council. Key issues raised in the submission included:

- Water conservation initiatives that could be implemented at the site to minimise potable water use and investigate options for non-potable water use during concrete production
- Recommendations to revise the pollutant reduction targets to improve water quality objectives
- Encroachment of fill levels on land zoned as RE1 (Public Recreation) under the Blacktown Local Environmental Plan 2015.

The proposal would include a number of water use targets during construction and operation, which would support the sustainability principles for Sydney Metro West as outlined in Section 8.15.1 of the exhibited REF. This also includes the requirement to identify and implement opportunities for treatment and reuse on the proposal, including water from concrete batching and casting facilities. Opportunities for the collection of and treatment of non-potable water across the construction site would also be considered where feasible and reasonable during detailed design.

The water management infrastructure would be designed to meet the pollutant reduction targets to improve the water quality of discharges from the proposal site when compared to pre-development flows. This is further discussed in the Addendum Report (Appendix B of this Determination Report).

About 0.18 hectares of the north-west corner of the amended proposal site would be located on land zoned as RE1 (Public recreation). This land would be used for the construction and operation of water management infrastructure comprising the proposed basins for the amended proposal. This land is within the land leased by Sydney Metro from the Office of Strategic Lands for the purpose of the proposal. No works would take place within the land zoned as E2 Environmental Conservation. The proposed environmental protection area to the south-west of the proposal site would be demarcated prior to construction to provide an adequate buffer to avoid any ecological impacts on this conservation area.

A detailed response to the issues raised in the submission is provided in Appendix C.

## 6.3. Proposed future engagement

Sydney Metro is committed to consulting with the community and other stakeholders throughout the life of the project. Community and stakeholder engagement activities would

continue prior to and during construction. Community and stakeholders would be provided with project updates by the following means:

- Works notifications distributed via targeted letterbox drops, email and uploaded to the project website
- Updates to the project website sydneymetro.info/metrowest
- Clear signage at construction site
- Doorknocking properties where required
- Stakeholder meetings and briefings (as required)
- Channels for the community to contact the project team including a 24-hour project information phone line, email and post
- Project email list (subscription based)
- Complaints management process
- Sydney Metro Place Manager for direct community and stakeholder contact.

# 7. Determination

In order for the proposed activity to proceed, Sydney Metro must examine and take into account to the fullest extent practicable the environmental impacts of the proposed activity in accordance with Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The objectives of this Determination Report are to:

- Assess the environmental impacts in respect of the proposed activity, which are detailed in the REF and the Addendum Report (Appendix B of this Determination Report)
- Determine the significance of those impacts
- Address the relevant matters under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in respect to the proposed activity.

This report has been prepared having regards to, among other things, the objective of Sydney Metro under the *Transport Administration Act 1988* to conduct its operations in compliance with the principles of ecologically sustainable development contained in Section 6(2) of the *Protection of the Environment Administration Act 1991.*

# 8. Statutory and planning framework

## 8.1. NSW legislation and regulations

### 8.1.1. Environmental Planning and Assessment Act 1979

The EP&A Act regulates land use planning and development in NSW. The proposal constitutes an ‘activity’ for the purposes of Part 5 of the EP&A Act by reason of clause 79 of the ISEPP – refer to Section 8.1.2. As such, the proposal is permissible without development consent.

Sydney Metro is a determining authority in respect of the activity for the purposes of Part 5 of the EP&A Act.

Section 5.5 of the EP&A Act requires Sydney Metro to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity. Section 8 of the REF assesses the likely effect of the proposal on the environment and threatened species, populations and ecological communities. Having regard to the provisions of Sections 5.5 and 5.7 of the EP&A Act, the proposal is not likely to significantly affect the environment or threatened species and therefore neither an Environmental Impact Statement, nor a Species Impact Statement is required.

### 8.1.2. State Environmental Planning Policy (Infrastructure) 2007

One of the aims of the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) is to provide a consistent planning regime for infrastructure and the provision of services across NSW. Part 3 of the ISEPP identifies the development controls for certain types of infrastructure or services, including port, wharf or boating facilities; railways; and road infrastructure facilities. The development controls specify the following planning categories:

- Development permissible without consent
- Development permissible with consent
- Exempt development
- Prohibited development
- Complying development.

Clause 79 clause 2(a)(v) of ISEPP outlines that temporary facilities for the management of railway construction that are in or adjacent to a rail corridor, are permissible without the need for development consent under Part 4 of the EP&A Act when undertaken by a public authority. Under clause 78, the proposal site is considered a rail corridor as it is land owned or leased by a public authority (Sydney Metro) for the purpose of railway or rail infrastructure facilities (being Sydney Metro West). The proposal would support the construction of the proposed Sydney Metro West by producing precast concrete segments required for tunnelling works. By virtue of the above, the proposal is permissible without development consent.

Division 1 of Part 2 of ISEPP also contains provisions for public authorities to consult with local councils and other agencies prior to the commencement of certain types of development. Chapter 6 of the REF discusses the consultation requirements of ISEPP and their relevance to the proposal. Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development.

Consultation, including consultation as required by the ISEPP (where applicable), is discussed in Section 5.0 of the REF.

## 8.2. Commonwealth legislation

### 8.2.1. Environment Protection and Biodiversity Conservation Act (EPBC) 1999

Under the EPBC Act, a referral to the Commonwealth Department of Agriculture, Water and the Environment is required for proposed ‘actions’ that have the potential to significantly impact on any Matter of National Environmental Significance, the environment in general, or

the environment of Commonwealth land (including leased land). An action may include a project, development, undertaking, activity, or series of activities. If the Commonwealth Minister for Environment determines that an approval is required under the EPBC Act, the proposed action is deemed to be a 'controlled action'. It must then undergo assessment and approval under the EPBC Act before the action is carried out. The Act provides that a proponent of an action that may be, or is, a controlled action must refer the proposal to the Minister for the Minister's decision as to whether the action is a controlled action.

The exhibited REF identified that the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest was identified as the only TEC in the exhibited ecological study area listed under the EPBC Act at the time of assessment (listed as critically endangered under the EPBC Act). As noted in Section 8.11 of the exhibited REF (Biodiversity), the proposal may result in partial clearing (<0.001 hectares) of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community.

The River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria was listed under the EPBC Act (critically endangered) on 15 December 2020. The River-Flat Eucalypt Forest in the northern part of the amended proposal area has been assessed to determine whether it would be included under the EPBC Act listing. The Addendum Biodiversity Assessment Report (Addendum BAR) (Appendix C of the Addendum Report) concluded that the extent of the River-Flat Eucalypt Forest in the northern part of the amended proposal site does not meet the minimum condition thresholds listed in the conservation advice and therefore is not eligible for inclusion under the EPBC Act.

Three threatened animal species listed under the EPBC Act are considered moderately likely to occur in the amended proposal site, including the Green and Golden Bell Frog (listed as endangered under the EPBC Act), the Swift Parrot (listed as critically endangered under the EPBC Act) and the Grey-headed Flying-fox (listed as vulnerable under the EPBC Act). No threatened plants listed under the EPBC Act are considered to have a moderate or higher likelihood of occurring. The proposal would result in a minor reduction in extent of suitable foraging habitat for the Green and Golden Bell Frog, Swift Parrot and Grey-headed Flying-fox.

The EPBC Act assessments of significance indicate that there is a high level of certainty that the impacts to threatened biodiversity for any Matter of National Environmental Significance are unlikely to be significant and an EPBC Act referral is not required. Refer to Appendix I of the REF (Biodiversity Assessment Report), Section 8.11 (Biodiversity) of the REF, and Appendix C of the Addendum Report for further information.

An EPBC search identified three Commonwealth land parcels within a one kilometre radius of the amended proposal site: a Director War Services Home, Telstra Corporation Limited and an unnamed site. Whilst the EPBC search tool does not explicitly identify the location of the sites, the site is not Commonwealth Land therefore the identified Commonwealth Land parcels are outside of the amended proposal site. The assessment provided in Chapter 8 (Environmental impact assessment) of the REF identified that there would not be a significant impact on any land, including land beyond the proposal site. In this regard the proposal would not have an impact on Commonwealth land and an EPBC Act referral is not required.

# 9. Environmental Management

Section 8 (Environmental management) of the REF outlines the approach to environmental management for the proposal. Section 9 of this Determination Report also includes Conditions of Approval to minimise and manage the impacts of the proposal (as amended).

## 9.1. Environmental management systems

The Sydney Metro environmental management system would be used to manage the construction of the proposal. The management system would provide the framework for implementing the environmental management measures documented in the REF, and any conditions of other approvals, licences or permits.

## 9.2. Environmental management plans

### Construction Environmental Management Framework

The Sydney Metro Construction Environmental Management Framework details the approach to environmental management and monitoring during construction, which will be applied to the proposal. The framework is a linking document between planning approval documentation (including commitments made within the REF) and construction environmental management documentation, which would be developed by the construction contractors.

The Construction Environmental Management Framework details the environmental, stakeholder and community management systems and processes for the construction of the proposal.

### Construction Noise and Vibration Standard

Noise and vibration impacts of the proposal would be managed in accordance with the Sydney Metro Construction Noise and Vibration Standard, which aims to manage noise and vibration levels where feasible and reasonable using a variety of mitigation measures. The Construction Noise and Vibration Standard provides guidance for managing construction noise and vibration impacts to provide a consistent approach to management and mitigation across all Sydney Metro projects.
The Standard also provides:

- A list of standard mitigation measures that would be implemented where feasible and reasonable
- Trigger levels (based on exceedances of noise management levels) for the implementation of additional mitigation measures.

### Construction Traffic Management Framework

Construction traffic impacts would be managed in accordance with the Sydney Metro Construction Traffic Management Framework. This framework provides an overall strategy and approach for construction traffic management, and an outline of the traffic management requirements and processes that would be applied. It establishes the traffic management processes and acceptable criteria to be considered and followed in managing impacts to the road network.

## 9.3. Operational Management

As noted in the REF and Addendum Report, it is not envisaged that there would be any substantial environmental impacts during the operation of the proposal. However, should any unforeseen environmental impacts develop during operation, these would be managed through implementation of mitigation measures.

# 10. Conditions of approval

The Determination is subject to compliance with the Conditions of Approval (CoA) in Table 10-1.

The Conditions of Approval are consistent with the management and mitigation measures in Section 8 of the REF, and as amended due to proposed project changes (refer to Section 3 of Appendix C).

**Table 10-1 Conditions of approval**

| Ref | Impact | Conditions |
|---|---|---|
| **Noise and vibration** | | |
| **NV1** | Construction noise and vibration | During construction, receivers that would potentially be affected by noise and/or vibration from the works would be appropriately notified before the relevant works start. |
| **NV2** | Construction airborne noise | Noise monitoring at the most affected receiver(s) would be undertaken at the start of construction works to check the levels are as predicted and to confirm that the standard mitigation measures are adequate, further mitigation measures would be considered and implemented where feasible and reasonable. |
| **Traffic and transport** | | |
| **T1** | Traffic incidents | In the event of a traffic-related incident, coordination would be carried out with Transport Coordination and/or other parts of Transport for NSW. |
| **T2** | Emergency vehicles access | Access to properties for emergency vehicles would be provided at all times. |
| **T3** | Road safety | All trucks would enter and exit the proposal site in a forward direction, where feasible and reasonable. |
| **T4** | Staff parking | All staff parking would be provided on-site and not on surrounding local streets. |
| **T5** | Road safety | The driver induction process would include safety awareness in relation to all road users, particularly pedestrians and cyclists at the proposal site access point at Archbold Road/Lenore Drive during construction. |
| **Landscape and visual character** | | |
| **LV1** | Visual impacts - construction | Where feasible and reasonable, the elements within the construction site would be located to minimise visual impacts (for example storing materials and machinery behind fencing). |
| **LV2** | Landscape and visual impact – operation | Sheds would be finished in a colour which aims to minimise visual impacts, if visible from areas external to the site. |
| **LV3** | Lighting impacts during operation | Lighting of the sites would be orientated to minimise glare and light spill impacts on adjacent receivers in accordance with AS4282:2019. |

| Ref | Impact | Conditions |
|---|---|---|
| **Aboriginal heritage** | | |
| **AH1** | Test excavation | Archaeological test excavation would be limited to the amended proposal site and undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010a) to confirm the geographic extent of RCIF 2 (AHIMS ID 45-5-3159), Blacktown Southwest 11 (AHIMS ID 45-5-0559), area of PAD identified within Ropes Creek Artefact Scatter 09 (AHIMS ID 45-5-5355), Blacktown Southwest 7 (AHIMS ID 45-5-0559) and RCAS 13 (AHIMS ID 45-5-5441).<br>Test excavation would be limited to areas subject to potential impacts by the proposal, and outside the area already salvaged and subject to impacts by the St Mary's Wastewater System Augmentation project. Archaeological test excavation would be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010a). |
| **AH2** | Consultation | As part of the preparation of the test excavation methodology and ACHAR, comprehensive Aboriginal stakeholder consultation would be carried out in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010b) and the *National Parks and Wildlife Regulation 2019*. |
| **AH3** | Aboriginal heritage | An AHIP would be submitted to the NSW DPC for those portions of the proposal site subject to impacts once test excavation is completed. The AHIP application would be supported by an ACHAR and test excavation report. |
| **AH4** | Overlapping impact | Sydney Metro would liaise with Transport for NSW regarding overlapping impacts to Aboriginal site AIF-06 (AHIMS ID 45-5-4599) and coordinating further assessment and management. |
| **AH5** | Unexpected finds | In the event that suspected Aboriginal ancestral remains are exposed during construction, the requirements of Section 3.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010) would be implemented. |
| **Non-Aboriginal heritage** | | |
| **NAH1** | Unexpected finds | An Unexpected Finds Procedure, to be implemented in the event that potential non-Aboriginal heritage objects are exposed during construction, would be prepared that complies with the *Heritage Act 1977*. |
| **NAH2** | Archaeological monitoring and s140 Excavation Permit | Excavation works would aim to avoid the area of moderate potential for locally significant archaeological relics associated with the Chatsworth Estate homestead where possible.<br>Should excavation works in this area be unavoidable, a program of archaeological monitoring would be implemented. If necessary, a s140 Excavation Permit granted under section 141 of the *Heritage Act 1977* would be obtained from Heritage NSW prior to the commencement of excavation works. |
| **NAH3** | Archaeological Methodology and Research Design | Any application for an Excavation Permit under the *Heritage Act 1977* would be accompanied by an Archaeological Methodology and Research Design (AMRD). The AMRD would outline the archaeological potential and significance of the area to be impacted and assess the impact of the proposed excavation works on those resources. The AMRD would provide appropriate methodologies for investigation, protection and/or avoidance of archaeological remains. |
| **Flooding** | | |
| **F1** | Potential increase in mainstream peak flood flows | Detailed design of the proposal site would include provision of appropriate onsite stormwater detention/flood detention facilities to cater for events up to and including the 1% AEP event. |

| Ref | Impact | Conditions |
|---|---|---|
| **F2** | Potential geomorphic impacts due to changed flow regime in low flows and frequent flood event | Detailed design of the proposal site would include the provision of appropriate on-site stormwater detention/flood detention facilities. Outlet sizing would be designed to satisfactorily mitigate potential increases in peak flows in frequent events. |
| **F3** | Potential impacts on overland flooding and drainage conditions | Detailed design of the proposal site would include the provision of appropriate flow diversion channels or culverts for management of external flows. |
| **F4** | Potential impacts on overland flooding and drainage conditions | Detailed design would integrate with the planned Archbold Road upgrade and extension cross drainage and road drainage outlets. |
| **F5** | Potential impacts on overland flooding and drainage conditions | Detailed design would provide appropriate scour protection works at channel/culvert discharge points to Ropes Creek. |
| **F6** | Potential impacts on the proposal resulting from flooding | Detailed design would provide filling to a height of at least 0.5m above Ropes Creek 1% AEP flood level. |
| **Soils and surface water** | | |
| **SW1** | Soil salinity | Prior to ground disturbance in high probability salinity areas, testing would be carried out to determine the presence of saline soils. If salinity is encountered, excavated soils would not be reused or it would be managed in accordance with Book 4 Dryland Salinity: Productive Use of Saline Land and Water (NSW DECC, 2008). Erosion controls would be implemented in accordance with Blue Book (Landcom, 2004). |
| **SW2** | Potential erosion and sedimentation | Erosion and sediment measures would be implemented in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004) and Volume 2D (NSW DECCW, 2008), commonly referred to as the 'Blue Book'. Additionally, any water collected from the proposal site would be appropriately treated and discharged to avoid any potential contamination or local stormwater impacts.<br>Temporary sediment basins would be designed in accordance with Managing Urban Stormwater: Soils and Construction and Managing Urban Stormwater, Volume 2D: Main Road Construction (DECC, 2008). |
| **SW3** | Wastewater discharge | Prior to discharge, wastewater would be treated to a level that is compliant with the ANZECC/ARMCANZ (2000) and ANZG (2018) default guidelines for 95 per cent species protection.<br>For the purposes of this management measure, during operation wastewater is defined as process water from operation of the precast facility and does not include surface runoff or stormwater. |
| **Contamination** | | |
| **C1** | Management of low risk contamination | For areas that have been identified as having moderate contamination impact potential, a further review of data would be performed.<br>Should the additional data review confirm that contamination is likely to have a very low or low impact potential, the areas would then be managed in accordance with the Soil and Water Management Plan for the proposal. This would typically occur where there is minor, isolated contamination that can be readily remediated through standard construction practices such as excavation and off-site disposal. |

| Ref | Impact | Conditions |
|---|---|---|
| **C2** | Detailed Site Investigation | Where data from the additional data review (mitigation measure C1) is insufficient to understand the impact of contamination, a Detailed Site Investigation would be carried out in accordance with the NEPM (2013) and other guidelines made or endorsed by the NSW EPA.<br>The areas requiring Detailed Site Investigation would be confirmed following the additional data review (C1), however on the basis of the PSCI, it is anticipated that a Detailed Site Investigation would be required to characterise fill materials, and sediment from dam / retention pond for on-site reuse and/or off-site disposal. Fly tipped wastes and deposited wastes (from former land use) would need to be characterised for off-site disposal. |
| **C3** | Remediation | Where data from additional data review (mitigation measure C1) or the Detailed Site Investigation (mitigation measure C2) confirms that contamination would have a moderate to very high risk, a Remedial Action Plan (RAP) would be developed for the area of the construction footprint.<br>The RAP would detail the remediation works required to mitigate impacts from contamination throughout and following completion of construction. The RAP would be prepared in accordance with relevant NSW EPA guidelines and where applicable, detail remediation methodologies in accordance with Australian Standards and other relevant government guidelines and codes of practice.<br>Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land.<br>The requirements for a RAP and remediation would be confirmed following the additional data review (mitigation measure C1) and Detailed Site Investigation (mitigation measure C2). |
| **C4** | Site audit statement | Where contamination is highly complex, such as significant groundwater contamination; contamination associated with vapour; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction, an accredited Site Auditor would review and approve the RAP and would develop a Site Audit Statement and Site Audit Report upon completion of remediation. The requirement for a Site Audit Statement would be confirmed following preparation of the RAP (mitigation measure C3). |
| **C5** | Residual contamination following construction | Ongoing management and monitoring measures would be documented in an appropriate form and implemented for any areas where minor, residual contamination remains following construction. |
| **C6** | Accidental leaks or spills – operation | The operational environmental management plan (OEMP) for the proposal would include an Emergency Response Plan (or equivalent) which would specify the procedure to be followed in the event of a spill, including the notification requirements and use of absorbent material to contain the spill. |
| **C7** | Contaminated soil - operation | Where contaminated soils are to remain on-site, an appropriate OEMP would be prepared and implemented. The OEMP would include relevant ongoing management requirements developed in accordance with the NEPM (2013) and relevant guidelines made or approved by the NSW EPA. Measures may include but are not limited to, including procedures for excavation works, inspections and audits. |

| Ref | Impact | Conditions |
|---|---|---|
| **C8** | Contaminated groundwater | Potential impacts from existing groundwater contamination (if present) during operation of the proposal would be managed through management and mitigation measures such as:<br>• Emplacement of appropriate topographic / drainage controls to minimise seepage and ponding of water across the site<br>• Drainage from sealed areas would be directed to stormwater drains (e.g. pipes, swales) via gross pollutant traps and sediment basins (if necessary) to mitigate potential impacts from sediments or wastes on receiving environments. |
| **Biodiversity** | | |
| **B1** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, the limits of the work zone, areas for parking and turning of vehicles and plant equipment would be clearly and accurately marked out. These areas would be located so that vegetation disturbance is minimised as much as possible and the drip-line of trees avoided. |
| **B2** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, exclusion zones would be identified and established around all vegetation to be retained, such as the environmental protection area in the west of the proposal site. Periodic monitoring would be undertaken to ensure all controls are in place and no inadvertent impacts are occurring. |
| **B3** | Potential impact to surrounding vegetation and threatened ecological communities | Materials, plant, equipment, work vehicles and stockpiles would be placed to avoid damage to surrounding vegetation and outside tree driplines. |
| **B4** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, personnel would be informed of the environmentally sensitive aspects of the proposal site, including plans for impacted and adjoining areas showing vegetation communities, important flora and fauna habitat areas, and locations where threatened species, populations or ecological communities have been recorded. Construction personnel would be made aware that any native fauna species encountered must be allowed to safely leave the proposal site where possible and a local wildlife rescue organisation or appropriately experienced ecologist must be called for assistance where necessary. |
| **B5** | Potential impact to surrounding vegetation and threatened ecological communities | Where possible, hollows would be cut out of hollow-bearing trees and re-established in large trees to the west of the proposal site to mitigate the loss of hollow habitat on fauna. |
| **B6** | Potential impacts to the Cumberland Plain Land Snail | Pre-clearing surveys for the Cumberland Plan Land Snail would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing to translocate any individuals that may be inhabiting areas that would be cleared or disturbed. This includes all areas of dumped rubbish across the proposal site. |
| **B7** | Potential impacts to the Cumberland Plain Land Snail | Prior to construction, exclusion zones would be established around Cumberland Plain Land Snails habitat in the environmental protection area. All personnel would be inducted to understand the exclusion zone to limit the potential of trampling snails |
| **B8** | Potential impacts to the Cumberland Plain Land Snail | Large woody debris cleared within the proposal site would be relocated into habitat to the west of the proposal site. |

| Ref | Impact | Conditions |
|---|---|---|
| **B9** | Potential impacts to the Green and Golden Bell Frog | Pre-clearing surveys for the Green and Golden Bell Frog would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing and dewatering of potential habitat to ensure that individuals have not inhabited the site. A suitably qualified ecologist would also be present during the dewatering of the habitat. A stop work in the immediate vicinity would be implemented if this species is identified on the proposal site, and then further consideration of approach to management of individuals on proposal site through consultation with a Green and Golden Bell Frog expert. |
| **B10** | Potential impacts to the Green and Golden Bell Frog | Any work in and around the suitable habitat during clearing would follow the Hygiene Protocol for the Control of Disease in Frogs (Department of Environment and Climate Change 2008b) to reduce the potential for introduction and spread of Chytrid fungus. |
| **B11** | Potential impacts from introduction and spread of weeds | Weed control would be undertaken by suitably qualified and/or experienced personnel. This may include:<br>• Manual weed removal in preference to herbicides<br>• Replacing non-target species removed/killed as a result of weed control activities<br>• Protecting non-target species from spray drift<br>• Using only herbicides registered for use within or near waterways for the specific target weed<br>• Applying herbicides during drier times when the waterway level is below the high-water mark<br>• Not applying herbicide if it is raining or if rain is expected<br>• Mixing and loading herbicides, and cleaning equipment away from waterways and drains. |
| **B12** | Potential impacts from introduction and spread of weeds | During construction, weed management would be undertaken in areas affected by construction prior to any clearing works in accordance with the *Biosecurity Act 2015* to ensure they are not spread to the surrounding environment; including during transport disposal off-site to a licenced waste disposal facility. |
| **B13** | Potential impacts from introduction and spread of weeds | All weeds, propagules, other plant parts and/or excavated topsoil material that is likely to be infested with weed propagules that are likely to regenerate would be treated on site or bagged, removed from site and disposed of at a licensed waste disposal facility. |
| **B14** | Potential impacts from introduction and spread of plant pathogens | During construction, all vehicles driving to and from the proposal site would follow a protocol to prevent the spread or introduction of phytophthora, namely vehicles would be clean, including the tyres and any equipment. |
| **B15** | Potential impact to surrounding vegetation and threatened ecological communities | The opportunity to translocate the forty-nine individuals of *Grevillea juniperina* subsp. *Juniperina* around Ropes Creek would be investigated and implemented if feasible and reasonable. |
| **B16** | Potential impacts related to fauna injury and mortality | A suitably qualified aquatic ecologist would be present during the dewatering of the northern dam. If native fish, turtle and/or frog species are found, they would be relocated into a similar aquatic environment by a trained aquatic ecologist under a Fisheries Permit issued by the NSW Department of Primary Industries. Sydney Metro would apply for a Fisheries Permit, if required. |
| **B17** | Potential impacts from the spread of exotic species | Water removed from the existing dam during dewatering would be filtered for *Salvinia molesta* and *Gambusia holbrooki* before releasing into surrounding environments to minimise the potential for spreading of these exotic species. |

| Ref | Impact | Conditions |
|---|---|---|
| **Resource use and waste management** | | |
| **WR1** | Compliance with legislative and policy requirements | All waste would be assessed, classified, managed, transported and disposed of in accordance with the Waste Classification Guidelines and the *Protection of the Environment Operations (Waste) Regulation 2014.* |
| **WR2** | Waste minimisation | Waste would be minimised by accurately calculating materials brought to the proposal site and limiting materials packaging. |
| **WR3** | Waste management | 100 per cent of usable spoil from construction would be reused, in accordance with the Sydney Metro spoil management hierarchy. |
| **WR4** | Reuse and recycling | Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities. |
| **WR5** | Waste tracking | A materials tracking system would be implemented for material transferred to offsite locations such as licensed waste management facilities. |
| **WR6** | Reuse and recycling | At least 95 per cent of inert and non-hazardous construction waste, excluding spoil, and at least 50 per cent of office waste would be recycled or alternatively beneficially reused. |
| **Air quality** | | |
| **AQ1** | Dust impacts during construction | The following best-practice dust management measures would be implemented during construction works:<br>• Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather<br>• Adjust the intensity of activities based on measures and observed dust levels and weather forecasts<br>• Minimise the amount of materials stockpiled and position stockpiles away from surrounding receivers<br>• Regularly inspect dust emissions and apply additional controls as required. |
| **AQ2** | Dust impacts during operation | The following best-practice dust management measures would be implemented during operation:<br>• Ensure that loads are covered and that haulage vehicles are cleaned to remove any loose debris before leaving the site<br>• Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather<br>• Position long-term stockpiles away from surrounding receivers<br>• Regularly inspect and where necessary clean sealed haulage roads to remove tracked materials. |
| **AQ3** | Exhaust emissions during construction and operation | Plant and equipment would be maintained in a proper and efficient manner. Visual inspections of emissions from plant would be carried out as part of pre-acceptance checks. |
| **AQ4** | Airborne hazardous materials uncovered during construction | The following best-practice measures would be implemented to manage airborne hazardous materials during construction:<br>• Temporary coverings or odour suppressing agents would be applied to excavated areas where appropriate<br>• Removal and disposal of hazardous materials would be undertaken in accordance with the relevant requirements in the *Work Health and Safety Act 2011, Work Health and Safety Regulation 2017* and any applicable guidelines. |

| Ref | Impact | Conditions |
|---|---|---|
| **Bushfire** | | |
| **BF1** | Bushfire protection measures | The proposal site would be managed as an Asset Protection Zone (APZ). The entire proposal site would be managed as an APZ as outlined within Appendix 4 of 'Planning for Bush Fire Protection 2019' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. The APZ would not extend into the environmental protection area in the south-west of the site. |
| **BF2** | Bushfire protection measures | Vulnerable buildings and/or critical assets would be constructed to appropriate BAL in accordance with the Australian Standard for the Construction of Buildings in Bushfire Prone Areas (AS3959). |
| **BF3** | Bushfire protection measures | The following measures would be implemented for access roads within the proposal site:<br>• Access roads would be two-wheel drive, all-weather roads<br>• Minimum 5.5 metre carriageway width kerb to kerb<br>• Maximum grades for sealed roads would not exceed 15 degrees and an average grade of not more than 10 degrees, or other gradient specified by road design standards, whichever is the lesser gradient<br>• Curves of roads would have a minimum inner radius of 6 metres<br>• Dead end roads would incorporate a minimum 12 metre outer radius turning circle, and would be clearly sign posted as a dead end<br>• A minimum vertical clearance of 4 metres would be provided to any overhanging obstructions, including tree branches. |
| **BF4** | Bushfire protection measures | The following water supply and utilities would be installed during construction and maintained during operation of the proposal:<br>• A minimum static water supply of 20,000 litres for firefighting purposes. The firefighting water can be available in a single tank or a number of tanks around the proposal site<br>• A hardened ground surface for truck access up to and within 4 metres of the water source<br>• A 65 millimetre metal Storz outlet with a gate or ball valve would be provided as an outlet on each of the tanks<br>• If the water tank is located above ground it would be of a non-combustible material<br>• If the water tank is located underground, it would have an access hole of 200 millimetres to allow tankers to refill direct from the tank.<br>• All associated fittings to the tank would be non-combustible. |
| **BF5** | Bushfire protection measures | Bushfire Emergency Management and Evacuation Plans would be developed for the construction and operation of the proposal. The bushfire evacuation procedures would be completed in accordance with NSW Rural Fire Service Guide to Developing A Bushfire Emergency Management Plan and meet the requirements of Australian Standard AS 3745-2010 – Planning for Emergencies in facilities. |
| **BF6** | Bushfire protection measures | Activities that generate sparks or excessive heat would be minimised when a total fire ban is declared by Rural Fire Service. |
| **Sustainability, climate change and greenhouse gas** | | |
| **SCC1** | Sustainability implementation | Sustainability initiatives would be incorporated into the detailed design and construction to support the achievement of the Sydney Metro West sustainability objectives. |
| **SCC2** | Sustainability implementation | Best practice level of performance would be achieved using market leading sustainability rating tools during construction and operation. |

| Ref | Impact | Conditions |
|---|---|---|
| **SCC3** | Greenhouse gas emissions | 25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction and operation of the proposal would be offset. |
| **SCC4** | Greenhouse gas emissions | An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a baseline inventory calculated at the detailed design stage. |
| **SCC5** | Climate change risks | Climate change risk treatments would be confirmed and incorporated into the detailed design. |
| **Cumulative impacts** | | |
| **CI1** | Cumulative impacts | Co-ordination and consultation with the following stakeholders would occur where required to manage the interface of projects under construction at the same time:<br>• Other parts of Transport for NSW<br>• Department of Planning, Industry and Environment<br>• Utility providers<br>• Construction contractors.<br>Co-ordination and consultation with these stakeholders would include:<br>• Provision of regular updates to the detailed construction program, construction sites and haul routes<br>• Identification of key potential conflict points with other construction projects<br>• Developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve:<br>- Adjustments to the Sydney Metro construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of other construction projects<br>- Co-ordination of traffic management arrangements between projects. |

# 11. Conclusion

The assessments in the REF and the Addendum Report (Appendix B) have been taken into account and it is concluded that the proposed activity is not likely to significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats.

Consequently, an Environmental Impact Statement is not required to be prepared under Division 5.1 of the EP&A Act. It is also considered that the proposed activity does not trigger the need for referral or approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The environmental impact assessment (REF, the Addendum Report and this Determination Report) is recommended to be approved subject to the Conditions of Approval contained in Section 10 this Determination Report.

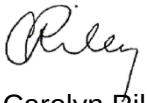
# Approval

## Review of Environmental Factors: Eastern Creek Precast Facilities

I, Carolyn Riley, Director Environment, Sustainability and Planning, Sydney Metro, state as follows:

*1.* I have examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity assessed in the Eastern Creek Precast Facilities - Review of Environmental Factors, the Addendum Report and this Determination Report in accordance with Section 5.5 of *the Environmental Planning and Assessment Act 1979.*

2. I determine, on behalf of Sydney Metro (the Proponent) that the proposed activity may be carried out in accordance with the Conditions of Approval in this Determination Report, consistent with the proposal described and mitigated in the Eastern Creek Precast Facilities - Review of Environmental Factors, the Addendum Report and this Determination Report.

**Signature:** 

**Name:** Carolyn Riley

**Title:** Director Environment, Sustainability and Planning

**Project:** Eastern Creek Precast Facilities

**Date:** **11/03/21**

# Appendix A  Review of Environmental Factors

# Sydney Metro West
# Eastern Creek Precast Facilities

## Review of Environmental Factors

### Volume 1 Main Document and Appendix A

November 2020

Cover: A precast facility used on the Sydney Metro City & Southwest project.

# Executive summary

Sydney Metro is proposing to construct and operate two adjacent precast facilities to support the construction of the proposed Sydney Metro West. The proposal is located in Eastern Creek within the Blacktown City Council local government area. The proposal would be located on Lenore Drive, Eastern Creek (the proposal site).

Sydney Metro West would connect Greater Parramatta with the Sydney CBD (central business district), and involve the construction and operation of around 24 kilometres of twin tunnels, between Westmead and Sydney CBD. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other.

It has been identified through detailed construction planning that additional precast facilities would be required to enable the efficient delivery of Sydney Metro West (including the section from The Bays to the Sydney CBD). Due to the scale of Sydney Metro West, the tunnelling and station excavation works have been separated into geographically-specific contract packages between Westmead and the Sydney CBD. Based on the delivery strategy for Sydney Metro West, multiple tunnelling packages would be in delivery at the same time and separate precast facilities would be required for each tunnelling contractor.

Additional precast capacity at the proposal site would provide the ability to align the production of precast segments with the delivery strategy, while supporting multiple tunnelling contractors concurrently.

The proposal would create around 120 jobs during construction and around 120 jobs during operation of the proposal.

Sydney Metro, a NSW Government agency, is the proponent and determining authority for this proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The purpose of this Review of Environmental Factors (REF) is to describe the proposal, to document potential impacts of the proposal on the environment, and to detail mitigation measures to be implemented.

## Description of the proposal

The proposal would comprise the following key features and activities:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate and adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
    - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
    - Boiler, aggregate bins and consumables
    - Office facilities
    - On-site parking for up to 60 light vehicles
- Internal roads (one lane in each direction) with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals). Sydney Metro is working with Transport for NSW to provide access to the proposal site from Lenore Drive, via a new section of Archbold Road and a Western Access Road between the northern and southern precast sites. An Addendum to the Archbold Road Upgrade and Extension REF (Transport for NSW, 2017) details this work and is subject to determination by Transport for NSW. As a result, the proposal does not include any external road works. Further extensions to Archbold Road would be completed at a later stage
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The facilities would operate concurrently, 24 hours a day, seven days a week for the majority of the lifespan of the project.

The proposal would be temporary, operating for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West.

The proposal site would be subdivided to create two separate lots, one for each precast facility.

A small portion located in the south-west section of the proposal site at Eastern Creek would be conserved as an environmental protection area associated with the presence of Cumberland Plain Woodland and Shale-Gravel Transition Forest. Vegetation within this area would be retained and protected during construction and operation of the proposal.

Key features of the proposal are shown in Figure 0-1.

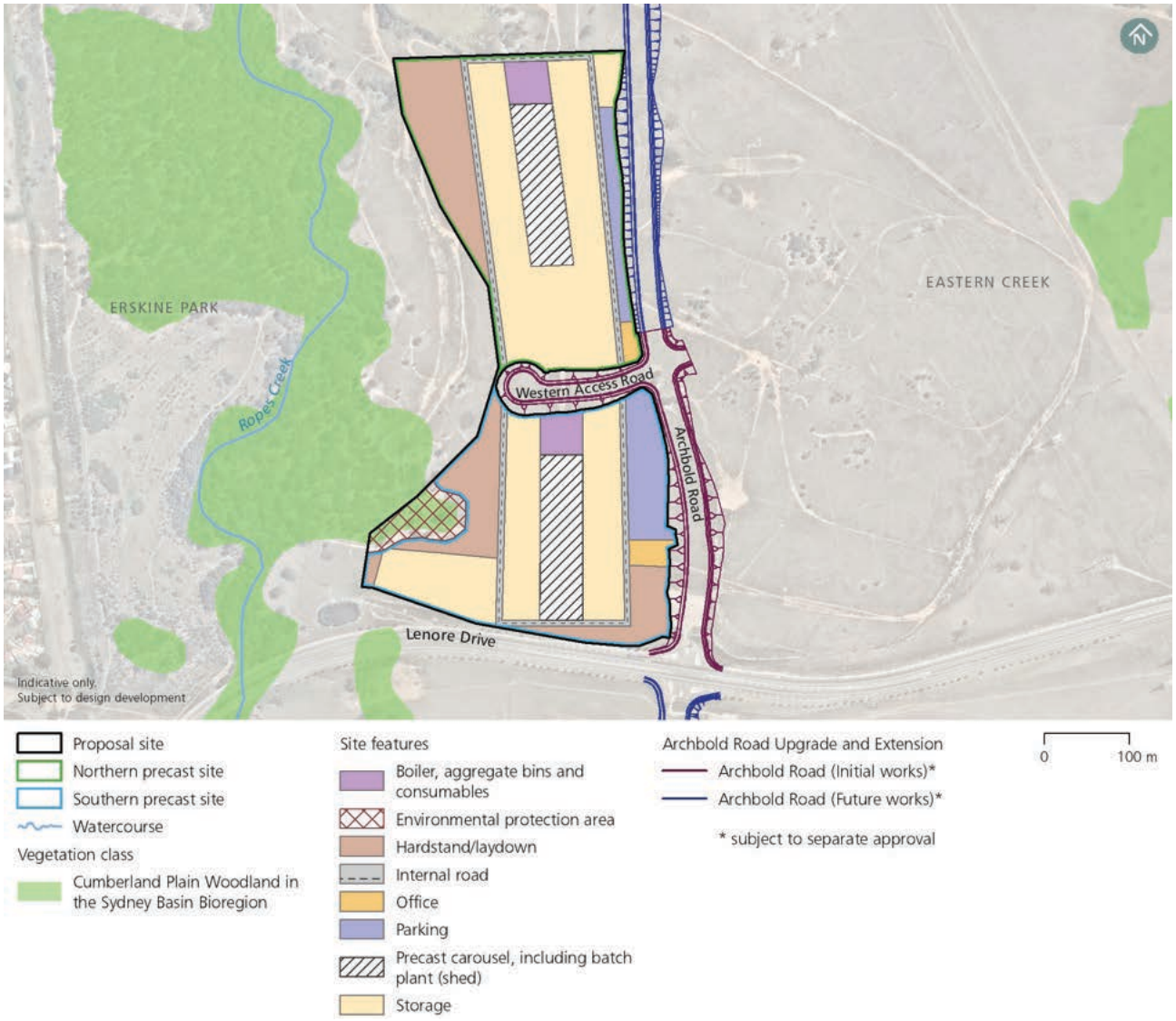



Figure 0-1: Indicative site layout

## Need for the proposal

Sydney Metro West would involve the construction and operation of a metro rail line between Westmead and Sydney CBD, including about 24 kilometres of underground twin tunnels. These tunnels would be lined with precast concrete segments which are erected by tunnel boring machines as they move forward. The need for Sydney Metro West is detailed in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a).

Stage 1 of the works for Sydney Metro West includes the tunnel and station excavation works from Westmead to The Bays. Future stage(s) of works, including tunnel excavation between The Bays and Sydney CBD, would be subject to future Environmental Impact Statement(s). While the design of major civil elements between Westmead and The Bays is well progressed, further planning is underway on elements such as tunnel alignment east of The Bays and through the complex Sydney CBD, and the overall delivery strategy for Sydney Metro West.

It has been identified through detailed construction planning that additional precast facilities would be required to enable the efficient delivery of Sydney Metro West (including the section from The Bays to the Sydney CBD).

Due to the scale of Sydney Metro West, the tunnelling and station excavation works have been separated into geographically-specific contract packages between Westmead and the Sydney CBD. Based on the delivery strategy for Sydney Metro West, multiple tunnelling packages would be in delivery at the same time and separate precast facilities would be required for each tunnelling contractor.

The precast facility at the Clyde stabling and maintenance facility construction site proposed as part of Stage 1 of the works for Sydney Metro West would not provide sufficient space or be able to meet the productivity requirements to support the Sydney Metro West delivery strategy. Furthermore, while tunnelling works are still underway, the precast facility at Clyde would need to be decommissioned for the land to support future construction activities, including fit out of the tunnels.

Additional precast capacity would provide the ability to align the production of precast segments with the delivery strategy, while supporting multiple tunnelling contractors concurrently. Precast facilities separate from the Clyde site would also be able to be used over the entire duration of Sydney Metro West tunnelling works, as they would not be required to be decommissioned to allow future construction activities to commence.

## Options considered

Options considered to provide precast segments for Sydney Metro West included a 'do nothing' option, the establishment of additional precast capacity within or adjacent to proposed Sydney Metro West construction sites, or the option of establishing and operating additional precast facilities at a new location.

The 'do nothing' option would not support the efficient delivery of construction works. The establishment of additional precast capacity within or adjacent to Sydney Metro West construction sites would require additional property acquisition, likely to be the acquisition of private residential, commercial or industrial land.

Constructing and operating additional precast facilities in a new location would allow the selection of a site with sufficient size to establish two standalone precast facilities, to meet precast segment production requirements for Sydney Metro West. This option would ensure Sydney Metro West has the capacity to meet the precast segment production requirements identified during the detailed construction planning phase of the project. This option would also minimise the need for private property acquisition as it would allow for the selection of government owned land for the proposal site.

Undertaking the proposal was identified as the preferred option, and is the subject of this REF.

## Statutory considerations

The EP&A Act provides for the environmental assessment of development in NSW. Part 5, Division 5.1 of the EP&A Act generally specifies the environmental impact assessment requirements for activities carried out by public authorities, such as Sydney Metro, which do not require development consent.

The proposal is categorised as a temporary facility, operating for an indicative timeframe of four to five years, for the management of railway construction (the construction of Sydney Metro West) that is in a rail corridor, pursuant to clause 79 clause 2(a)(v) of *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP). Under clause 78, the proposal site is considered a rail corridor as it is land owned by a public authority (Sydney Metro) for the purpose of railway or rail infrastructure facilities (being Sydney Metro West). As such, the proposal is permissible without consent under Part 4 of the EP&A Act when undertaken by a public authority. The proposal is not State Significant Infrastructure or State Significant Development and accordingly can be assessed under Division 5.1 of Part 5 of the EP&A Act.

This REF has been prepared to assess the construction and operational environmental impacts of the proposal. The REF has been prepared in accordance with clause 228 of the *Environment Planning and Assessment Regulation 2000*.

In accordance with section 5.5 of the EP&A Act, Sydney Metro, as the proponent and determining authority, must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. Based on the assessment contained in this REF, it is considered that the proposed activity is not likely to have a significant impact upon the environment.

Chapter 8 (Environmental impact assessment) of this REF presents the environmental impact assessment for the proposal, in accordance with these requirements.

## Environmental impact assessment

This REF assesses potential construction and operational environmental impacts of the proposal. Management and mitigation measures would be implemented to minimise the potential impacts of the proposal.

Due to the location of the proposal and its distance from the nearest receivers, the potential amenity related impacts (such as noise and air quality) associated with the construction and operation of the proposal would be negligible to minor.

The following potential key impacts have been identified:

- **Aboriginal heritage:** The preparation of an Aboriginal Heritage Impact Permit (AHIP), supported by test excavation and comprehensive Aboriginal stakeholder consultation, would be completed to manage potential impacts to Aboriginal heritage. The proposal would result in the partial to total loss of value of 10 Aboriginal sites. The overall archaeological significance of seven of these sites has been assessed as low. One site, RCAS 09 (AHIMS ID 45-5-5355) has been assessed as having moderate overall significance and two sites (AHIMS ID 45-3-3159 and AHIMS ID 45-5-0559) having high overall significance. One of the sites, AIF-06 (AHIMS ID 45-5-4599) is also within the boundary of the planned Archbold Road upgrade and extension. Sydney Metro and other relevant parts of Transport for NSW would coordinate any future Aboriginal Cultural Heritage Assessment Report(s) and AHIP application(s)
- **Biodiversity:** The proposal has sought to minimise impacts to biodiversity, including through establishing an environmental protection area to retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Construction of the proposal would require clearing of about 1.92 hectares of native vegetation, a subset of which is listed under the *Biodiversity Conservation* Act (2016) and *Environmental Protection of Biodiversity Conservation Act* (1999) as endangered and critically endangered community, respectively. This vegetation provides habitat (or has the potential to support) other protected threatened species
- **Cumulative impacts:** Co-ordination and consultation with relevant stakeholders (including other parts of Transport for NSW) would occur where required to manage the interface of projects under construction at the same time. Potential temporary cumulative impacts with other projects, on noise and vibration, traffic and transport, Aboriginal heritage, non-Aboriginal heritage flooding and biodiversity, may occur given the potential overlap with other projects including the planned Archbold upgrade and extension.

An assessment of each of the above and other environmental issues such as noise and vibration, traffic and transport, landscape and visual character, non-Aboriginal heritage, land use and socio-economic, flooding, soils and surface water, groundwater, contamination, waste and resource management, air quality, bushfire and sustainability, climate change and greenhouse gas is provided in Chapter 8 (Environmental impact assessment) of this REF.

## Benefits of the proposal

The proposal would support the delivery of the proposed Sydney Metro West and ensure the project has the capacity to meet the precast segment production requirements identified during the detailed construction planning phase of the project. It would also deliver social and economic benefits by providing around 120 jobs during construction and around 120 jobs during the operation of the proposal. The proposal would be designed and managed to provide operational efficiencies and to appropriately mitigate impacts on the surrounding environment and local community.

With the implementation of the proposed mitigation measures in Chapter 9 (Environmental management), any potential environmental impacts of the proposal would be adequately mitigated and managed and are therefore not considered to be significant.

## Justification and conclusion

This REF has been prepared having regard to sections 5.5 and 5.7 of the EP&A Act, and clause 228 of the EP&A Regulation that provides for Sydney Metro as a determining authority to take into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the proposal and whether or not the activity is likely to significantly affect the environment.

Should the proposal proceed, any potential associated adverse impacts would be appropriately managed in accordance with the mitigation measures outlined in this REF, and any conditions imposed in the Determination Report.

The proposal would not affect Commonwealth land or have a significant impact on any matters of national environmental significance, therefore a referral of the proposal for a controlled activity determination under the EPBC Act would not be required.

On balance, the proposal's long-term benefits would outweigh its impacts, and the proposal is considered to be justified.

## Next steps

Sydney Metro will exhibit the REF for a three-week period commencing in November 2020 to allow the community to provide written comments on the proposal.

The details of the proposal, the planning process and engagement activities would be communicated at the commencement of public exhibition through targeted stakeholder meetings, a newsletter delivered to nearby properties, emails to registered parties, information provided on the Sydney Metro website and on the Sydney Metro West interactive portal. Additional stakeholder and community consultation would continue to be implemented to inform the community and stakeholders prior to and during the proposal's construction (should it be approved during the proposal's determination phase).

Sydney Metro would continue to incorporate consultation outcomes based on feedback from residents, community and stakeholders during development of the proposal. Sydney Metro invites comments on this REF during public display. Submissions received during the public display period will be considered and addressed, and may inform any amendments to the proposal. The REF and submissions received will be used by Sydney Metro to assess and determine the proposal.

After this consideration, Sydney Metro will determine if the proposal should proceed as outlined and would inform the community and stakeholders of this decision. If the proposal is determined to proceed, Sydney Metro would continue to undertake activities in line with the requirements of the Sydney Metro Overarching Community Communications Strategy.

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# Contents

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# 1 Introduction

This chapter describes the background to the proposal, an overview of the proposal, and the purpose and an outline of the structure of this Review of Environmental Factors (REF).

## 1.1 Background

The proposed Sydney Metro West would connect Greater Parramatta with the Sydney CBD (central business district), doubling the rail capacity of Parramatta to the Sydney CBD corridor with a travel time target between the two centres of about 20 minutes. Sydney Metro West (the Concept) would involve the construction and operation of a metro rail line between Westmead and Sydney CBD, including about 24 kilometres of underground twin tunnels (refer to Figure 1-1). Stage 1 of the works for Sydney Metro West would involve major civil construction work between Westmead and the Bays including tunnelling and station excavation.

Sydney Metro West would deliver metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays with future planning and design work underway to determine a Sydney CBD station location. A potential station at Pyrmont is under consideration.

Sydney Metro (as 'the proponent') is seeking approval for the construction and operation of two adjacent precast facilities (the proposal) located on Lenore Drive, Eastern Creek (the proposal site) to support the construction of the proposed Sydney Metro West. The precast facilities subject to this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other.

The precast facilities do not form part of the Sydney Metro West Critical State Significant Infrastructure project, which would be approved separately.

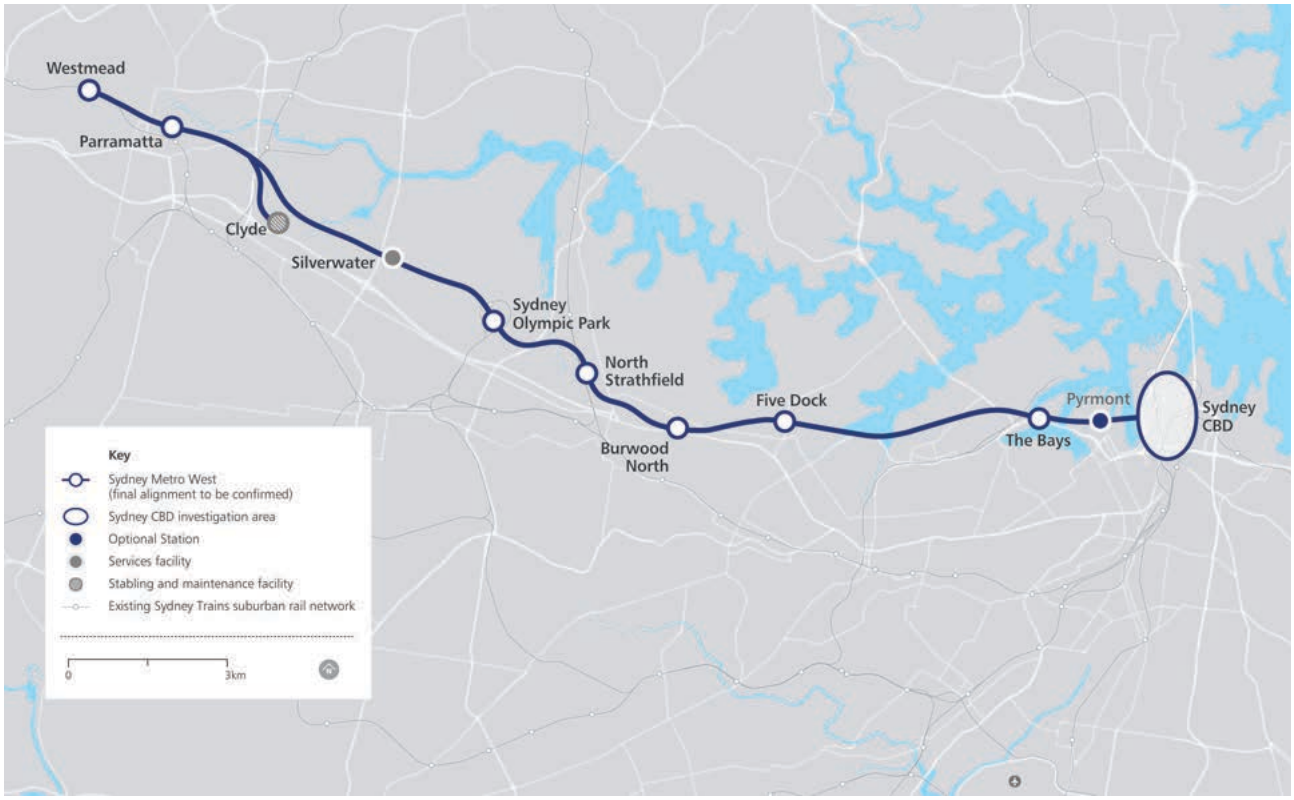


Figure 1-1: Sydney Metro West overview

## 1.2 Overview of the proposal

### 1.2.1 Location of the proposal

The proposal is located in Eastern Creek within the Blacktown City Council local government area (LGA). The proposal would be located on Lenore Drive, Eastern Creek (the proposal site). The proposal site has been identified as the preferred location as it has access to arterial roads for haulage, is within an area zoned for industrial use and has adequate buffers to residential areas. The proposal site is not within the land subject to the declaration of Sydney Metro West as Critical State Significant Infrastructure.

The 'proposal site' refers to the area that would be directly impacted by the proposal as shown in Figure 1-2. The proposal site is an undeveloped greenfield site within the broader context of surrounding planned and established industrial areas at Eastern Creek.

Directly to the north and east, the proposal site is bounded by undeveloped land zoned for future industrial use under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (WSEA SEPP) and owned by the Office of Strategic Lands (part of the Department of Planning, Industry and Environment Cluster). Further to the north of the proposal site, beyond the M4 Western Motorway, is an existing industrial and logistics area at Minchinbury. Further to the east of the proposal site is the Bingo Eastern Creek Recycling Facility and the wider Eastern Creek industrial precinct. To the south of the proposal site there is a zoned public recreation area. An electrical substation (owned by TransGrid) is located to the south-east of the proposal site. To the west of the proposal site is Ropes Creek and riparian vegetation. The Erskine Park residential area extends further west (about 375 metres) from the proposal site.

Beyond the proposal site, the wider locality features a mix of land uses, including residential, commercial, public recreation and a number of industrial sites.

The proposal site is under the ownership of Sydney Metro, and was acquired from the Office of Strategic Lands.


Figure 1-2: Local context

### 1.2.2 Key features of the proposal

The proposal would comprise the following key features and activities:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate adjacent precast facilities, the northern and southern precast facilities, on the proposal site. Each precast facility would include:
  - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
  - Boiler, aggregate bins and consumables
  - Office facilities
  - On-site parking for up to 60 light vehicles
- Internal roads with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The precast facilities would operate concurrently, 24 hours a day, seven days a week, for the majority of the lifespan of the project.

The proposal site would be subdivided to create two separate lots, one for each precast facility.

The proposal would be temporary, operating for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West.

The proposal is described further in Chapter 5 (Description of the proposal).

### 1.2.3 Relevant development proposals and approvals

Other development proposals and approvals that are relevant to this proposal are discussed below. These proposals do not form part of the activity which is assessed in this Review of Environmental Factors.

#### Sydney Metro West

The proposal would support the construction of the proposed Sydney Metro West. The precast facilities would manufacture precast concrete segments necessary for lining the underground twin tunnels.

A temporary precast concrete segment production facility (Clyde facility) is included within the Clyde stabling and maintenance facility construction site as part of Stage 1 of the works for Sydney Metro West. This would also support tunnelling works for Sydney Metro West. Further information on Sydney Metro West is included in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a) (SSI-10038).

It has been identified through detailed construction planning that additional precast facilities would be required to support the production and storage needs for tunnelling (including the section from The Bays to Sydney CBD). The additional precast capacity would maximise productivity and enable the efficient delivery of Sydney Metro West. Further details regarding the need for the proposal are outlined in Chapter 2 (Need for the proposal). Further detail on Sydney Metro West including a summary of the potential environmental impact associated with carrying out the project is discussed in Chapter 7 (Related development).

#### Archbold Road Upgrade and Extension

Transport for NSW has plans to upgrade and extend Archbold Road adjacent to the precast facility proposal site. The Archbold Road Upgrade and Extension REF (Transport for NSW, 2017) was determined in December 2017 and would include a future upgrade and extension of Archbold Road between the Great Western Highway, Minchinbury and Old Wallgrove Road, Eastern Creek. Once complete, Archbold Road would be a key north-south route providing access to the Western Sydney Employment Area (WSEA). Transport for NSW is the proponent of the Archbold Road Upgrade and Extension REF.

The construction of this project will be delivered in stages as funding becomes available and as required by adjacent development. The first stage of works is currently in planning and construction would include about 700 metres of the 'new' Archbold Road heading north from the Archbold Road and Lenore Drive intersection. As part of these works an Archbold Road Upgrade and Extension Addendum REF was prepared to assess design changes to this section of road and include construction of a Western Access Road between the northern and southern precast sites. Sydney Metro is working with Transport for NSW to provide access to the proposal site from Lenore Drive, via a new section of Archbold Road and a Western Access Road between the northern and southern precast sites.

An Addendum to the Archbold Road Upgrade and Extension REF details this work and is subject to determination by Transport for NSW. As a result, the proposal does not include any external road works.

This first stage of the planned Archbold Road upgrade and extension would provide access to the proposal site from Lenore Drive, via a new section of Archbold Road and the Western Access Road. As a result, this proposal (for the precast facilities) does not include any external road works. Sydney Metro is working in collaboration with Transport for NSW to co-ordinate the efficient delivery of these projects, so that construction of future stages of Archbold Road does not restrict access to the precast facilities.

Works for the Western Access Road would take place on land under the ownership of Sydney Metro, however Transport for NSW would be the proponent of these works and they do not form part of this proposal (for the precast facilities) or the proposal site. Following construction, the Western Access Road is intended to be dedicated as a public road.

Further extensions of Archbold Road would be completed at a later stage and do not form part of this proposal for the precast facilities.

#### Ropes Creek Precinct Draft Development Control Plan

Ropes Creek Precinct Draft Development Control Plan (DCP) was prepared in November 2016 for the Ropes Creek Precinct (NSW Department of Planning, Industry & Environment (DPIE), 2016). The aim of this Draft DCP is to ensure the orderly and efficient development of the Ropes Creek Precinct as envisaged by the WSEA SEPP. The Ropes Creek Precinct, where the proposal site would be located, would be subject to a masterplan process. This masterplan would be developed in accordance with the controls established by the DCP, once finalised.

## 1.3 Purpose of this Review of Environmental Factors

This REF describes the proposal (refer to Chapter 5 (Description of the proposal)), documents its likely environmental impacts (refer to Chapter 8 (Environmental impact assessment)) and details the measures that would be implemented to mitigate and manage against any potential impacts (refer to Chapter 9 (Environmental management)). Sydney Metro, a NSW Government agency, is the proponent and a determining authority for this proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The REF has been prepared to meet the environmental assessment requirements of Division 5.1 of Part 5 of the EP&A Act (refer to Section 4.1.1).

The environmental impacts of the proposal have been assessed in accordance with Clause 228(1) of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation), the *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The REF helps fulfil the requirements of section 5.5 of the EP&A Act; namely that Sydney Metro examines and takes into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposed activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the need for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of Part 5 of the EP&A Act
- The significance of any impact on threatened species, populations and communities as defined by the BC Act, in accordance with section 7.8 of the *Biodiversity Conservation Regulation* (2017) and therefore the requirement to prepare a species impact statement
- The potential for the proposal to significantly impact a Matter of National Environmental Significance or Commonwealth land and the need to make a referral to the Commonwealth Department of Agriculture, Water and the Environment for a decision by the Minister for the Environment on whether assessment and approval is required under the EPBC Act (refer to Section 4.2.1).

## 1.4 Structure and content of the REF

The structure and content of the REF is outlined in Table 1-1.

Table 1-1: Structure and content of the REF

| Chapter | Description |
|---|---|
| **Chapter 1 – Introduction** | Outlines the background of the proposal |
| **Chapter 2 – Need for the proposal** | Outlines the need for the proposal |
| **Chapter 3 – Options development and selection** | Provides an overview of the options that were considered during the development of the proposal |
| **Chapter 4 – Statutory and planning considerations** | Outlines the relevant environmental planning instruments and policies and provides an assessment of their relevance to the proposal |
| **Chapter 5 – Description of the proposal** | Provides a detailed description of the proposal, including the elements of the proposal, construction and operation |
| **Chapter 6 – Stakeholder and community consultation** | Outlines the planned community and stakeholder engagement activities to be carried out to support the REF exhibition and construction phase |
| **Chapter 7 – Related development** | Provides an overview of the proposed Sydney Metro West and a summary of the potential environmental impacts associated with carrying out the project |
| **Chapter 8 – Environmental impact assessment** | Provides an assessment of the potential environmental impacts associated with the construction and operation of the proposal |
| **Chapter 9 – Environmental management** | Outlines the proposed environmental management systems to be implemented and provides the management and mitigation measures to be implemented during the construction and operation of the proposal, to manage the impacts identified in the REF |
| **Chapter 10 – Justification and conclusion** | Provides the justification for the proposal and an outline of the key conclusions of this report. |

The REF has been informed by key technical papers, which provide detailed assessment of specific environmental issues associated with the proposal. These technical papers form appendices to this REF as follows:

- Appendix B – Noise and Vibration Technical Paper (SLR, 2020)
- Appendix C – Traffic and Transport Assessment (Jacobs, 2020)
- Appendix D – Landscape and Visual Impact Assessment (Iris, 2020)
- Appendix E – Statement of Heritage Impact (Artefact, 2020)
- Appendix F – Archaeological Survey Report (Artefact, 2020)
- Appendix G – Hydrology and Flooding Technical Paper (Jacobs, 2020)
- Appendix H – Preliminary Site Contamination Investigation (Jacobs, 2020)
- Appendix I – Biodiversity Assessment Report (Jacobs, 2020)
- Appendix J – Bushfire Risk Assessment (Blackash Bushfire Consulting, 2020).

# 2 Need for the proposal

This chapter discusses the need for and objectives of the proposal. It also provides an outline of the consistency of the proposal with relevant government policies and strategies.

## 2.1 Need for the proposal

Sydney Metro West would involve the construction and operation of a metro rail line between Westmead and Sydney CBD, including about 24 kilometres of underground twin tunnels. These tunnels would be lined with precast concrete segments which are erected by tunnel boring machines as they move forward. The need for Sydney Metro West is detailed in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a).

Stage 1 of the works for Sydney Metro West includes the tunnel and station excavation works from Westmead to The Bays. Future stage(s), including tunnel excavation between The Bays and Sydney CBD, would be subject to future Environmental Impact Statement(s). While the design of major civil elements between Westmead and The Bays is well progressed, further planning is underway on elements such as tunnel alignment east of The Bays and through the complex Sydney CBD, and the overall delivery strategy for Sydney Metro West.

It has been identified through detailed construction planning that additional precast facilities would be required to enable the efficient delivery of Sydney Metro West (including the section from The Bays to the Sydney CBD).

Due to the scale of Sydney Metro West, the tunnelling and station excavation works have been separated into geographically-specific contract packages between Westmead and the Sydney CBD. Based on the delivery strategy for Sydney Metro West, multiple tunnelling packages would be in delivery at the same time and separate precast facilities would be required for each tunnelling contractor.

The precast facility at the Clyde stabling and maintenance facility construction site proposed as part of Stage 1 of the works for Sydney Metro West would not provide sufficient space or be able to meet the productivity requirements to support the Sydney Metro West delivery strategy. Furthermore, while tunnelling works are still underway, the precast facility at Clyde would need to be decommissioned for the land to support future construction activities, including fit out of the tunnels.

Additional precast capacity would provide the ability to align the production of precast segments with the delivery strategy, while supporting multiple tunnelling contractors concurrently. Precast facilities separate from the Clyde site would also be able to be used over the entire duration of Sydney Metro West tunnelling works, as they would not be required to be decommissioned to allow future construction activities to commence.

## 2.2 Consistency with strategic planning and policy

The proposal aligns with key NSW Government policies and strategies as it would enable the efficient delivery of the proposed Sydney Metro West. The consistency of Sydney Metro West with these policies and strategies is described in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a). Further discussion of how this proposal is consistent with NSW and local government policies and strategies is provided below.

### 2.2.1 Western Sydney Employment Area

The proposal site is located within the Ropes Creek Precinct of the WSEA. The WSEA was established to supply employment land close to major road transport and provide jobs for Western Sydney. The proposal would support the WSEA by providing employment for around 120 workers during construction of the proposal and around 120 workers during operation. Development within the WSEA is governed by *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (WSEA SEPP) (discussed further in Chapter 4 (Statutory and planning considerations)).

### 2.2.2 Greater Sydney Region Plan: A Metropolis of Three Cities

The *Greater Sydney Region Plan: A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) sets the 40-year vision and 20-year implementation plan for Sydney to develop as three unique and connected cities – the Western Parkland City, the Central River City and the Eastern Harbour City. The proposal site is located in the Blacktown LGA, which is on the western boundary of the Central River City.

The plan recognises the strategic location of Blacktown LGA, straddling the boundary between the Central River City and Western Parkland City. The plan discusses the need for creating conditions for a stronger economy. The proposal aligns with this vision by providing employment for skilled and specialised workers.

### 2.2.3 Central City District Plan

The *Central City District Plan* (Greater Sydney Commission, 2018b) is the 20-year plan for the implementation of the vision detailed in the Greater Sydney Region Plan. The Central City District includes the Blacktown, Cumberland, Parramatta and The Hills LGAs, with Greater Parramatta as its metropolitan centre. The Plan establishes key goals for the growth and development of the Central City District which align with the directions and objectives outlined in the Greater Sydney Region Plan (Greater Sydney Commission, 2018a).

The following goals are applicable to the proposal:

*C1. Planning for a city supported by infrastructure including new public transport services.*

The proposal would support the construction of Sydney Metro West, which is consistent with this aim.

*C11. Industrial and urban services land is planned and managed.*

The proposal supports this objective as it would utilise land for industrial services while providing employment opportunities. The proposal would also support economic development in the WSEA which has been identified as part of the district's industrial and urban services land supply.

### 2.2.4 Blacktown Local Strategic Planning Statement 2020

*The Blacktown Local Strategic Planning Statement (LSPS) 2020 (Blacktown City Council, 2020) provides a 20-year land use vision for Blacktown City, and directs how future growth and change will be managed. The Blacktown LSPS gives effect to the Central City District Plan outlined above.*

The Blacktown LSPS supports the delivery of Sydney Metro and other transport services with a view of achieving a 30-minute city. The proposal would support the construction of Sydney Metro West which would bring direct, fast, and reliable public transport to enable access to education, employment, and other services.

The Blacktown LSPS also supports growing targeted industry sectors and maximising opportunities to attract advanced manufacturing in industrial land. The proposal would utilise land for industrial services while providing employment opportunities. The proposal is within the Mount Druitt Precinct as identified in the Blacktown LSPS. As noted above, the proposal is also within the WSEA, located to the south of the Mount Druitt Precinct. The proposal would therefore contribute to this major employment and industrial area by providing additional jobs in Western Sydney.

### 2.2.5 Our Blacktown 2036 – Draft Community Strategic Plan

*The Our Blacktown 2036 – Community Strategic Plan* (Blacktown City Council, 2017) reflects Blacktown City's growing population and the changing needs of the community. It incorporates the principles of social justice, ecologically sustainable development, and the quadruple bottom line (environmental, social, economic, and civic leadership considerations).

The Plan envisions a growing city supported by accessible infrastructure that meets the diverse needs of the growing community, including the provision of transport networks that connect the city of Blacktown for vehicle and non-vehicle users. The proposal is consistent with this aim as it would assist in the delivery of public transport infrastructure to improve connectivity and accessibility across Greater Sydney as the population grows.

A core element of the Plan is a smart and prosperous economy focused on creation of local jobs. The proposal would create around 120 construction jobs and around 120 jobs during operation.

## 2.3 Proposal objectives

The objectives of the proposal are to:

- Support the efficient delivery of construction works for Sydney Metro West through the provision of precast concrete segments to line tunnels
- Provide an approach to the production of precast segments which aligns with the delivery strategy for Sydney Metro West
- Be designed and managed to provide operational efficiencies and to appropriately mitigate impacts on the surrounding environment and local community.

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# 3 Options development and selection

This chapter outlines the options considered as part of the proposal.

## 3.1 Identified options

Options considered to provide precast segments for Sydney Metro West included a 'do nothing' option or the establishment of new precast facilities. These options are discussed in the following sections.

### 3.1.1 Option 1 – 'Do nothing'

The 'do nothing' option would involve using a single precast facility at Clyde (proposed as part of Stage 1 of the works for Sydney Metro West). The proposed facility at Clyde only has the capacity to support one independently operating precast facility and would not be able to meet the productivity requirements to support the Sydney Metro West delivery strategy identified during the detailed construction planning phase. As such, this option would not achieve the objectives of the proposal as it would not support the efficient delivery of construction works.

### 3.1.2 Option 2 – Establish additional precast capacity within or adjacent to proposed Sydney Metro West construction sites

The proposed construction sites identified in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a) do not allow for capacity for the establishment of additional precast facilities. Establishing precast facilities on land adjacent to these construction sites would require additional property acquisition, likely to be the acquisition of private residential, commercial or industrial land.

The footprint of the precast facility within the existing site Clyde would not be able to be expanded as the remainder of site is required for other construction activities. Expansion of the site beyond the existing footprint at Clyde would require additional private property acquisition.

This option would meet the objectives of the proposal related to the efficient delivery of Sydney Metro West however it would result in unnecessary impacts associated with additional private property acquisition.

### 3.1.3 Option 3 – Establish additional precast facilities at a new location

This option would involve constructing and operating two adjacent precast facilities in a suitably determined location (outside of the Sydney Metro West construction footprint). This option would allow the selection of a site with sufficient size to establish two separate precast facilities, to meet precast segment production requirements for Sydney Metro West. This option would also allow for the selection of government owned land, and avoid the need for acquisition of private residential, commercial or industrial land. Standalone facilities would also offer greater flexibility, as they would not be required to be decommissioned to allow future Sydney Metro West construction activities to commence in a timely manner.

Furthermore, the construction and operation of precast facilities outside of the Sydney Metro West construction footprint would offer the opportunity to support job creation and economic development across Greater Sydney.

Based on the above evaluation, Option 3 best meets the objectives of the proposal and was selected as the preferred option.

## 3.2 Proposal site selection

Once it was determined that a new site for precast facilities would be required, Sydney Metro undertook a search for potential sites to establish the proposal. Principles influencing the selection of the proposal site included:

- Availability of land to establish two precast facilities, with a preference for government-owned land, in order to minimise the need for private property acquisition and associated impacts, and land zoned for industrial uses
- Accessibility to the arterial road network from the site to enable efficient transportation of input materials and final precast products to minimise impacts to local roads
- Relative proximity to the proposed Sydney Metro West (i.e. within the Sydney Metropolitan area)
- Topography, proximity of adjacent infrastructure, and engineering requirements
- Minimal impact or capability to mitigate impacts to the environment including impacts to noise and visual sensitive receivers, traffic, biodiversity, and water and air quality.

Sydney Metro undertook a search of properties within NSW Government-owned land and properties available for sale of the necessary size to support the precast facilities. Private land which was already for sale was also considered in the search for a site, however resulted in limited options of the appropriate size and zoning for the precast facilities.

Sydney Metro identified a land holding (the proposal site) by the Office of Strategic Lands in the Blacktown LGA (which has since been acquired by Sydney Metro). The particular land holding on Lenore Drive in Eastern Creek (the proposal site) was determined to satisfy the above criteria and would be an ideal location for the new precast facility.

The proposal site was selected as the preferred location for the proposed precast facility as it is located relatively close to the Sydney Metro West construction sites and provides an adequate land parcel within an existing industrial zone. The proposal site was located on a government land holding, which avoided the need for private property acquisition and associated impacts. The proposal site is located along Lenore Drive which minimises requirements for road construction works and accommodates efficient vehicular access via arterial roads during construction and operation of the proposal. The site is located in close proximity to the M7 Motorway providing efficient access and egress with the ability to avoid residential areas. In addition, the proposal site is sufficiently separated from residential receivers, with the nearest residential receivers about 375 metres to the west. Ropes Creek and riparian vegetation provide a buffer between the site and the residential area thereby minimising potential amenity-related impacts associated with the construction and operation of the proposal.

Once the preferred site was selected, the indicative layout of the proposal was planned in response to the key ecological constraints on site, which include Ropes Creek at the western boundary of the proposal site and the associated riparian vegetation. An environmental protection area has been established in the south-west of the proposal site to provide an adequate buffer to avoid any ecological impacts on this riparian vegetation from the construction and operation of the proposal.

# 4 Statutory and planning considerations

This chapter outlines the relevant statutory requirements and explains the environmental planning and approvals process for the proposal. The environmental planning instruments relevant to the proposal are also outlined.

## 4.1 NSW Legislation and regulations

### 4.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the main legislation regulating land use planning and development assessment in NSW.

The applicable planning approvals pathway for a development under the EP&A Act is generally dependent on the development's size, environmental impact and capital cost, as well as relevant planning provisions under other NSW legislation, including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs). Further discussion on SEPPs and LEPs likely to be applicable to the proposal is provided below. The main part of the EP&A Act that is relevant to the proposal that would be carried out by or on behalf of Sydney Metro is Part 5, which is discussed in the following section.

**Part 5 of the EP&A Act**

Part 5 of the EP&A Act applies to activities that are permissible without consent and are generally carried out by a public authority. Activities under Part 5 of the EP&A Act are assessed and determined by either a Minister or public authority – referred to as a determining authority. Sydney Metro is a public authority and is the proponent and determining authority of the proposed works.

The proposal comprises an 'activity' for the purposes of Part 5 of the EP&A Act by reason of clause 79 of *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) (refer to Section 4.1.2).

As the determining authority for the purposes of Division 5.1 of Part 5 of the EP&A Act, Sydney Metro must:

a. Examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity, in accordance with section 5.5 of the EP&A Act
b. Consider whether or not the activity is likely to significantly affect the environment or is likely to significantly affect threatened species, populations and ecological communities.

Chapter 8 (Environmental impact assessment) of this REF assesses the likely effect of the proposal on the environment and threatened species, populations and ecological communities.

Clause 228 of the EP&A Regulation defines the factors which must be considered when assessing the likely impact of an activity on the environment under Part 5 of the EP&A Act. Appendix A specifically responds to the factors for consideration under clause 228. An environmental impact statement would be required for the proposal if Sydney Metro considers the proposal to be likely to significantly affect the environment, including critical habitat or threatened species, populations or ecological communities and their habitats.

Clause 228 of the EP&A Regulation contains a detailed list of factors that must be taken into account when assessing the impact of an activity on the environment. Where the only anticipated significant impacts relate to threatened species, population or ecological communities or their habitats or critical habitat, then a species impact statement may be prepared instead of an environmental impact statement.

The proposal is not likely to have significant impact on the environment including threatened species, populations or ecological communities or their habitats or critical habitat (refer to Section 8.11 (Biodiversity)); therefore neither an environmental impact statement nor species impact statement is required. In this situation a REF is typically prepared, hence the decision to prepare this document.

During the exhibition period, the community would be encouraged to make submissions to Sydney Metro on the proposal and information contained in the REF.

Following the exhibition period, Sydney Metro will consider issues raised in submissions and respond to community and stakeholder feedback. If required, Sydney Metro may also propose changes to the proposal. Documentation of any proposed changes to the proposal will be available to the public via the Sydney Metro website (sydneymetro.info/west).

Following consideration of community and stakeholder feedback received during exhibition of the REF, Sydney Metro will determine whether to proceed with the proposal. If the proposal proceeds, it would be designed, constructed and operated in accordance with the mitigation measures outlined in this REF, any subsequent documents and any additional conditions.

The planning approvals process for the proposal under Division 5.1 of Part 5 the EP&A Act is outlined in Figure 4-1

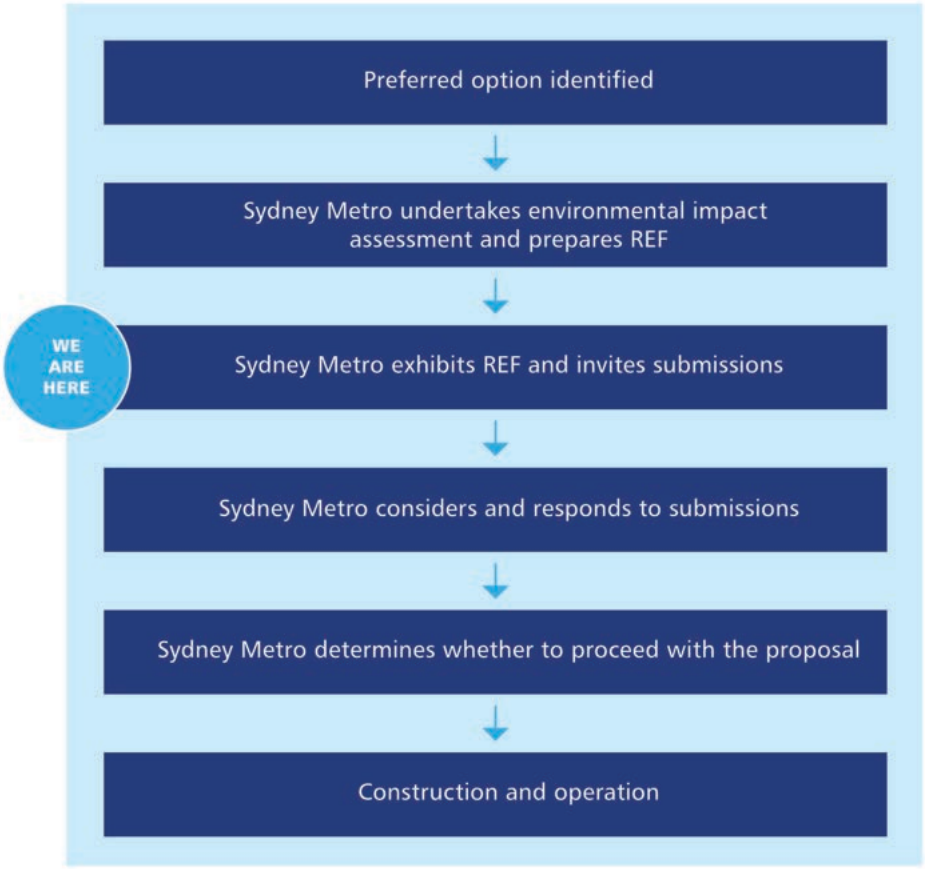


Figure 4-1: Planning approvals process for the proposal

### 4.1.2 State Environmental Planning Policy – Infrastructure 2007

ISEPP is the primary environmental planning instrument relevant to the proposal. One of the aims of the ISEPP is to provide a consistent planning framework for the delivery of infrastructure and the provision of services across NSW. Part 3 of the ISEPP identifies the development controls for certain types of infrastructure or services, including railways and road infrastructure facilities. The development controls specify the following planning categories:

- Development permissible without consent
- Development permissible with consent
- Exempt development
- Prohibited development
- Complying development.

Clause 79 clause 2(a)(v) of ISEPP outlines that temporary facilities for the management of railway construction that are in or adjacent to a rail corridor, are permissible without the need for development consent under Part 4 of the EP&A Act when undertaken by a public authority. Under clause 78, the proposal site is considered a rail corridor as it is land owned by a public authority (Sydney Metro) for the purpose of railway or rail infrastructure facilities (being Sydney Metro West). The proposal would support the construction of the proposed Sydney Metro West by producing precast concrete segments required for tunnelling works. By virtue of the above, the proposal is permissible without development consent.

Division 1 of Part 2 of ISEPP also contains provisions for public authorities to consult with local councils and other agencies prior to the commencement of certain types of development. Chapter 6 of this REF discusses the consultation requirements of ISEPP and their relevance to the proposal.

### 4.1.3 State Environmental Planning Policy No. 55 – Remediation of Land

*State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55) provides a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment.

Clause 7 of the SEPP 55 requires a consent authority to consider:

- Whether the land is contaminated
- Whether the land in its contaminated state would be suitable for carrying out of development as proposed
- If the land requires remediation to be suitable for the proposed development and is satisfied that the land will be remediated prior to being used for the proposed purpose.

The majority of works associated with the proposal would be superficial (or up to two metres below existing site levels), however there is potential to encounter contamination during excavation. Potential for contamination of soils and groundwater within/beneath the proposal site may be associated with current and historical activities and the possible inappropriate management of hazardous building materials in former structures adjacent to the proposal site.

A range of mitigation measures have been included to manage potential contamination during construction and operation of the proposal.

The potential for contamination, and mitigation measures, are discussed further in Section 8.10 (Contamination) of this REF.

### 4.1.4 State Environmental Planning Policy – 33 Hazardous and Offensive Development

*State Environmental Planning Policy – 33 Hazardous and Offensive Development* (SEPP 33) aims to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact.

Potentially hazardous means a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:

- To human health, life or property, or
- To the biophysical environment, and
- Includes a hazardous industry and a hazardous storage establishment.

The proposal includes the importation of aggregate and concrete batching for the construction of precast concrete segments. Based on the nature of the proposal and the mitigation measures to be implemented it is not considered to be a 'potentially hazardous industry' or 'potentially offensive industry' under SEPP 33.

Some dangerous goods would be stored on site including chemicals used in the manufacture of concrete, oils for lubrication of moulds and maintenance chemicals, oils, and lubricants for the plant. The quantities of all dangerous goods stored onsite would however be well below the SEPP 33 thresholds.

### 4.1.5 State Environmental Planning Policy (Western Sydney Employment Area) 2009

The proposal site is subject to the WSEA SEPP as shown in Figure 4-2.

The proposal is located within land zoned as IN1 – General Industrial under the WSEA SEPP.

The land use objectives of this zone include:

- To facilitate a wide range of employment-generating development including industrial, manufacturing, warehousing, storage and research uses and ancillary office space
- To encourage employment opportunities along motorway corridors, including the M7 and M4
- To minimise any adverse effect of industry on other land uses
- To facilitate road network links to the M7 and M4 Motorways
- To encourage a high standard of development that does not prejudice the sustainability of other enterprises or the environment
- To provide for small-scale local services such as commercial, retail and community facilities (including child-care facilities) that service or support the needs of employment-generating uses in the zone.

The proposal would be consistent with the above objectives for the following reasons:

- The proposal would encourage temporary employment opportunities during construction and operation of the precast facilities
- The operation of the proposal would be industrial in nature and therefore, would allow for the continuous growth and establishment of the industrial precinct where it is located
- The proposal has been designed with sufficient buffers and is adjacent to land zoned for industrial use. Therefore, with the implementation of adequate mitigation and management measures, the proposal is anticipated to have minimal environmental impacts as described in Chapter 8 (Environmental impact assessment) of this REF.

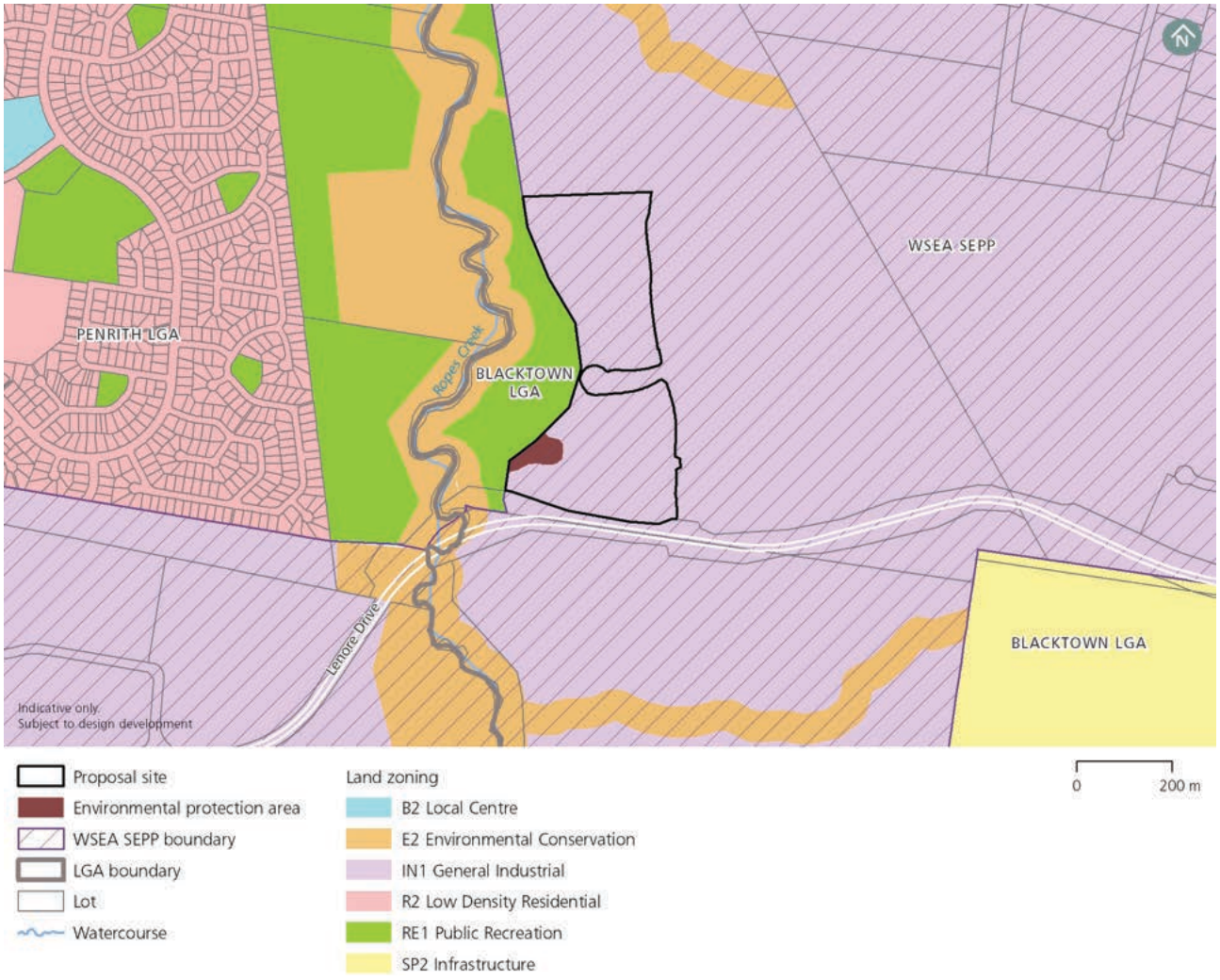


Figure 4-2: Land zoning map

### 4.1.6 Local Environmental Plan

The proposal site is located within the Blacktown LGA. The operation of ISEPP however means that the LEP does not govern permissibility of the proposal. In addition, the provisions of the Blacktown LEP 2015 do not apply as the land is not included in the land application map and the WSEA SEPP includes both zoning and controls for the proposal site.

### 4.1.7 Ropes Creek Precinct Draft Development Control Plan (Draft)

A Draft DCP was developed in November 2016 for the Ropes Creek Precinct (DPIE, 2016). The aim of this Draft DCP is to ensure the orderly and efficient development of the Ropes Creek Precinct as envisaged by the WSEA SEPP. The Ropes Creek Precinct, where the proposal site would be located, would be subject to a masterplan process. This masterplan would be developed in accordance with the controls established by the DCP.

The Draft DCP includes the following development controls relevant to the proposal:

- Built form and streetscape amenity
- Subdivision requirements
- Landscape design
- Traffic, parking and access
- Infrastructure services
- Environmental management.

Once the Draft DCP becomes effective it would provide the planning objectives and controls against which the consent authority will assess future Development Applications.

Key sections of the DCP that have been considered for the proposal include:

- **Built form and streetscape amenity** – Section 8.3 (Landscape and visual) and Appendix D (Landscape and Visual Impact Assessment)
- **Traffic, parking and access** – Section 8.2 (Traffic and transport) and Appendix C (Traffic and Transport Assessment)
- **Environmental management** – Section 8.7 (Flooding), Section 8.10 (Contamination), Appendix G (Hydrology and Flooding Technical Paper) and Appendix H (Preliminary Site Contamination Investigation).

### 4.1.8 Other relevant NSW legislation

Table 4-1 provides an overview of other relevant NSW legislation that is potentially relevant to the proposal.

Table 4-1: Other relevant NSW legislation applicable to the proposal

| NSW legislation | Requirements for the proposal |
|---|---|
| **Aboriginal Land Rights Act 1983** | The NSW *Aboriginal Land Rights Act 1983* applies to Crown lands that are not lawfully needed for an essential public purpose; referred to as claimable Crown land.<br>No claimable Crown lands would be affected by the proposal. |
| **Biodiversity Conservation Act 2016** | The BC Act provides for the protection of threatened species, populations and ecological communities in NSW. If a threatened species, population or ecological community, or its habitat, is likely to occur in any area that may be affected by the proposal then an assessment of significance must be prepared to determine whether the proposal would have a significant impact. If it is concluded that there would be a significant impact, then Sydney Metro would be required to prepare a Biodiversity Development Assessment Report for approval by the Environment, Energy and Science Group of the Department of Planning, Industry and Environment (former NSW Office of Environment and Heritage).<br>The proposal is unlikely to have a significant impact on any threatened species or community listed under the BC Act (refer to Section 8.11 (Biodiversity)). Therefore, the provisions of this Act would not influence how the proposal would be approved. The Act has been considered for completeness in accordance with the requirements under Part 5 of the EP&A Act. |

| NSW legislation | Requirements for the proposal |
|---|---|
| **Biosecurity Act 2015** | The *Biosecurity Act 2015* and its subordinate legislation commenced on 1 July 2017. The *Biosecurity Act 2015* replaces wholly or in part 14 separate pieces of biosecurity related legislation including the *Noxious Weeds Act 1993*. Under the *Biosecurity Act 2015*, all plants, including weeds, are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.<br>The *Biosecurity Act 2015* and regulations provide specific legal requirements for high risk activities and State level priority weeds. The State level priority weeds and associated legal requirements relevant to the region are outlined in the *Greater Sydney Regional Strategic Weed Management Plan 2017 - 2022* (Greater Sydney Local Land Services, 2017) together with the high-risk priority weeds from the regional prioritisation process.<br>As such, if present, priority weeds on the proposal site would be assessed and controlled to fulfil the General Biosecurity Duty and minimise biosecurity risks.<br>Biosecurity risks are discussed further in Section 8.11 (Biodiversity). |
| **Contaminated Land Management Act 1997** | Section 60 of the *Contaminated Land Management Act 1997* (CLM Act) imposes a duty on landowners to notify the NSW Environment Protection Authority (EPA), and potentially investigate and remediate land if contamination is above EPA guideline levels.<br>Given the proposed works are predominately surficial or up to two metres below existing site levels, contamination risk is considered manageable.<br>Contamination is discussed further in Section 8.10 (Contamination) of this REF. |
| **Crown Land Management Act 2016** | The *Crown Land Management Act 2016* sets out requirements for the management of Crown land in NSW. Crown land is land owned by the State Government for the people of NSW under the care and control of the Minister for Lands. The proposal would not impact on Crown land. |
| **Heritage Act 1977** | The NSW *Heritage Act 1977* (Heritage Act) provides protection for items of 'environmental heritage' in NSW. Items considered to be significant to the State are listed on the State Heritage Register and cannot be demolished, altered, moved or damaged, or their significance altered without approval from the Heritage Council of NSW.<br>The State Heritage Register was established under section 22 of the Heritage Act and is a list of places and objects of particular importance to the people of NSW, including archaeological sites.<br>Sections 139 to 145 of the Heritage Act prevent the excavation or disturbance of land known or likely to contain relics, unless in accordance with an excavation permit. There are no listed items of heritage significance identified within the proposal site. Refer to Section 8.6 (Non-Aboriginal heritage) and Section 8.7 (Aboriginal heritage) for further information regarding impacts to heritage items. |
| **National Parks and Wildlife Act 1974** | Sections 86, 87 and 90 of the *National Parks and Wildlife Act 1974* require consent from the Department of Premier and Cabinet (DPC) for the destruction or damage of Aboriginal objects. There are no gazetted Aboriginal Places in the proposal site however there are ten Aboriginal sites within the proposal site that the proposal is likely to impact. Therefore, an Aboriginal Heritage Impact Permit (AHIP) is required under section 90 of this Act. Refer to Section 8.7 (Aboriginal heritage) for further information including mitigation measures to manage the impacts. |
| **Native Title (New South Wales) Act 1994** | This Act provides for native title in relation to land or waters. No Native Title Claims within the proposal site were identified therefore the proposal would not affect land subject to native title or to which an Indigenous Land Use Agreement applies. |

| NSW legislation | Requirements for the proposal |
|---|---|
| **Protection of the Environment Operations Act 1997** | The *Protection of the Environment Operations Act 1997* (POEO Act) administers environment protection licences (EPLs) for specific activities relating to air, water and noise pollution, and waste management. The NSW EPA and local government, where relevant, administer the POEO Act.<br>Development activities require an EPL under the POEO Act if those activities meet the assessment criteria outlined in Schedule 1 of the Act. As per Schedule 1 of the POEO Act, an EPL would be required if the annual production of concrete products exceeds 30,000 tonnes per annum threshold. As the processing capacity of the proposal would be about 266,450 tonnes per annum, the proposal would meet the definition of a scheduled activity under Schedule 1 and an environment protection licence(s) would be required.<br>In addition, the POEO Act would require construction to be managed to prevent and avoid the potential to cause water, noise and/or air pollution. The Act also includes requirements in relation to the management of waste.<br>This would be achieved through implementing the mitigation and management measures identified in Chapter 9 (Environmental management). Notification to the EPA would also be required (as the administrators of this Act) in instances where any pollution incident has the potential to cause or threaten material harm to the environment (refer to section 148 of the Act). |
| **Roads Act 1993** | In accordance with section 138 of the *Roads Act 1993*, consent from Transport for NSW would be required for the carrying out of work in, on or over a classified road.<br>For works on unclassified roads, Clause 5 of Schedule 2 of the Act provides that a public authority is not required to obtain a road authority's consent.<br>The proposal would not include carrying out work in, on or over a classified road therefore consent from Transport for NSW would not be required. |
| **Waste Avoidance and Resource Recovery Act 2001** | The purpose of the *Waste Avoidance and Resource Recovery Act 2001* is to develop and support the implementation of regional and local programs to meet the outcomes of a State-wide strategy for waste avoidance and resource recovery. It also aims to 'minimise the consumption of natural resources and final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste'.<br>Waste generation and disposal reporting would be carried out during the construction and operation of the proposal. Procedures would be implemented in an attempt to promote the objectives of the Act.<br>Waste and resource management is further discussed in Section 8.12 (Waste and resource management). |
| **Water Act 1912 and Water Management Act 2000** | The *Water Act 1912* and the *Water Management Act 2000* (WM Act) are the two key pieces of legislation for the management of water in NSW and contain provisions for the licensing of water access and use. Groundwater extraction or extraction from Ropes Creek is not expected to occur and approvals under the WM Act would not be required. |
| **Fisheries Management Act 1994** | The *Fisheries Management Act 1994* provides for the protection of threatened fish and marine vegetation and aims to conserve, develop and share fishery resources and conserve marine species, habitats and diversity.<br>The proposal would not involve explosives, obstruct fish passage or require any dredging or reclamation works. |
| **Rural Fires Act 1997** | The *Rural Fires Act 1997* makes provision for the prevention, mitigation and suppression of bush and other fires in LGAs of NSW and rural fire districts.<br>Section 52 of this Act requires Bushfire Management Committees to prepare Bushfire Risk Management Plans across a fire district. The proposal site is within the Cumberland Bushfire Risk Management Plan area, which has been reviewed as part of the bushfire assessment in Section 8.14 (Bushfire).<br>Section 63 of this Act establishes the duties of public authorities and owners and occupiers of land to prevent bushfires. As noted in Section 8.14 (Bushfire), the proposal would implement ongoing bushfire management measures to mitigate potential bushfire risk in the proposal site. |

## 4.2 Commonwealth legislation

### 4.2.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as 'matters of national environmental significance'.

Under the EPBC Act, a referral to the Commonwealth Department of Agriculture, Water and the Environment is required for proposed 'actions' that have the potential to significantly impact on any matter of national environmental significance, the environment in general, or the environment of Commonwealth land (including leased land).

An action may include a project, development, undertaking, activity, or series of activities. If the Commonwealth Minister for Environment determines that an approval is required under the EPBC Act, the proposed action is deemed to be a 'controlled action'. It must then undergo assessment and approval under the EPBC Act before the action is carried out. The Act provides that a proponent of an action that may be, or is, a controlled action must refer the proposal to the Commonwealth Minister for the Commonwealth Minister's decision as to whether or not the action is a controlled action.

One threatened ecological community was identified within the proposal site: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (listed as critically endangered under the EPBC Act). In addition, three threatened animal species listed under the EPBC Act are considered moderately likely to occur in the proposal site, including the Green and Golden Bell Frog (listed as endangered under the EPBC Act), the Swift Parrot (listed as critically endangered under the EPBC Act) and the Grey-headed Flying-fox (listed as vulnerable under the EPBC Act).

As noted in Section 8.11 (Biodiversity), the proposal may result in partial clearing (<0.001 hectares) of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. In addition, the proposal would result in a minor reduction in extent of suitable foraging habitat for the Green and Golden Bell Frog, Swift Parrot and Grey-headed Flying-fox. However, the EPBC Act assessments of significance indicate that there is a high level of certainty that the impacts to threatened biodiversity for any Matter of National Environmental Significance are unlikely to be significant and an EPBC Act referral is not required. Refer to Appendix I (Biodiversity Assessment Report) and Section 8.11 (Biodiversity) for further information.

An EPBC search identified three Commonwealth land parcels within a one kilometre radius of the proposal site: a Director War Services Home, Telstra Corporation Limited and an unnamed site. Whilst the EPBC search tool does not explicitly identify the location of the sites, the site is not Commonwealth Land therefore the identified Commonwealth Land parcels are outside of the proposal site. The assessment provided in Chapter 8 (Environmental impact assessment) of this REF identified that there would not be a significant impact on any land, including land beyond the proposal site. In this regard the proposal would not have an impact on Commonwealth land.

## 4.3 Summary of statutory requirements

A summary of the potential licences, permits, approvals and notifications that may be required for the construction, maintenance and operation of the proposal are outlined in Table 4-2.

Table 4-2: Summary of potential licences, permits and approvals

| Legislation | Authority | Requirement | Comment |
|---|---|---|---|
| **EP&A Act** | Sydney Metro | Consideration: clause 79 of the Infrastructure SEPP outlines that development for the purpose of railways and railway infrastructure facilities which are permissible without the need for development consent under Part 4 of the EP&A Act when undertaken by a public authority. | This REF has been prepared to meet the assessment requirements under Part 5 of the EP&A Act. |
| **EP&A Regulation** | Sydney Metro | Consideration: under clause 228, the factors to be taken into account concerning the impact of an activity on the environment, and the 'Is an EIS required?' guideline (Department of Urban Affairs and Planning, 1999). | This REF has considered factors under Clause 228 in Appendix A. |
| **National Parks and Wildlife Act 1974** | DPC | Application: an application must be sought for an AHIP under Section 90 of the *National Parks and Wildlife Act 1974* Act in order to undertake a proposed activity which is likely to involve harm to an Aboriginal Place or object, | An application for an AHIP would be required for areas within the proposal site that contain the ten AHIMS sites (one site ID pending) under section 90 of the *National Parks and Wildlife Act 1974*. |
| ***Protection of the Environment Operations Act 1997* (POEO Act)** | EPA | Licence: an application for an EPL(s) would be required as the processing capacity of the proposal would be about 266,450 tonnes per annum, therefore the proposal would meet the definition of a scheduled activity under Schedule 1, Clause 13 (Concrete works) of the POEO Act and an EPL(s) would be required. | An application for an EPL(s) would be required as the proposal is considered as a scheduled activity under Schedule 1, Clause 13 (Concrete works) of the POEO Act. |

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# 5 Description of the proposal

The key construction and operational components of the proposal are described in this chapter.

## 5.1 Proposed works

The proposal consists of the construction and operation of two separate and adjacent precast concrete segment facilities to support the construction of metro tunnels for the proposed Sydney Metro West. Each facility would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels and would be able to be operated independently of each other by different tunnelling contractors. The proposal site would be about 16 hectares in size.

Key features of the proposal are shown in Figure 5-1.

The proposal would comprise the following key features and activities:

- Site preparation consisting of:
  - Vegetation clearing, including the removal of about two hectares of native vegetation
  - Site remediation
  - Connection of utilities (e.g. power, water, sewerage, gas and communications)
  - Earthworks to level the site (this may involve the use of retaining walls)
  - Installation of lighting and signage
- Construction and operation of two adjacent precast facilities, a northern and a southern precast facility, each being sited on about eight hectares. Each precast facility would encompass the following:
  - A double-sided casting carousel
  - Segment storage
  - A concrete batching plant (inside shed with a height of around eight metres)
  - Boiler, aggregate bins and consumables
  - A laydown/hardstand area
  - Offices and site amenities
  - Loading and unloading and circulation space for heavy vehicles
  - On-site parking for up to 60 light vehicles
- Internal roads (one lane each direction) generally around the key operational areas of the facility with entrances to each facility from the Western Access Road located between the northern and southern precast facilities
- Landscaping works along the frontage to Lenore Drive and about 50 metres north along Archbold Road.

The proposal would be temporary, operating for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West. The future use of the site beyond the operation of the proposal would be determined by Sydney Metro and would be subject to separate approvals, as required. If no future use of the site is proposed at that time, the site would be placed into care and maintenance.

The proposal site would be subdivided to create two separate lots, one for each precast facility.

The proposal does not include the construction of the surrounding road network (planned Archbold Road upgrade and extension and the construction of the Western Access Road), which would be undertaken by other parts of Transport for NSW under a separate approval (refer to Section 1.2.3).

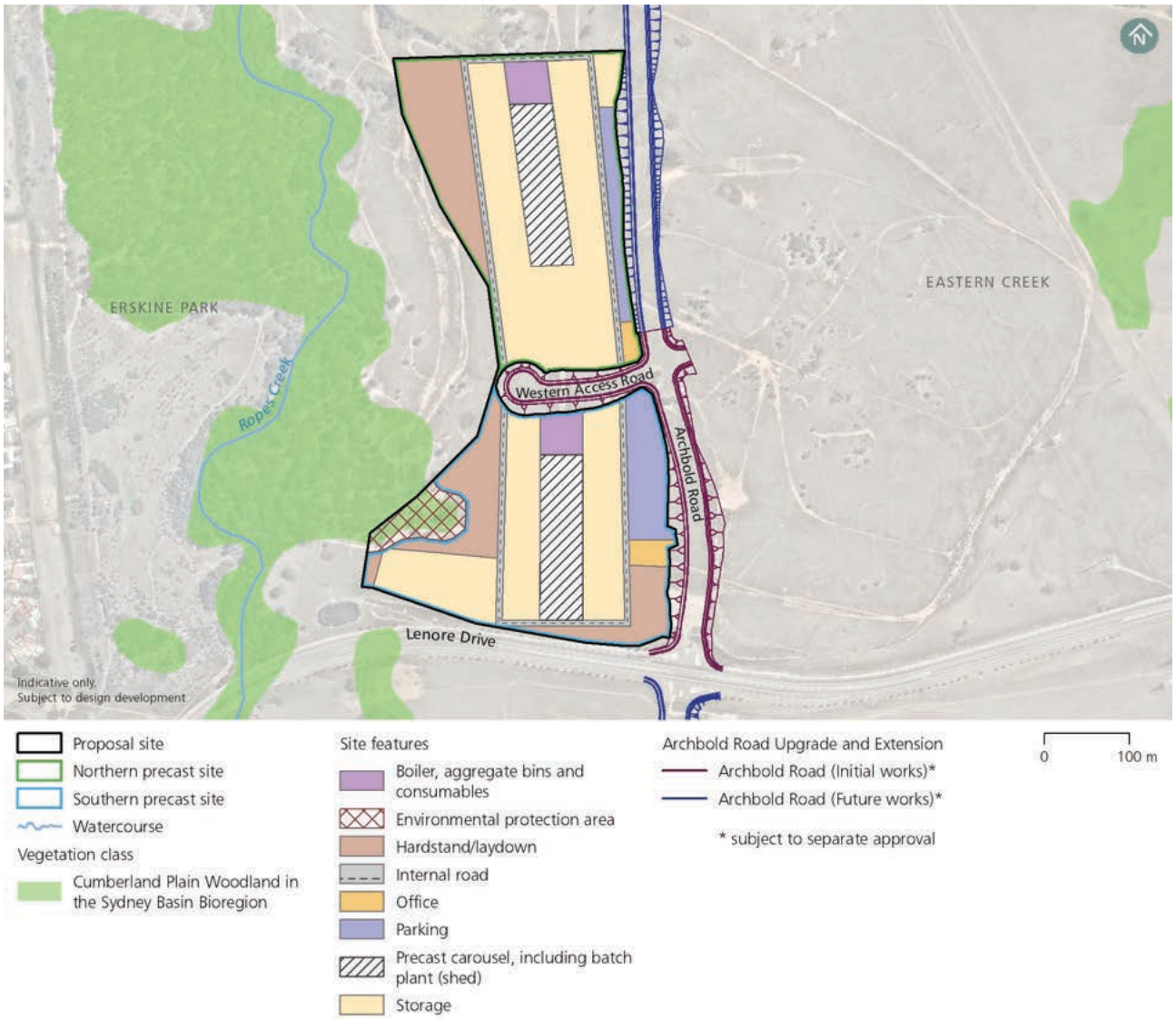


Figure 5-1: Indicative site layout

## 5.2 Construction

Construction of the proposal would comprise the key stages and activities outlined in Table 5-1. These stages would not necessarily be sequential and may be undertaken concurrently subject to the contractors' requirements.

It is expected that the southern precast facility would commence construction first, with some overlap in the construction of both facilities. Concurrent construction of the precast facilities has been assumed for the environmental impact assessment of the proposal (Chapter 8 (Environmental impact assessment)), to provide a conservative assessment of impacts.

Table 5-1: Proposed indicative construction stages

| Construction stage | Description |
|---|---|
| **Stage A: Site establishment** | The following works would be required to establish the proposal site:<br>• Vegetation clearing<br>• Installation of erosion and sediment controls and undertaking water management works<br>• Remediation<br>• Earthworks / levelling and creation of building and storage pads<br>• Utilities connections<br>• Transporting materials and equipment to the site<br>• Establishment of temporary fencing around the proposal site and temporary roads/site access, which may include a temporary haul route during construction of the planned Archbold Road upgrade and extension<br>• Installation of temporary construction compound, including amenities and offices. |
| **Stage B: Civil and building work** | • Establishment of internal roads, access and egress and car parking<br>• Construction/establishment of key built form including:<br>  • Hardstand/lay down and storage areas<br>  • Aggregate bins and cement silos<br>  • Sheds (production facilities and batch plant) - including internal assembly of batch plant facilities and boiler<br>  • Gantry cranes<br>  • Site offices. |
| **Stage C: Commissioning** | • Decommissioning/demobilisation of the construction area<br>• Fit-out of production facilities and batch plant<br>• Testing and commissioning of operational facilities<br>• Landscaping. |

### 5.2.1 Site establishment

#### Preliminary works

The full extent of the proposal site would be cleared with the exception of the environmental protection area in the south-western portion of the proposal site (refer to Figure 5-1).

Installation and connection of essential services would be undertaken during site establishment to service the site amenities, including water and sewerage, power, natural gas and communications. The proposal site layout has been designed to minimise the need for vegetation clearing, including through the establishment of an environmental protection area where riparian vegetation would be retained and protected. Vegetation clearing would include the removal of about two hectares of native vegetation, however much of this is of poor quality. Further detail on impacts to native vegetation is included in Section 8.11 (Biodiversity).

#### Temporary construction compounds

Temporary construction compounds to provide site offices, worker amenities and parking would be established for the duration of construction. These would generally be situated in the same location as the operational site offices (refer to Figure 5-1).

#### Earthworks

Earthworks would be required to level the proposal site (up to a depth of about two metres) to provide a level surface for plant and vehicle movements, level pads for built form, storage areas, hardstand/laydown areas and internal roads for both facilities. In some locations, retaining walls may also be required. The extent of levelling required for the proposal is indicative and would be confirmed at detailed design. Indicative earthworks volumes are provided in Table 5-2.

Table 5-2: Indicative earthworks volumes

| Type | Indicative volume ($m^3$) |
|---|---|
| **Total cut** | 11,500 |
| **Total fill** | 141,500 |
| **Imported fill** | 130,000 |

### 5.2.2 Civil and building work

Sealed internal access roads and car parking areas would be established.

Sealed and graded laydown and storage areas would also be established (refer to Figure 5-1). Earthworks pads would be constructed for the construction of the sheds.

### 5.2.3 Commissioning

Commissioning of the proposal would include:

- Fitting out of the production facilities, installation of utilities and establishment of warehouses
- Line marking, lighting and signposting
- Testing and commissioning of the equipment
- Finishing works including landscaping and site rehabilitation, where required.

Landscaping design and locations would be determined during detailed design. Landscaping associated with the proposal would likely include vegetation along the Lenore Drive frontage. This landscaping would likely include a mix of native shrub species endemic to the area and turfed areas that would provide visual relief from the industrial appearance of the precast facilities.

### 5.2.4 Construction program

Construction is proposed to commence in early 2021 and be completed by the end of 2022, however the timing of construction of the two precast facilities at the proposal site would depend on the final delivery strategy of Sydney Metro West and the construction contractors' requirements. The total duration of construction is anticipated to be around 20 months.

### 5.2.5 Construction workforce

The peak workforce during the construction of the proposal is anticipated to be up to about 60 workers at each separate facility at the proposal site (about 120 in total).

### 5.2.6 Construction plant and equipment

Indicative plant and equipment required during site establishment, civil and building and commissioning would include:

- Light vehicles
- Forklift (10 tonne)
- Delivery trucks
- Scissor lift
- Compressor
- Generators
- External form vibrators
- Hydraulic pump
- Weld sets
- Gantry cranes
- Truck pump
- Water cart
- Excavators
- Graders
- Paving machine
- Concrete mixer truck
- Crane (35 tonne)
- Roller.

Additional plant and equipment to that identified above may be needed. The requirement for additional equipment would be determined by the construction contractors.

### 5.2.7 Resources, materials and sourcing

The type and quantities of resources and materials needed to construct the proposal are relatively minor and readily available within Sydney. Materials required to construct the proposal would be sourced from the surrounding metropolitan area and would include:

- About 130,000 cubic metres fill deficit
- Materials for concrete hardstand areas e.g. aggregate, sand and water
- Potable water which would be connected during site establishment works
- Water to be used for construction.

Materials would be transferred to the construction site by road, primarily along the connecting motorway network.

Sydney Metro's sustainable procurement policy requirements aim to procure material locally, contain a high recycled content and a low embodied energy. Materials that are cost and performance competitive and comparable in environmental performance would be obtained.

### 5.2.8 Waste

All generated waste would be appropriately stored and separated to maximise recycling volumes. Storage would be within the proposal footprint prior to its transfer off-site. Waste volumes associated with the proposal are anticipated to be minor. The likely waste materials that would be generated during construction comprise:

- Concrete
- Asphalt
- Green waste (from removing and pruning trees and vegetation)
- Surplus building material
- Spoil, such as excavated natural material, general solid waste, special waste, restricted solid waste, and/or hazardous waste
- Sediments
- General office waste (including sewerage and grey water)
- Domestic waste from personnel (including food scraps, glass and plastic bottles, paper and plastic containers).

The waste would be transported from the construction site to an appropriately licenced facility. The location where the waste would be transferred for reuse, reprocessing or disposal would depend on its nature, type and classification. The approach to waste management is further detailed in Section 8.13 (Resource use and waste management).

There is potential for contaminated waste to be encountered during construction at the proposal site during surficial excavations. Any required testing and classification would take place on-site. The potential for contamination is discussed further in Section 8.10 (Contamination).

### 5.2.9 Traffic management, haul routes and access

Traffic management and access measures would be developed during detailed design and implemented in accordance with the Sydney Metro Construction Traffic Management Framework (refer to Section 8.2 (Traffic and transport)).

During the construction period the following indicative vehicle numbers are anticipated during standard construction hours for each precast facility:

- Eleven light vehicles per hour
- Ten heavy vehicles per hour.

Temporary traffic management controls would be implemented to allow trucks and heavy vehicles to safely enter and exit the proposal site.

A temporary haul road would be established for site access prior to completion of Archbold Road works. Site access and egress to and from the construction site would be left-in, right-out of the site via a new intersection.

The haulage route is anticipated to occur to the east of the proposal site along the following route:

- From the proposal site to the upgraded and extended Archbold Road (subject to separate approval by Transport for NSW) to Lenore Drive or to the temporary haulage route prior to the completion of Archbold Road
- Lenore Drive to Old Wallgrove Road
- Old Wallgrove Road to Wallgrove Road
- Old Wallgrove Road to Westlink M7.

No haulage routes are anticipated to travel west of the proposal site.

Parking for construction workers would be provided within the proposal site adjacent to the construction compound, generally in the same location shown as the parking area on the operational layout (refer to Figure 5-1).

### 5.2.10 Water management

The following construction water management infrastructure would be included as part of the proposal:

- Sediment basins installed at various locations around the proposal site
- Installation of diversion drains to ensure external 'clean' runoff does not enter and mix with site runoff, and internal 'dirty' runoff is conveyed to the proposed sediment basin for treatment.

### 5.2.11 Utilities

Utilities installation across the proposal site and in the immediate surrounds would be completed as part of the proposal.

The proposed utility connections include:

- Connection to power supply at Old Wallgrove Road
- Sewerage to an existing line running along the western boundary of the proposal site
- Water, natural gas and communications at street frontage.

### 5.2.12 Hours of work

The NSW Interim Construction Noise Guideline 2009 (ICNG) (NSW EPA, 2009) has identified 'recommended standard hours for construction work'. They have been established to preserve the local amenity of an area at certain times depending on the surrounding land use.

Construction works would generally be scheduled during standard construction hours, namely:

- 7.00 am to 6.00 pm Monday to Friday
- 8.00 am to 1.00 pm Saturday
- No work on Sundays or during public holidays.

Other activities that may be carried out outside of the standard daytime construction hours would include:

- Work determined to comply with the relevant noise management level at the nearest sensitive receiver
- The delivery of materials outside approved hours as required by the NSW Police or other authorities for safety reasons
- Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm
- Situations where agreement is reached with affected receivers.

No other out-of-hours works are anticipated as part of the proposal. If out-of-hours works are required, Sydney Metro would follow the ICNG and Sydney Metro Construction Noise and Vibration Standard and obtain any necessary approvals.

## 5.3 Operation and maintenance

### 5.3.1 Built form

The proposed built form that would be constructed at each of the two separate precast facilities at the proposal site would include:

- Aggregate bins enclosed on three sides including a roof structure, with a height of about four metres
- A shed (approximately 10,000 square metres footprint) with a height of about eight metres
- Concrete batch plant with silos at a height of about eight metres to contain adequate volumes of cement product
- Containerised boilers
- About six mobile gantry cranes at each facility up to 10 metres in height (electric and controlled remotely with control panels)
- Demountable-type site offices
- Water management infrastructure including rainwater tanks to capture rainwater from sheds, appropriate on-site stormwater and flood detention facilities, and a water recycling facility.

### 5.3.2 Operation

It is anticipated that the southern precast facility would start operating from around mid-2022 and the northern precast facility from around late-2022. The facilities would operate during the construction of the metro tunnels as part of Sydney Metro West. Based on the current delivery strategy, the precast facilities subject to this proposal are expected to operate for a period of around four to five years. To provide a conservative assessment, this impact assessment assumes that both of these precast facilities are operating concurrently, however there may be periods when only one precast facility is required.

Once operational, the proposal would produce precast tunnel lining segments to be transported to the Sydney Metro West tunnelling support sites. Figure 5-2 shows the key steps and locations of the processes that would take place during the operation of the precast facilities. These steps are described below with the numbers corresponding with steps shown in Figure 5-2.

Based on the process for precast facilities on previous Sydney Metro projects, the key operational processes to produce and transport precast tunnel lining segments would likely include:

1. Daily delivery of raw materials to the proposal site including sand, aggregate, cement products and steel/fibre reinforcement to storage locations
2. Storage of raw materials in aggregate bins and cement silos
3. Transfer of raw materials with front end loader to loading conveyors and hoppers to the batching plant
4. Mixing of raw materials and transport of fresh concrete mix via loading conveyor hoppers to buckets
5. Pouring of concrete mix into steel mould for compaction. Mould would then travel through the curing chambers
6. Removal of segments from mould with a vacuum lifter attached to a crane
7. Storage of segments inside shed for appropriate quality checks and identification
8. Transportation of completed segments outside to hardstand/laydown areas for stockpiling
9. Loading of segments onto delivery vehicles via gantry cranes for delivery to Sydney Metro West tunnelling support sites.

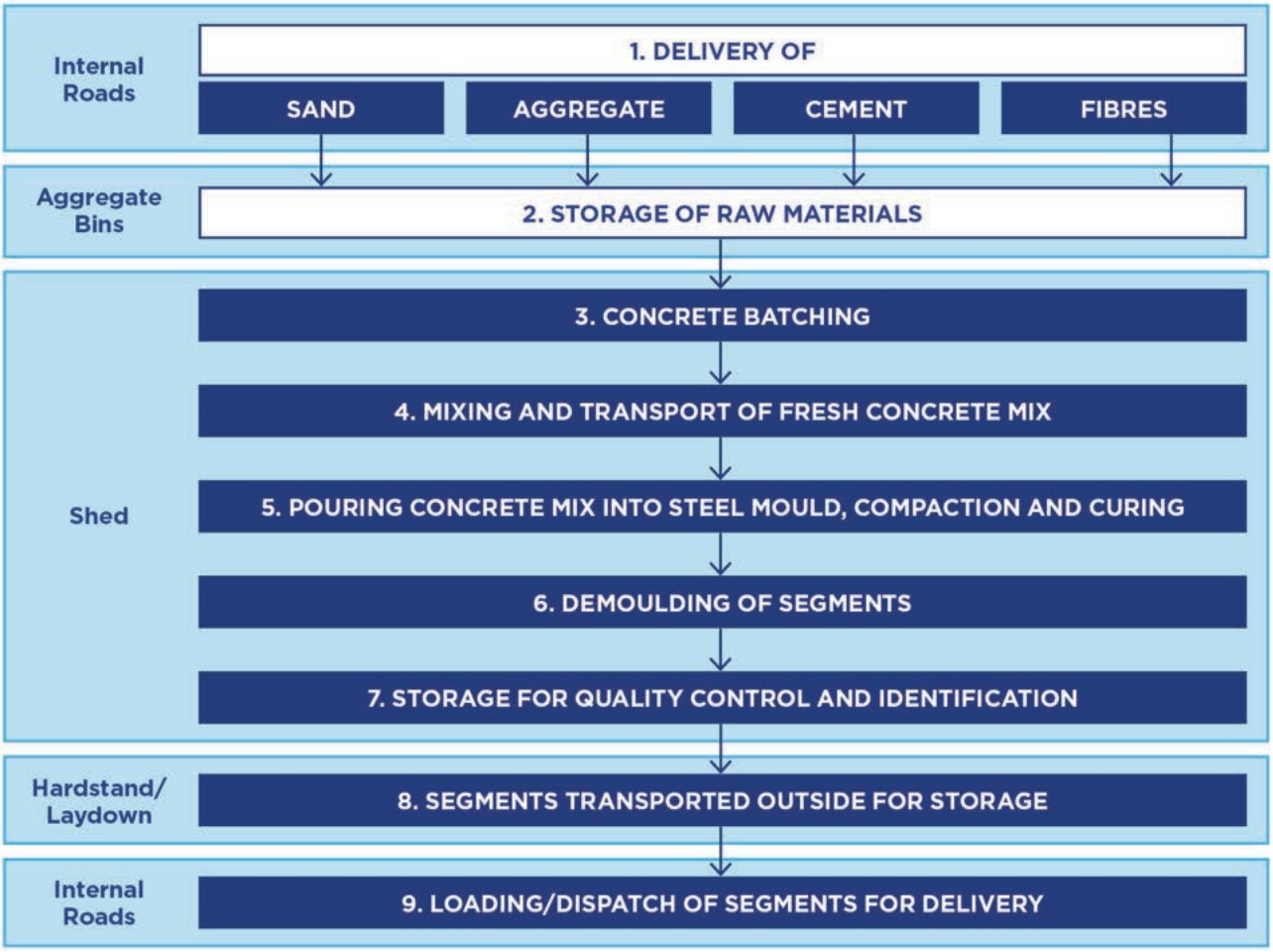


Figure 5-2: Operational process of precast facilities

To meet the demand for Sydney Metro West tunnelling requirements, the precast facilities would have a capacity to produce 730 tonnes of concrete per day and would operate up to 24 hours per day and seven days per week.

### 5.3.3 Operational workforce

The total operational workforce would be around 120 personnel (60 for each facility) on the proposal site at any one time. Indicative shift times are as follows:

- Day shift from 7.00 am to 5.00 pm
- Night shift from 7.00 pm to 5.00 am.

There would generally be a two-hour window between shifts for handover, and one day per week scheduled for maintenance.

### 5.3.4 Traffic management

During operations, raw materials would be delivered to the proposal site and the precast segment products transported from the proposal site. The haulage route is anticipated to occur to the east of the proposal site along the following route:

- From the proposal site to the upgraded and extended Archbold Road (subject to separate approval by others) to Lenore Drive
- Lenore Drive to Old Wallgrove Road
- Old Wallgrove Road to Wallgrove Road
- Old Wallgrove Road to Westlink M7.

No haulage routes are anticipated to travel west of the proposal site.

It is expected that the workforce would travel to and from the proposal site via light vehicles with parking provided on site. Indicative operational vehicle movements are outlined in Table 5-3.

Table 5-3: Indicative operational vehicle movements

| Time of the day | Heavy vehicles (indicative maximum per hour) | Light vehicles (indicative maximum per hour, not including staff) | Light vehicles – staff (indicative maximum based on shift change times) |
|---|---|---|---|
| **Day (7am – 6pm)** | 12 | 8 | 120 (7am and 5pm) |
| **Evening (6pm – 10pm)** | 6 | 5 | 120 (7pm) |
| **Night (10pm – 7am)** | 6 | 5 | 120 (5am) |

### 5.3.5 Operational ancillary infrastructure

Key operational ancillary infrastructure is outlined in Table 5-4.

**Table 5-4: Operational ancillary infrastructure**

| Item | Description |
|---|---|
| **Lighting** | Lighting would be provided throughout the operational footprint to allow for 24-hour operations. The lighting specification would be confirmed at detailed design. However, it is envisaged that lighting would comprise directional flood lighting tilted to focus on the operational areas included within each precast facility and storage areas, lighting attached to the external shed walls, and street lighting along internal roads. |
| **Signage** | The exact location, size and types of signage would be determined during detailed design. However, it is envisaged that illuminated signs would be located at relevant locations for the purposes of wayfinding and access to/from each precast facility, sheds and storage areas. A business identification sign would likely be located at the proposal site entrance. Additional signage necessary for the operation of the proposal (e.g. operational guidance) may also be included within the site. |
| **Fencing** | Security fencing would be installed along the boundaries of the proposal site. |

### 5.3.6 Maintenance

The precast facilities would be placed on a routine cleaning, inspection and maintenance schedule that would be undertaken periodically throughout the operation of the proposal. Maintenance and service vehicles would park in designated parking areas at each precast facility. As noted in Section 5.3.3, a two-hour handover window would be provided between shift times, and one day per week scheduled for maintenance.

## 5.4 Property acquisition

A total of about 16 hectares of land would be needed to construct the proposal. No property acquisition would be required as Sydney Metro is the landowner.

The proposal site would be subdivided to create two separate lots, one for each precast facility.

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# 6 Stakeholder and community consultation

This chapter summarises the planned community and stakeholder engagement activities to be undertaken to support the REF exhibition and construction phase. The REF exhibition period will include targeted consultation to provide an opportunity for stakeholders and the community to provide feedback on the proposal.

## 6.1 Consultation objectives

A communications and consultation strategy would guide and describe the key activities that would take place to inform and engage with the local community and key stakeholders across the proposal's lifecycle. The approach to stakeholder and community consultation for the proposal includes:

- Implementing a communication and engagement plan that supports the REF program
- Informing the community and other stakeholders by providing clear, factual and timely information about planned construction and operational work and its associated environmental and social impacts
- Providing a mechanism for prompt issues resolution
- Providing adequate opportunities for community members and other stakeholders to provide feedback
- Ensuring coordinated communications with other relevant government agencies and stakeholders.

This REF will be exhibited for a three-week period commencing in November 2020. Through this process the community and stakeholders will be invited to make submissions, raise issues, seek clarification or ask questions about any aspect of the proposal. All issues that are raised will be considered by Sydney Metro. Where required, community updates would be provided online and delivered to local residents.

## 6.2 Statutory notification requirements

### 6.2.1 Infrastructure SEPP notification

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to commencing work that would affect various infrastructure. A summary of the ISEPP consultation requirements is detailed below in Table 6-1.

Table 6-1: ISEPP consultation requirements

| Consultation required under clauses 13-16 of ISEPP | Relevant agency | Is consultation required? |
|---|---|---|
| **Are the works likely to have a substantial impact on the stormwater management services which are provided by council?** | Blacktown City Council | No.<br>The proposal would not be connected to a council owned stormwater management system. |
| **Are the works likely to generate traffic to an extent that will strain the existing road system in a LGA?** | Blacktown City Council | No.<br>The proposal would represent a negligible increase in traffic generation and therefore would not strain the existing road system in the locality. |
| **Will the works involve connection to a council owned sewerage system? If so, will this connection have a substantial impact on the capacity of the system?** | Blacktown City Council | No.<br>The proposal would not be connected to a council owned sewerage system. |
| **Will the works involve connection to a council owned water supply system? If so, will this require the use of a substantial volume of water?** | Blacktown City Council | No.<br>The proposal would be connected to a Sydney Water owned potable water main on Lenore Drive and would not be connected to a Council owned water supply system. |

| Consultation required under clauses 13-16 of ISEPP | Relevant agency | Is consultation required? |
|---|---|---|
| **Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a minor or inconsequential disruption to pedestrian or vehicular flow?** | Blacktown City Council | No.<br>The proposal would not involve works on a public place which is under local council management or control. |
| **Will the works involve more than a minor or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?** | Blacktown City Council | No.<br>No roads or footpaths within and around the proposal site would require excavation as part of the proposal. |
| **Is there a local heritage item (that is not also a state heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the item/area are more than minor or inconsequential?** | Blacktown City Council | No.<br>There are no listed items of heritage significance identified within the proposal site and immediate surrounds.<br>In addition, the proposal site is not within a heritage conservation area. |
| **Are the works located on flood liable land? If so, will the works change flooding patterns to a more than minor extent?** | Blacktown City Council, NSW State Emergency Service | No.<br>The majority of the proposal site is located outside flood liable land and therefore, the proposal would not impact flooding patterns more than a minor extent. |
| **Are the works adjacent to a national park, nature reserve or other area reserved under the *National Parks and Wildlife Act 1974*?** | DPIE– Environment, Energy and Science Group | No.<br>The proposal site is not located adjacent to a national park or nature reserve. The closest nature reserve is the Prospect Nature Reserve and Prospect Reservoir located about 5 km east of the proposal site. |
| **Development on land in Zone E1 National Parks and Nature Reserves or in a land use zone that is equivalent to that zone?** | DPIE – Environment, Energy and Science Group | No.<br>The proposal site is located within an industrial zone (IN1 General Industrial) under the WSEA SEPP. |
| **Are the works adjacent to a declared aquatic reserve or marine park under the *Marine Estate Management Act 2014*?** | DPIE | No.<br>There are no aquatic reserves or marine parks within the proposal site or surrounds. |
| **Are the works in the foreshore area as defined by the *Place Management NSW Act 1998* (formerly known as *Sydney Harbour Foreshore Authority Act 1998*)** | DPIE – Housing and Property (former Property NSW) | No.<br>The proposal site is not within the foreshore area. |
| **Do the works involve the development of a fixed or floating structure in or over navigable waters?** | Transport for NSW | No.<br>The proposal does not involve any works in or over navigable waters. |
| **Are the works for the purpose of residential development, as educational establishment, a health services facility, a correctional facility or group home in an area that is bush fire prone land?** | NSW Rural Fire Services | No.<br>The proposal is a temporary facility for the management of railway construction. |

Based on the above considerations, notification to public authorities under the ISEPP would be not be required.

## 6.3 Aboriginal community involvement

Aboriginal stakeholder consultation has been undertaken in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (NSW Department of Environment, Climate Change and Water (DECCW), 2010). This consultation process and the received feedback have been documented as part of the Archaeological Survey Report (Appendix F) to support the proposal.

The Deerubbin Local Aboriginal Land Council were consulted as part of the ongoing Aboriginal consultation process for the proposal, given that the proposal site may contain Aboriginal cultural heritage and archaeological sites. Further detail is provided in Section 8.5 (Aboriginal heritage) of this REF.

Further consultation is anticipated to be undertaken separately, through the preparation of an Aboriginal Cultural Heritage Assessment Report (ACHAR) and associated test excavations. This consultation would be documented within the ACHAR, as these activities are to be undertaken separate to the REF preparation.

## 6.4 Consultation during REF exhibition

### 6.4.1 Consultation activities proposed during public exhibition

The REF will be placed on public exhibition for three weeks commencing in November 2020. During this period, written submissions will be accepted for consideration. The REF will be displayed online at sydneymetro.info and exhibited at St Clair Library and Blacktown City Council Chambers.

Community members and stakeholders are invited to submit their feedback on the proposal to Sydney Metro by:

- Emailing: sydneymetrowest@transport.nsw.gov.au or
- Writing to Sydney Metro, PO Box K659, Haymarket NSW 1240 and should be clearly marked 'Comments on Sydney Metro West Eastern Creek Precast Facilities Review of Environmental Factors'.

During the exhibition period, community members and stakeholders can direct any enquiries to Sydney Metro:

- Enquiries phone line: 1800 612 173
- Email: sydneymetrowest@transport.nsw.gov.au

### 6.4.2 Engagement activities and tools

Table 6-2 lists the key engagement activities and tools and how they will be used to engage with the community and stakeholders during the public exhibition of the REF.

Table 6-2: Key community and stakeholder engagement tools and activities

| Engagement tool | Activity |
|---|---|
| **Proposal website and interactive portal** | Project information and the REF will be available via the Sydney Metro website sydneymetro.info and the Sydney Metro West interactive portal. |
| **Community newsletter** | A newsletter will be distributed to surrounding residential, community and commercial properties. It will also be made available on the Sydney Metro website and interactive portal. |
| **Electronic direct mail** | An email will be sent to a targeted email distribution list. |
| **Stakeholder and government consultation** | Sydney Metro will consult with relevant parts of Transport for NSW, Office of Strategic Lands, Blacktown City Council and other key stakeholders as required. |
| **Sydney Metro Place Manager** | A dedicated Sydney Metro place manager will reach out to the nearby community and businesses to share details of the REF and explain how they can comment and make a submission. The place manager will also be available to respond to community members seeking more information on the REF and the project. |

## 6.5 Response to Submissions

Following the REF exhibition, Sydney Metro will consider submissions received and will:

- Summarise the issues raised in the submissions
- Provide responses to each issue raised in the received submissions
- Describe any proposed modifications and assess the environmental impact of these changes as required
- Identify any proposed new or revised environmental management and mitigation measures.

The responses to submissions will be published on the Sydney Metro website sydneymetro.info.

## 6.6 Post-determination consultation activities

Subject to determination of the proposal, Sydney Metro would continue to engage with community and stakeholders in the lead up to, and during the construction of the proposal as per the Overarching Community Communications Strategy.

Methods used for engaging and providing information to the community and stakeholders during the proposal delivery phase are outlined in Table 6-3. These activities would be undertaken by the construction contractor in consultation with Sydney Metro.

Table 6-3: Key community and stakeholder engagement activities during proposal delivery phase

| Tool | Purpose | Frequency |
|---|---|---|
| **Community emails** | To allow communication with the project team and inform the community of progress, key milestones or activities including traffic changes. | As required |
| **Community information line (1800 612 173)** | Access to the project team during construction hours with message service after hours via a 1800 number. | 24 hours a day, seven days a week |
| **Letterbox notifications** | Notification letters to inform identified sensitive receivers (local residents and businesses) affected by changes to road network and traffic conditions. | At least seven days prior to change |
| **Project website (Sydney Metro)** | Documents uploaded to the website (sydneymetro.info) would include the REF, traffic alerts, notification letters and other public material related to the works. | To coincide with distribution |
| **Signposting** | Information or directional signage at the location of the traffic change to give advice to road users and pedestrians on duration of change and alternative paths. | At least seven days prior to change |
| **Variable Message Signs** | Electronic variable message signs to provide advanced notice to road users of major traffic changes, emergencies, incidents and traffic delays. | At least seven days prior to change, or as required |
| **Doorknocking** | Used to discuss potential impacts of the proposal on highly impacted stakeholders, especially residents and businesses directly impacted by construction activities. | As required |
| **Meetings with individual/groups** | Discuss project activities, including work in progress, upcoming activities and any issues associated. Meetings may also be used to discuss potential impacts and proposed mitigation measures. | As required |
| **Place Manager** | Maintaining close and ongoing contact with local communities and stakeholders during the delivery phase of the precast facilities. | Ongoing |

# 7 Related development

This chapter identifies development which is related to the proposal that is subject to separate planning approvals.

Sydney Metro West is considered to be related development as the construction and operation of the precast facilities (this proposal) would support the delivery of Sydney Metro West. This chapter provides an overview of the Sydney Metro West project and a summary of the potential environmental impacts associated with carrying out the project. Stage 1 of Sydney Metro West is considered in this assessment, as subsequent stages are subject to future assessments.

Given that the location of the proposal is about 15 kilometres away, Sydney Metro West did not meet the criteria for the cumulative impact assessment (Section 8.16 (Cumulative impacts)), and is not expected to result in cumulative impacts to the same receivers.

## 7.1 Sydney Metro West

### 7.1.1 Background

The Sydney Metro West Concept includes the construction and operation of a new 24-kilometre metro rail line between Westmead and the Sydney CBD. Stage 1 includes all major civil construction works between Westmead and The Bays, including station excavation and tunnelling. A detailed description of the Concept and Stage 1 is provided in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a).

The Sydney Metro West, Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a) was placed on public exhibition for community feedback from 30 April 2020 to 26 June 2020. Future stage(s) would be subject to subsequent Environmental Impact Statement(s).

A total of 188 submissions were received by DPIE in response to the Environmental Impact Statement during the exhibition period. Sydney Metro have reviewed all the submissions and have prepared a Submissions Report (Sydney Metro, 2020b) responding to any issues raised.

A separate Amendment Report (Sydney Metro, 2020c) has also been prepared. The Amendment Report outlines the proposed amendments since the exhibition of the Environmental Impact Statement and the associated environmental assessment.

The Sydney Metro West Concept is shown on Figure 7-1.

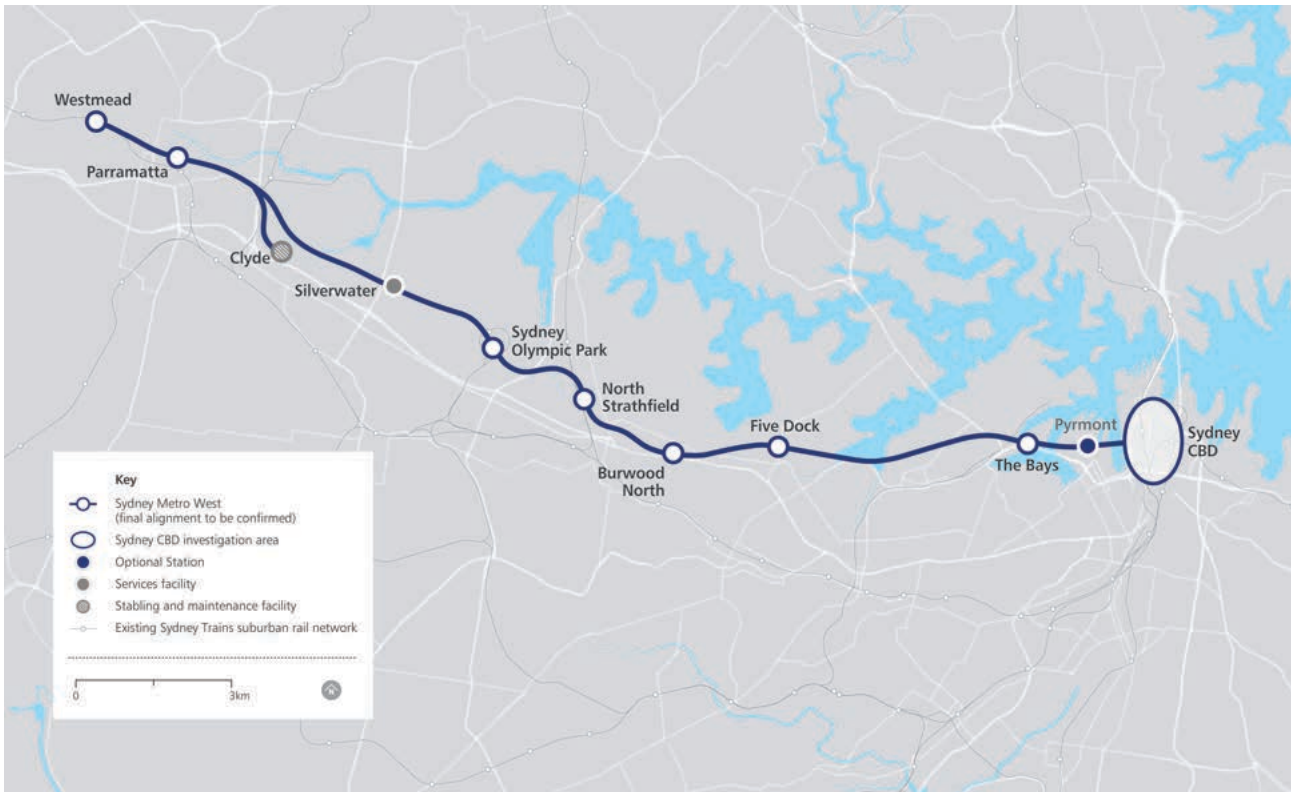


Figure 7-1: Sydney Metro West

### 7.1.2 Summary of potential impacts

An assessment of the potential environmental impacts and approach to environmental management for the project is provided in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a). A summary of potential impacts is provided in Table 7-1.

Where possible, Sydney Metro has avoided and minimised impacts as part of project development and design. Consultation has been carried out with affected stakeholders during the assessment process so that key potential impacts of the Concept and Stage 1 have been identified at an early stage, and where possible, avoided or appropriate mitigation measures developed. Potential impacts associated with Stage 1 would be adequately managed through the implementation of construction environmental management documentation and the specific performance outcomes and mitigation measures identified in the Environmental Impact Statement.

Table 7-1: Summary of potential impacts – Sydney Metro West Stage 1

| Issue | Potential impact |
|---|---|
| **Traffic and transport** | • Temporary increase in construction traffic on the local and regional road network, resulting in potentially temporary increased congestion and delays. Construction site traffic would be managed to minimise movements during peak periods and avoid school zones during pick up and drop off times<br>• Potential temporary local traffic disruptions and short-term access restrictions and detours for road users. Directional signage and line marking would be used to direct and guide drivers and pedestrians past construction sites and on the surrounding network. This would be supplemented by variable message signs to advise drivers of potential delays, traffic diversions, speed restrictions, or alternate routes<br>• Potential temporary access restrictions for pedestrians and cyclists within and surrounding the construction sites. Access to existing properties and buildings would be maintained in consultation with property owners<br>• Potential temporary impacts to the public transport network, particularly in Westmead, North Strathfield and Burwood North, associated with the temporary relocation of bus stops and changes to bus routes resulting in minor impacts to commuters<br>• Potential temporary pedestrian and cyclist safety impacts near construction site access and egress points. Vehicle access to and from construction sites would be managed to maintain pedestrian, cyclist and motorist safety. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasion, police presence<br>• Several on and off-street parking spaces would be temporarily unavailable to the general public for the duration of construction, with the main potential impacts at Westmead and Parramatta. |
| **Noise and vibration** | • Given the nature and duration of works and the close proximity of receivers, airborne noise during construction is expected to temporarily exceed noise management levels at all sites – and at some sites by possibly more than 20 dBA. Noise intensive works within the construction sites at night would generally only be completed inside acoustic sheds (or once other acoustic measures have been established). Regardless, 'moderate' worst-case temporary impacts are expected at some receivers<br>• Potentially temporary highly noise affected receivers (subject to noise levels of 75 dBA or greater) at Westmead metro station, Clyde stabling and maintenance facility, North Strathfield metro station, Burwood North Station and Five Dock Station construction sites<br>• Potentially temporary high sleep disturbance impacts at Westmead metro station and Five Dock Station construction sites. Moderate sleep disturbance impacts at Sydney Olympic Park metro station and Burwood North Station construction sites<br>• Potential temporary ground-borne noise impacts at nearby receivers associated with tunnelling and excavation works at construction sites. Less ground-borne noise and vibration intensive alternative construction methodologies may be adopted where deemed feasible and reasonable<br>• Potential temporary exceedances of vibration criteria including cosmetic damage screening criteria, and human comfort criteria at several buildings closest to construction sites. Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure<br>• Potential minor construction and operational traffic noise impacts to receivers near Westmead metro station construction site particularly along Grand Avenue and Alexandra Avenue. Further assessment of construction traffic would be completed during detailed design and measures would be implemented to minimise temporary traffic noise impacts. |

| Issue | Potential impact |
|---|---|
| **Non-Aboriginal heritage** | • Potential minor direct impact on one item considered to be of State heritage significance (State Abattoirs at Sydney Olympic Park). Sydney Metro has amended the design to minimise impacts to this item<br>• Potential moderate indirect visual impacts on two items listed on the State Heritage Register (Roxy Theatre at Parramatta and White Bay Power Station at The Bays) and one item considered to be of State heritage significance (State Abattoirs at Sydney Olympic Park). The policies of the White Bay Power Station Conservation Management Plan would be considered in regard to visual impacts of the Stage 1 works<br>• Potential moderate indirect visual impacts on four items of local heritage significance. Archival recording would be carried out prior to the commencement of construction works<br>• Potential direct impact on potential archaeological resources at Parramatta and The Bays. An archaeological research design(s) would be implemented that identifies the need for archaeological testing or monitoring. Mitigation measures would be recommended in accordance with Heritage Council guidelines. |
| **Aboriginal heritage** | • Potential disturbance of a potential Aboriginal archaeological deposit of moderate to high significance and moderate to high potential for intact archaeological deposits, located within the Parramatta metro station construction site. This includes a site recorded on the AHIMS register as 45-6-3582. Archaeological test excavation (and salvage when required) would be carried out where intact natural profiles with the potential to contain significant archaeological deposits are encountered<br>• Potential disturbance of Aboriginal archaeological deposit of moderate significance and low to moderate potential for intact archaeological deposits, located within the Parramatta metro station, Clyde Stabling and maintenance facility and The Bays Station construction sites<br>• As outlined in Section 8.5 (Aboriginal heritage), this proposal for precast facilities at Eastern Creek would result in the partial to total loss of value of ten Aboriginal sites. One of these Aboriginal sites, AIF-06 (AHIMS ID 45-5-4599), is located within the boundary of both the proposal site and the Archbold Road upgrade and extension. It is assumed the Aboriginal site would be directly impacted by the planned Archbold Road upgrade and extension. The overall archaeological significance of these sites has been assessed as low for seven of the sites, with one site (AHIMS ID 45-5-5355) having moderate overall significance and two sites (AHIMS ID 45-5-3159 and AHIMS ID 45-5-0559) having high overall significance. Combined, Stage 1 of the works for Sydney Metro West and the precast facilities would result in a potential increased loss of Aboriginal heritage value. Test excavation and further assessment would be undertaken for both projects to understand potential Aboriginal heritage impacts and to identify appropriate management approaches including salvage of identified items. |
| **Property and land use** | • Acquisition of private land and publicly owned land for construction sites. The construction sites are located where permanent operational infrastructure would also be required, to minimise property impacts and residual land holdings at the completion of construction. All acquisitions would be carried out in consultation with landowners and in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*. Sydney Metro has appointed Personal Managers to offer residents and small businesses assistance and support throughout the acquisition process<br>• During construction, the use of land within the Stage 1 footprint would change from its existing use to use as a construction site. Except where required for subsequent construction activities associated with future stages of the Concept, temporary use areas for construction purposes would be stabilised and appropriately rehabilitated. |

| Issue | Potential impact |
|---|---|
| **Landscape character and visual amenity** | • Potential temporary visual impacts as a result of the introduction of new elements including acoustic sheds or other acoustic measures, machinery and equipment, site hoardings, partially complete structures, and other construction works. All structures (including acoustic sheds or other acoustic measures, site offices and workshop sheds) would be finished in a colour which aims to minimise their visual impact, if visible from areas external to the construction site<br>• Loss of mature street trees and vegetation providing screening and amenity and opening up views towards the construction sites such as at the Clyde stabling and maintenance facility construction site. Opportunities for the retention and protection of existing street trees and trees within the site would be identified during detailed construction planning. |
| **Business impacts** | • Broad economic benefits by way of job generation<br>• Benefits to businesses from increased demand from construction workers requiring food and beverage services and other goods<br>• Potential temporary impacts to businesses including reductions in passing trade for vehicular and pedestrian traffic due to detours and road and footpath closures, and impacts on servicing and delivery/access. |
| **Social impacts** | • Potential and actual loss of and temporary disruption to existing social infrastructure, including open space, with associated impacts on community interactions and connectedness<br>• The community's enjoyment of certain community facilities may potentially be temporarily reduced where they are located close to construction sites<br>• Potential temporary changes to community character, such as changes to streetscape, access, businesses, increased numbers of workers and visitors in the area due to construction activity, resulting in changes to connections to the surrounding area<br>• Potential temporary changes to sense of place due to impacts of construction, such as impacts to heritage items, loss of established businesses, changes to streetscape and urban fabric, resulting in potential loss of community connections to the surrounding area. |
| **Groundwater and ground movement** | • Potential minor impacts associated with localised ground movement and/or settlement due to excavation or groundwater drawdown causing damage to infrastructure. Condition surveys of buildings and structures in the vicinity of the tunnel and excavations would be carried out prior to the commencement of excavation at each site<br>• Minor potential impacts on two registered groundwater users, one near Westmead metro station construction site and one near Burwood North Station construction site. Further investigations would be carried out and make good provisions implemented as required<br>• Potential migration of contaminated groundwater towards, and into, station excavations, posing a potential exposure risk to site users/workers, and potentially reducing the beneficial use of the aquifer. Monitoring would occur of groundwater levels and quality of the site area before, during and after construction for potential contaminants of concern. Water level data would be regularly reviewed by a qualified hydrogeologist<br>• Groundwater collected within site excavations and within the tunnels during construction would be discharged to the local stormwater system at each construction site. Temporary water treatment plants would treat collected groundwater so that the discharged water quality meets the requirements of any relevant environment protection licence for Stage 1 or the requirements of the *Protection of the Environment Operations Act 1997*. |

| Issue | Potential impact |
|---|---|
| **Hydrology and flooding** | • Potential for inundation of construction areas during flood events particularly in areas where flooding currently occurs (such as high flood risk areas in Parramatta metro station, Clyde stabling and maintenance facility and The Bays Station construction sites). Detailed construction planning would consider flood risk at construction sites<br>• Minor potential flooding impacts associated with the interruption of overland flow paths by installation of temporary construction site infrastructure (i.e. noise barriers, acoustic sheds (or other acoustic measures), retaining walls) and/or modifications to landforms (i.e. placement of fill materials, stockpiles). Key areas of potential flooding risk include the Parramatta metro station, Clyde stabling and maintenance facility, Silverwater services facility and The Bays Station construction sites<br>• Minor potential increases in peak flooding levels, increases in the extent of floods and an increase in flood hazard during flooding events at Clyde stabling and maintenance facility. These potential increases are within acceptable limits<br>• Potential increases in flow velocity and scour potential may result where Stage 1 construction works alter flood flow patterns and significantly divert or concentrate flood flows. Further design refinement at the Clyde stabling and maintenance facility construction site would occur during detailed design to mitigate the identified potential impacts. |
| **Biodiversity** | • Direct removal of 0.18 hectares of native vegetation including 0.15 ha of Mangrove forest at Clyde and 0.03 hectares of Grey Box-Forest Red Gum grassy woodland at the Westmead metro station construction site. Biodiversity impacts, primarily at Clyde, would be offset in accordance with the requirements of the Biodiversity Conservation Act 2016 and relevant guidelines<br>• Potential impacts to the habitat of seven threatened fauna species however these impacts are unlikely to detrimentally effect these species on a whole<br>• Impacts to the vegetation riparian zones of Duck Creek and A'Becketts Creek that may limit the movement of threatened fauna species in that area<br>• As outlined in Section 8.11 (Biodiversity), this proposal for precast facilities at Eastern Creek would require clearing of about 1.92 ha of native vegetation, a subset of which includes 1.74 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered). Combined, Stage 1 of the works for Sydney Metro West and the precast facilities would result in the direct impact to around 1.77 ha of BC Act listed Cumberland Plain Woodland. This combined impact from these projects are anticipated to be limited and adequately managed through the implementation of mitigation measures. The overall contribution to biodiversity impacts in the Cumberland Plain region is relatively low. |
| **Air quality** | • Some unavoidable risks of temporary nuisance impacts from dust are expected at some locations. Best-practice dust management measures would be implemented during all construction works and additional measures would be implemented if required subject to outcomes of monitoring. |
| **Spoil and waste management** | • Moderate potential residual impacts would include generation of unusable spoil during tunnelling due to contamination or acid sulfate soils. All waste would be assessed, classified, managed, transported and disposed of in accordance with the *Waste Classification Guidelines and the Protection of the Environment Operations (Waste) Regulation 2014*. |
| **Hazards** | • Potential temporary impacts associated with the storage, use and transport of dangerous goods and hazardous substances. The method for delivery of explosives would be developed prior to the commencement of blasting (if proposed) in consultation with the Department of Planning, Industry and Environment and be timed to avoid the need for on-site storage<br>• Potential risk of impacts to utilities (both above ground and underground) including high voltage power lines, gas distribution lines, and high pressure gas mains near the Clyde stabling and maintenance facility construction site. Ongoing consultation would be carried out with utility providers for high pressure gas or petroleum pipelines to identify appropriate construction methodologies to be implemented. |

| Issue | Potential impact |
|---|---|
| **Cumulative impacts** | • Given the potential overlap of construction with a number of large infrastructure projects, potential temporary cumulative impacts have been identified at Westmead, Parramatta, Sydney Olympic Park and The Bays<br>• Key potential construction stage cumulative issues are generally expected to be relatively minor and would include temporary local traffic impacts and accessibility, temporary noise and vibration (particularly night time works), temporary visual impact and amenity effects and spoil disposal and disposal routes. Sydney Metro would work closely with the proponents of other nearby projects and stakeholders such as Transport Coordination to manage and coordinate the interface with other major projects under construction at the same time. |

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# 8 Environmental impact assessment

This chapter provides an environmental impact assessment for the construction and operation of the proposal.

## 8.1 Noise and vibration

A noise and vibration impact assessment has been prepared for the proposal. This assessment is attached as Appendix B (Noise and Vibration Technical Paper) of this REF. The methodology and results of this assessment are summarised in this section.

Potential cumulative noise impacts associated with multiple works being completed near the proposal at the same time or consecutively are discussed in Section 8.16 (Cumulative impacts).

### 8.1.1 Methodology

The noise and vibration assessment involved:

- Defining the existing background noise levels based on previously undertaken ambient noise monitoring (between 2016 and 2019)
- Establishing representative construction scenarios, locations, working times and duration of activities that would apply to construction of the proposal
- Predicting noise levels at receivers within the assessment area due to the proposed construction activities using a noise prediction model
- Assessing potential construction noise impacts with reference to the ICNG and the Sydney Metro Construction Noise and Vibration Standard
- Assessing potential construction vibration impacts
- Assessing potential operational noise impacts with reference to the Noise Policy for Industry (NPfI) and NSW Road Noise Policy (RNP)
- Identifying management and mitigation measures to minimise and manage the predicted noise and vibration impacts.

**Policies and guidelines**

The following policies and guidelines were used to assess noise and vibration impacts:

- ICNG (Department of Environment and Climate Change (DECC), 2009)
- Assessing Vibration: a technical guideline (Department of Environment and Conservation, 2006)
- AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors
- RNP (DECCW, 2011)
- BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2 (BSI, 1993)
- DIN 4150 Part 3-2016 Structural vibration – Effects of vibration on structures (Deutsches Institute fur Normung, 1999)
- NPfI (EPA, 2017).

**Construction noise assessment**

Construction noise was assessed in accordance with the ICNG. The ICNG identifies Noise Management Levels (NMLs), which are the project-specific noise criteria used to help manage noise impacts at all receiver locations. NMLs are defined by existing ambient noise levels and the receiver's sensitivity to construction noise. NMLs are categorised for residential and other sensitive land uses.

If construction noise levels are predicted to exceed NMLs, potential noise impacts would be managed through the implementation of feasible and reasonable mitigation measures.

The construction noise assessment uses the following terms:

- $L_{Aeq(15minute)}$ is the 'energy average noise level' considered over a 15-minute period. This parameter is used to assess potential construction noise impacts
- $L_{A90}$ is the 'background noise level' in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively. The $L_{Aeq(15minute)}$ NMLs are based on $L_{A90}$ background noise levels
- $L_{AFmax}$ is the maximum noise level measured during a monitoring period, using 'fast' weighting
- Rating Background Level (RBL) is representative of the typical lowest ambient noise level not exceeded for more than 90 per cent of the daytime, evening, or night-time period.

The ICNG provides an approach for determining $L_{Aeq(15minute)}$ NMLs at residential receivers by applying the measured $L_{A90}$ background noise levels, as described in Table 8-1.

Table 8-1: Determination of NMLs for residential receivers

| Time of day | NML $L_{Aeq(15\ minute)}$ | How to apply |
|---|---|---|
| **Standard construction hours**<br>**Monday to Friday 7:00am to 6:00pm**<br>**Saturday 8:00am to 1:00pm**<br>**No work on Sundays or public holidays** | Noise affected RBL + 10 dBA | The noise affected level represents the point above which there may be some community reaction to noise:<br>• Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent would apply all feasible and reasonable work practices to meet the noise affected level<br>• The proponent would also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly Noise Affected 75 dBA | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account:<br>• Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences)<br>• If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| **Outside recommended standard hours** | Noise affected RBL + 5 dBA | • A strong justification would typically be required for works outside the recommended standard hours<br>• The proponent would apply all feasible and reasonable work practices to meet the noise affected level<br>• Where all feasible and reasonable practises have been applied and noise is more than 5 dBA above the noise affected level, the proponent would negotiate with the community. |

*Note: The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy.*

The assessment of predicted airborne noise impacts around the construction site is based on the exceedance of the NMLs as per the construction scenarios identified in Table 8-3. The likely subjective response of people potentially affected by the impacts is shown in Table 8-2.

Table 8-2: Exceedance bands and corresponding subjective response to impacts

| Exceedance of management level | Likely subjective response | Impact colouring |
|---|---|---|
| **No exceedance** | No impact | |
| **1 to 10 dB** | Minor | |
| **11 dB to 20 dB** | Moderate | |
| **Greater than 20 dB** | High | |

### Construction scenario descriptions

Representative scenarios have been developed to assess the likely impacts from the various construction phases of the works. These scenarios are outlined in Table 8-3. The assessment uses realistic worst-case scenarios to determine the impacts from the noisiest 15-minute period that are likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

The assessment is generally considered conservative as the calculations assume several items of construction equipment are in use at the same time within individual scenarios.

The equipment assumed to be in use in each scenario is included in Appendix B (Noise and Vibration Technical Paper).

Table 8-3: Construction scenario descriptions

| Scenario | Activity | Description |
|---|---|---|
| **Site establishment** | Vegetation clearing | Clearing the proposal site of existing vegetation, trees, soil and debris |
| | Earthworks | Bulk earthworks including excavation, compaction and haulage of materials |
| | Utilities | Installation of power, water, sewerage, etc. |
| **Civil and building work** | Establishment of roads | Construction of pavements and sealing of internal access roads for the proposed precast facilities |
| | Construction of built form | Construction of precast facilities and site offices |
| **Commissioning** | Decommissioning and fit out | Includes decommissioning/demobilisation of the construction area, fit-out of the shed and commissioning of operational facilities |
| | Landscaping | Site landscaping |

### Construction vibration

The potential impacts during vibration intensive works have been assessed assuming a vibratory roller could be used anywhere within the proposal site.

### Operational noise assessment

Operational noise was assessed in accordance with the NPfI (NSW EPA, 2017) which describes 'trigger levels' to inform the noise level at which feasible and reasonable noise management measures should be considered. Two forms of noise objectives are provided – one to account for 'intrusive' noise impacts (exceeding background noise levels by more than 5 dB) and one to protect the 'amenity' of particular land uses. The more stringent of these two is the project specific noise trigger level. The predicted levels represent worst-case scenarios during the concurrent operation of both facilities. Noise emissions would vary depending on delivery and production schedules and would frequently be lower than the worst-case levels presented.

The project-specific noise trigger levels for the nearest residential and commercial receivers are shown in Table 8-4. The more stringent of the intrusive and amenity trigger levels are shown in bold. The Noise Catchment Areas (NCAs) are described in section 8.1.2.

The methodology for determining the project-specific noise trigger levels is further explained in Appendix B (Noise and Vibration Technical Paper).

Table 8-4: Project noise trigger levels – Operational noise assessment

| NCA | Receiver type | Period | Recommended amenity noise level $L_A$eq (dBA) | Measured noise level (dBA) | | Project noise trigger level $L_{Aeq(15minute)}$ (dBA) | |
|---|---|---|---|---|---|---|---|
| | | | | RBL | $L_{Aeq(period)}$ | Intrusiveness | Amenity[1,2] |
| **NCA01, NCA03 and NCA04** | Residential | Daytime | 55 | 37 | 47 | **42** | 58 |
| | | Evening | 45 | 37[3] | 46 | **42** | 48 |
| | | Night-time | 40 | 37[3] | 45 | **42** | 43 |
| | Commercial | When in use | 65 | - | - | - | **68** |
| **NCA02** | Residential | Daytime | 55 | 41 | 55 | **46** | 58 |
| | | Evening | 45 | 41[3] | 57 | **46** | 48 |
| | | Night-time | 40 | 41 | 49 | 46 | **43** |
| | Commercial | When in use | 65 | - | - | - | **68** |

*1 The recommended amenity noise levels have been assigned as the project amenity noise level (i.e. not reduced by 5 dB) as other sources of industrial noise in the area are distant and unlikely to significantly affect receivers near to the project*
*2 The project amenity noise levels have been converted to a 15-minute level by adding 3 dB*
*3 The measured evening/night-time RBL was found to be higher than the daytime/evening. In these situations, the evening/night-time RBL would typically be reduced to match the daytime/evening RBL however the NPfI acknowledges this may not always be appropriate and alternate approaches may be justified. In this case, a conservative approach has been used and the RBL has been reduced.*

#### Sleep disturbance

The most current method for assessing sleep disturbance is contained in the NPfI. The NPfI defines sleep disturbance criterion as 52 dBA $L_{AFmax}$ or the prevailing background level plus 15 dB, whichever is greater. The 52 dBA $L_{AFmax}$ criterion has been used for this proposal as this is the criterion which applies to the nearest residential receivers in NCA01.

#### Road traffic noise

Construction and operational traffic noise were assessed with reference to the RNP.

The RNP requires any increase in the total traffic noise level to be limited to 2 dBA above that of the existing road traffic noise level for both construction and operation.

### 8.1.2 Existing environment

#### Background and ambient noise levels

Existing noise levels in the proposal site are generally controlled by road traffic noise from distant major roads, including the M4 Motorway and Great Western Highway, along with industrial noise from the surrounding existing industrial/commercial facilities.

All identified receivers surrounding the proposal site have been grouped into NCAs to assist in summarising the potential impacts. The noise study area comprises the proposal site and NCAs which are shown Figure 8-1 and described in Table 8-5.

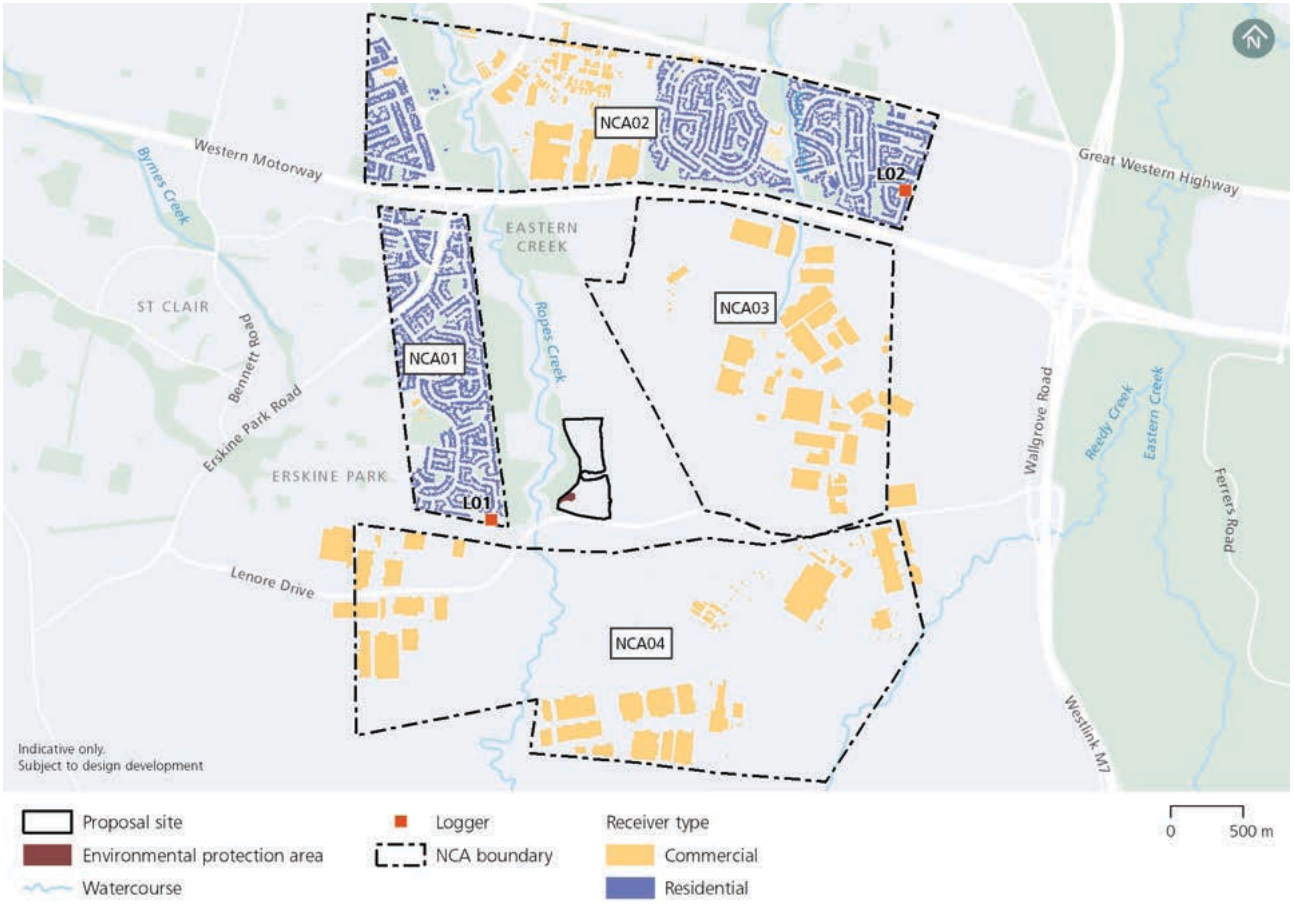


Figure 8-1: NCAs for the proposal

Table 8-5: NCAs and associated land uses

| NCAs | Description |
|---|---|
| **NCA01** | Located west of the proposal in Erskine Park. This catchment is mostly residential with the nearest receivers about 375 metres to the west of the proposal. A small number of commercial receivers are in this catchment at the Erskine Park Shopping Centre, which is off Shallow Drive. |
| **NCA02** | Located to the north of the proposal in Minchinbury, between the M4 Motorway and Great Western Highway. This catchment consists of commercial and industrial receivers to the immediate north of the proposal, and residential receivers to the north-east and north-west. The nearest receivers in this catchment are about 1.7 kilometres away. |
| **NCA03** | Located to the east of the proposal in Eastern Creek and west of M7 Motorway. This catchment is commercial and industrial. No residential land uses are located within this catchment. The nearest receiver is about 800 metres east of proposal. |
| **NCA04** | Located to the south of the proposal in Erskine Park (to the south-west), Eastern Creek (to the south) and Horsley Park (further south). This catchment is commercial and industrial. The nearest receivers in this catchment are about 800 metres away. No residential land uses are located within this catchment. |

### Sensitive receivers

Receivers potentially sensitive to noise and vibration have been categorised as residential buildings, commercial/industrial buildings, or 'other sensitive' land uses which includes educational institutions, childcare centres, medical facilities, places of worship, outdoor recreation areas, or commercial and industrial buildings. Receiver types and locations are shown in Figure 8-1.

The noise study area includes residential buildings and other sensitive land uses such as schools, and commercial and industrial buildings. No other receivers have been identified within the noise study area.

### Background noise monitoring

Unattended noise monitoring was completed in the vicinity of the proposal site in 2016 and 2019 as part of previous nearby projects. There have not been any significant changes to the proposal site and surrounds since this monitoring was undertaken which would influence its suitability for this assessment. The measured noise levels have been used to determine the existing noise environment and to set criteria to assess the potential impacts from the proposal. The noise monitoring locations are included in Figure 8-1 and Table 8-6.

The results of the unattended ambient noise surveys are summarised in Table 8-6 as the RBL, and $L_{Aeq}$ noise levels for the ICNG daytime (7.00 am to 6.00 pm), evening (6.00 pm to 10.00 pm) and night-time (10.00 pm to 7.00 am) periods.

Short-term attended noise monitoring was completed at each ambient noise monitoring location. Attended noise monitoring results confirmed the results of the unattended noise monitoring.

Table 8-6: Summary of unattended noise monitoring results

| Noise monitoring location | Address | Measured noise level (dBA)[1,2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | Background noise (RBL) | | | Average noise level ($L_{Aeq}$) | | |
| | | Daytime | Evening | Night | Daytime | Evening | Night |
| **L01** | 82 Weaver Street, Erskine Park | 37 | 37[3] (actual 40) | 37[3] (actual 39) | 47 | 46 | 45 |
| **L02** | 8 Farrington Street, Minchinbury | 41 | 41[3] (actual 45) | 41 | 55 | 57 | 49 |

*1 The RBL and LAeq noise levels have been determined with reference to the procedures in the NPfI.*
*2 Daytime is 7.00 am to 6.00 pm, evening is 6.00 pm to 10.00 pm and night-time is 10.00 pm to 7.00 am.*
*3 RBL for evening set at no greater than the daytime, and RBL for night-time set no greater than the day or evening following conservative principles outlined in the NPfI.*

## 8.1.3 Potential impacts – construction

In summary, the assessment of potential temporary construction noise impacts has found that even with conservative assumptions, the potential for any impact from noisy activities associated with the proposal would be marginal at most. Notwithstanding, Sydney Metro is committed to minimising construction noise impacts to the greatest possible extent through the implementation of the Sydney Metro Construction Noise and Vibration Standard, the adoption of appropriate work practices and sourcing of fit-for-purpose plant and equipment.

### Construction noise

Potential noise impacts during construction of the proposal are predicted to comply with the relevant criteria for the majority of the works.

The predicted airborne noise levels and potential NML exceedances from construction works at the proposal site are summarised in Table 8-7. The predicted noise levels assume a worst-case scenario therefore it is expected that the construction noise levels would frequently be lower than predicted at the most exposed receiver for most construction activities. The worst-case predicted noise level is 50 dBA, which is comparable to the existing LAeq noise levels in the noise catchment area (refer to Table 8-7). This noise level would be below annoyance levels with the potentially affected buildings. Therefore, this exceedance is considered to be of low significance.

At most there would be a minor temporary exceedance of the NML for some residential receivers in NCA01 during the site establishment – earthworks activity. This potential exceedance would be experienced by a small number of residential receivers (those closest to the site) for a short period of time during daytime when earthworks are occurring at the proposal site boundary closest to the sensitive receivers. The predicted levels of construction noise would be similar to the existing ambient levels of noise in the catchment.

Construction noise level contours across the proposal site are shown in Figure 8-2 for the scenario which results in the highest predicted noise levels at the closest sensitive receivers (Site establishment – earthworks).

Table 8-7: Predicted worst-case construction noise impacts

| NCA | NML (dBA) | Predicted worst-case $L_{Aeq(15minute)}$ noise level (dBa) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Site establishment | | | Civil and building work | | Commissioning | |
| | | Vegetation clearing | Earthworks | Utilities | Establishment of roads | Construction of built form | Decommissioning and fit out | Landscaping |
| **Residential – Daytime** | | | | | | | | |
| **NCA01** | 47 | 47 | 50 | 34 | 46 | 45 | 42 | 31 |
| **NCA02** | 51 | <30 | <30 | <30 | <30 | <30 | <30 | <30 |
| **NCA03** | 47 | N/A – no residential receivers in this NCA | | | | | | |
| **NCA04** | 47 | N/A – no residential receivers in this NCA | | | | | | |
| **Commercial – Daytime** | | | | | | | | |
| **NAC01** | 70 | 39 | 42 | <30 | 39 | 37 | 34 | <30 |
| **NCA02** | 70 | 32 | 35 | <30 | 33 | 31 | <30 | <30 |
| **NCA03** | 70 | 40 | 43 | <30 | 40 | 38 | 35 | <30 |
| **NCA04** | 70 | 39 | 42 | <30 | 38 | 37 | 34 | <30 |

*LEGEND No Exceedance* *1 - 10 dB above NML* *11 - 20 dB above NML* *> dB above NML*

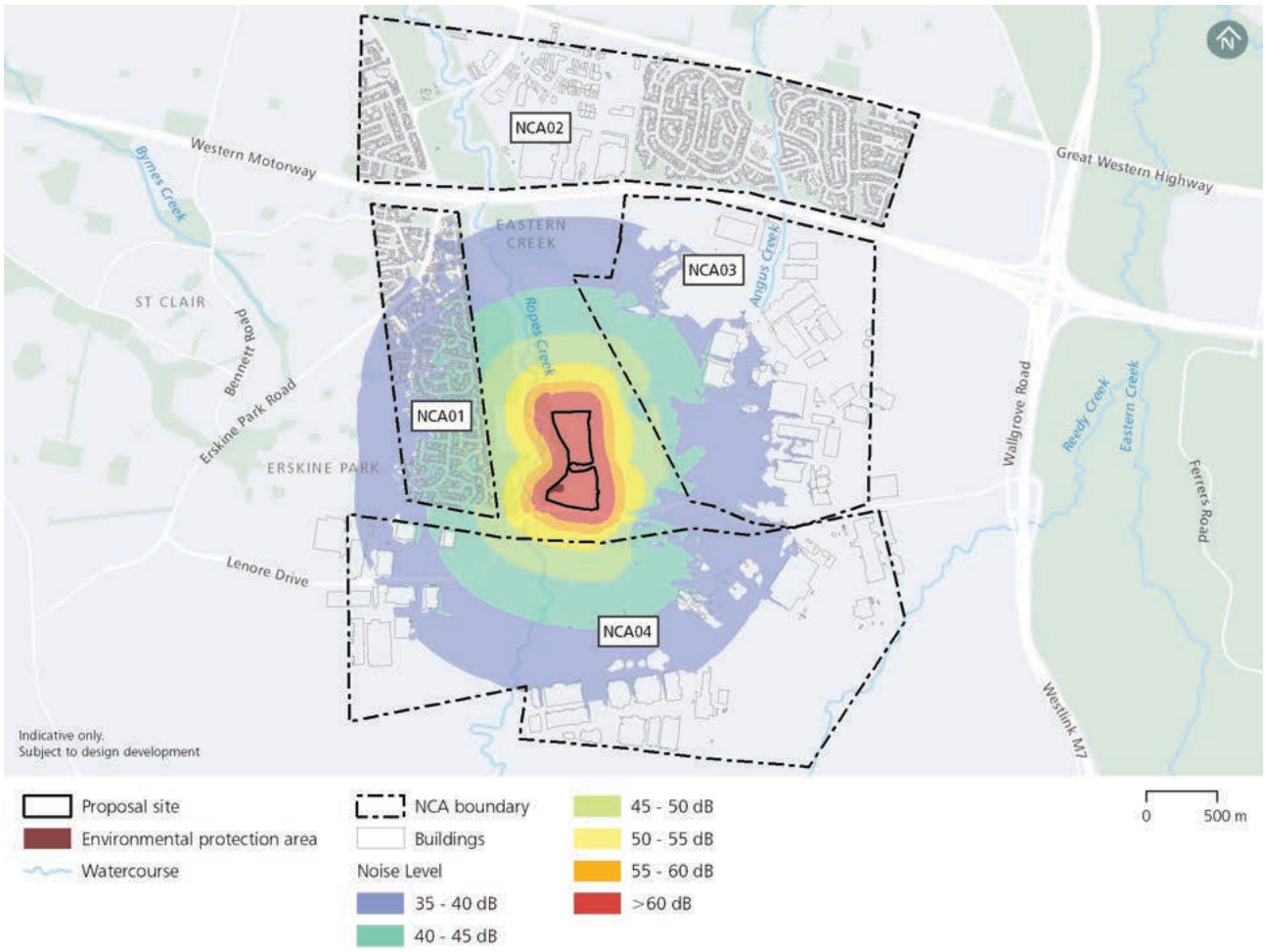


Figure 8-2: Predicted construction noise level contours – Site establishment – earthworks

### Construction road traffic noise

Construction traffic would travel east from the proposal site and access the M7 Motorway via existing busy arterial roads through commercial/industrial areas. No noise impacts from construction traffic at sensitive receivers are expected.

### Construction vibration

Vibration intensive equipment is proposed to be used during construction including the use of a vibratory roller. The nearest receivers are about 375 metres from the proposal site and impacts from vibration intensive works during construction of the proposal are anticipated to be negligible.

The separation distance between the proposal site and the nearest potentially affected receivers is sufficient for vibration levels to be compliant with both the human comfort and cosmetic damage criteria.

## 8.1.4 Potential impacts – operation

In summary, the assessment of potential operational noise impacts has found that even with conservative assumptions, the potential for any impact from noisy activities associated with the proposal would be marginal at most. Notwithstanding, Sydney Metro is committed to minimising operational noise impacts to the greatest possible extent through the implementation of the Sydney Metro Construction Noise and Vibration Standard, the adoption of appropriate work practices and sourcing of fit-for-purpose plant and equipment.

Although the Sydney Metro Construction Noise and Vibration Standard is typically applied to the construction phase of projects, it is proposed to adopt this standard for the operational phase of the precast facilities considering their role in supporting construction of Sydney Metro West and their use by the tunnelling contractors.

### Operational noise

The assessment shows that the concurrent operation of both the northern and southern precast facilities would comply with all relevant objectives at all receivers under neutral weather conditions during day, evening and night periods. Compliance is also predicted during noise-enhancing weather conditions, such as strong wind or rain (including wind conditions from the proposal site towards receivers).

The predicted operational noise levels at the nearest receivers from industrial noise emissions are summarised in Table 8-8 for both standard and noise-enhancing weather conditions using all conservative assumptions. Operation noise level contours are shown in Figure 8-3.

Table 8-8: Operational noise assessment

| Receiver Type | Receiver Location | Period | $L_{Aeq(15\ minutes)}$ Noise Level (dBA) | | | Compliance? |
|---|---|---|---|---|---|---|
| | | | Project Trigger Level | Predicted | Exceedance | |
| **Standard weather conditions** | | | | | | |
| **Residential** | NCA01 | Daytime | 42 | 39 | - | Yes |
| | | Evening | 42 | 38 | - | Yes |
| | | Night-time | 42 | 38 | - | Yes |
| | NCA02 | Daytime | 46 | 30 | - | Yes |
| | | Evening | 46 | <30 | - | Yes |
| | | Night-time | 43 | 30 | - | Yes |
| **Commercial** | NCA01 | When in use | 68 | 37 | - | Yes |
| | NCA02 | When in use | 68 | 30 | - | Yes |
| | NCA03 | When in use | 68 | 37 | - | Yes |
| | NCA04 | When in use | 68 | 36 | - | Yes |
| **Noise-enhancing weather conditions** | | | | | | |
| **Residential** | NCA01 | Daytime | N/A[1] | N/A[1] | N/A[1] | N/A[1] |
| | | Evening | 42 | 40 | - | Yes |
| | | Night-time | 42 | 42 | - | Yes |
| | NCA02 | Daytime | N/A[1] | N/A[1] | N/A[1] | N/A[1] |
| | | Evening | 46 | <30 | - | Yes |
| | | Night-time | 43 | 31 | - | Yes |
| **Commercial** | NCA01 | When in use | 68 | 41 | - | Yes |
| | NCA02 | When in use | 68 | 35 | - | Yes |
| | NCA03 | When in use | 68 | 41 | - | Yes |
| | NCA04 | When in use | 68 | 40 | - | Yes |

*1 Noise-enhancing weather conditions are not a feature of the area during the daytime. Weather data for the area is included in Appendix B (Noise and Vibration Technical Paper).*


Figure 8-3: Predicted operation noise level contours

### Sleep disturbance

Maximum noise levels from the operation of the proposal are expected to comply with the relevant criteria. Truck movements and precast segment loading activities would be expected to result in the highest noise levels from the operation of the proposal. Table 8-9 shows the predicted worst-case maximum noise levels at the nearest residential receivers.

Table 8-9: Summary of predicted sleep disturbance noise levels

| NCA | Source | $L_{Amax}$ Noise Level (dBA) | | Compliance? |
|---|---|---|---|---|
| | | Criteria | Predicted | |
| **NCA01** | Truck movements | 52 | 47 | Yes |
| **NCA02** | | | 35 | Yes |

### Operational road traffic noise

Operational traffic would access the proposal site from Lenore Drive via a temporary haulage route. Once completed, operational traffic would access the proposal site via the planned Archbold Road upgrade and extension and generally travel east to access the M7 Motorway via existing arterial roads and through commercial/industrial areas. Therefore, no impacts to sensitive receivers are expected from operational traffic.

### 8.1.5 Management and mitigation measures

The Sydney Metro Construction Noise and Vibration Standard would be applied to the construction and operation of the proposal. The Standard aims to manage noise and vibration levels where feasible and reasonable using a variety of mitigation measures, and provides:

- A list of standard mitigation measures that would be implemented where feasible and reasonable
- Trigger levels (based on exceedances of airborne NMLs) for the implementation of additional mitigation measures.

The mitigation measures that would be implemented to address potential noise and vibration impacts are listed in Table 8-10. No operational mitigation measures for the proposal are required as operational noise levels are expected to be compliant under neutral and adverse weather conditions during the day, evening and night periods.

Table 8-10: Management and mitigation measures – noise and vibration

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **NV1** | Construction noise and vibration | During construction, receivers that would potentially be affected by noise and/or vibration from the works would be appropriately notified before the relevant works start. |
| **NV2** | Construction airborne noise | Noise monitoring at the most affected receiver(s) would be undertaken at the start of construction works to check the levels are as predicted and to confirm that the standard mitigation measures are adequate. If the standard mitigation measures are not found to be adequate, further mitigation measures would be considered and implemented where feasible and reasonable. |

## 8.2 Traffic, transport and access

A traffic and transport assessment was carried out to assess the potential temporary impacts of the proposal for all users and relevant interfaces. This assessment is attached as Appendix C (Traffic and Transport Assessment) of this REF. The methodology and results of this assessment are summarised in this section.

Potential cumulative traffic and transport impacts associated with multiple works being completed near the proposal at the same time are discussed in Section 8.16 (Cumulative impacts).

### 8.2.1 Methodology

The traffic and transport assessment involved:

- Identifying existing conditions including site access, road network, traffic conditions, traffic volumes, parking availability, public transport and pedestrian and cyclist provisions
- Assessing the potential impact of the proposal during construction and operation, including on road network performance, parking, property access, public transport, pedestrians and cyclists. Traffic counts were collected in November 2019 to inform the assessment of road network performance. There have been no recent major roadworks, upgrades or developments within the vicinity of the proposal site that would impact on the suitability of the November 2019 traffic counts for the assessment
- Identifying management and mitigation measures to mitigate potential impacts of the proposal on the traffic and transport network.

Traffic modelling was undertaken using SIDRA Intersection 8 software to assess intersection performance during morning and evening peak periods in terms of capacity, level of service and other performance measures such as delay and maximum queue length.

Intersection level of service has been determined for intersections within the vicinity of the proposal site based on the criteria outlined in Table 8-11.

Table 8-11: Intersection level of service criteria

| Level of service | Average delay per vehicle (seconds/vehicle) | Traffic signals and roundabouts |
|---|---|---|
| **A** | Less than 15 | Good operation |
| **B** | 15 to 28 | Good with acceptable delays and spare capacity |
| **C** | 29 to 42 | Satisfactory |
| **D** | 43 to 56 | Operating near capacity |
| **E** | 57 to 70 | At capacity; at signals, incidents will cause delays |
| **F** | Over 70 | Extra capacity required |

Further details relating to the traffic modelling approach and performance indicators are provided in Appendix C (Traffic and Transport Assessment).

### 8.2.2 Existing environment

#### Road network and traffic volumes

The existing road network in the vicinity of the proposal is shown in Figure 8-4. Old Wallgrove Road and Lenore Drive form an east-west arterial road that provides access to local roads servicing industrial precincts at Eastern Creek and Erskine Park. Old Wallgrove Road connects to Wallgrove Road and the M7 Motorway at its eastern end, which provide access to the wider Sydney arterial and motorway network.

Wallgrove Road and the M7 Motorway run in a north-south direction and are designated as tertiary and primary freight routes respectively. Both roads carry high volumes of freight vehicles. As a primary freight route, the M7 Motorway provides interstate access and access to strategically important ports, airports, industrial areas, freight terminals, and intermodal terminals and hubs. As a tertiary freight route, Wallgrove Road provides connections to the local road network and the lower-order elements of the State road system.

Local roads in the vicinity of the proposal site include Telopea Place, Roberts Road, Eastern Creek Drive, Southridge Street and Mini Link Road. These roads provide access to nearby industrial precincts and the intersection of these roads with Old Wallgrove Road are signalised. Unrestricted kerbside parking is permitted on Telopea Place, Roberts Road, Eastern Creek Drive and Southridge Street.

As noted in Chapter 1 (Introduction), the future road network would include the planned Archbold Road upgrade and extension which would provide a connection between the Great Western Highway, Minchinbury and Old Wallgrove Road, Eastern Creek (subject to separate approval by Transport for NSW). This first stage of the planned Archbold Road upgrade and extension would provide access to the proposal site from Lenore Drive, via a new section of Archbold Road and the Western Access Road. As a result, this proposal (for the precast facilities) does not include any external road works. Further extensions of Archbold Road would be completed at a later stage. Prior to completion of the planned Archbold Road upgrade and extension, construction traffic generated by the proposal would utilise a temporary haul road between Lenore Drive and the proposal site access.

Existing traffic volumes are the highest on Wallgrove Road, which carries over 1,000 vehicles per hour in each direction during peak hours. Traffic volumes are also high on Old Wallgrove Road / Lenore Drive, which carries between 690 and 1,090 vehicles per hour in each direction and has a westbound peak direction during the morning peak hour, and an eastbound peak direction during the evening peak hour. Traffic volumes on all other roads near the proposal are substantially lower. Table 8-12 outlines estimated peak hour midblock volumes on the key roads within the vicinity of the proposal.

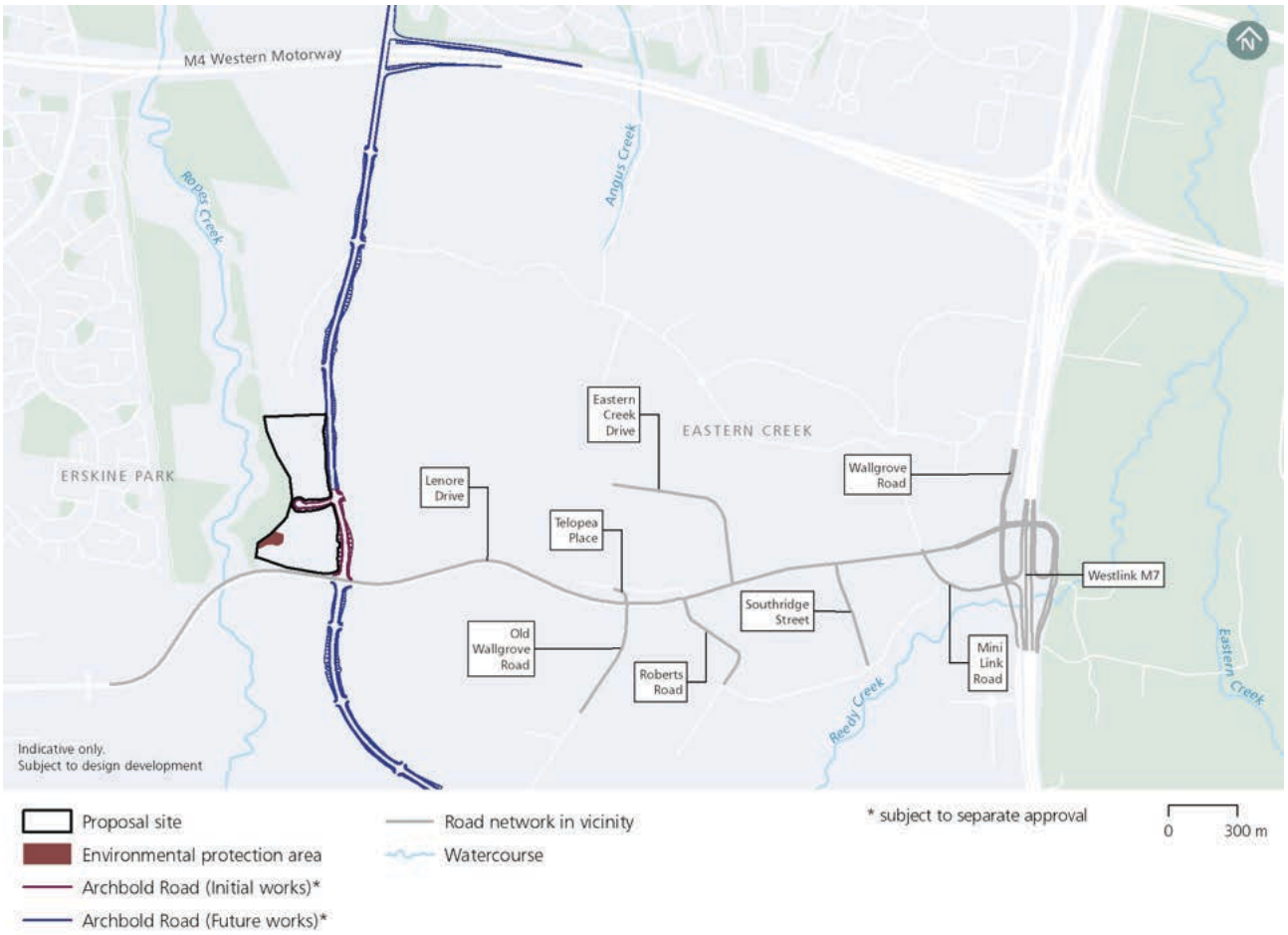


Figure 8-4: Existing road network in the vicinity of the proposal

Table 8-12: Existing peak hour traffic volumes by direction (2019)

| Road | Direction | Morning peak hour volumes (vehicles per hour) | Evening peak hour volumes (vehicles per hour) |
|---|---|---|---|
| **Old Wallgrove Road / Lenore Drive** | Eastbound | 750 | 880 |
| | Westbound | 1,090 | 690 |
| **Wallgrove Road** | Northbound | 1,070 | 1,380 |
| | Southbound | 1,410 | 1,480 |
| **Telopea Place / Old Wallgrove Road** | Northbound | 230 | 510 |
| | Southbound | 40 | 30 |
| **Roberts Road** | Northbound | 250 | 370 |
| | Southbound | 330 | 290 |
| **Eastern Creek Drive** | Northbound | 120 | 60 |
| | Southbound | 90 | 80 |
| **Southridge Street** | Northbound | 80 | 170 |
| | Southbound | 10 | 30 |
| **Mini Link Road / Quarry Road** | Northbound | 320 | 350 |
| | Southbound | 0 | 10 |

### Intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the proposal site identified that all intersections surrounding the proposal currently perform satisfactorily at or above level of service C. Further details regarding existing intersection performance is provided in Appendix C (Traffic and Transport Assessment).

### Public transport

There are no train stations located in close proximity to the proposal site. The closest station is Rooty Hill, located about six kilometres north of the proposal site.

Bus routes 738 and 835 operate on Old Wallgrove Road and Lenore Drive within the vicinity of the proposal site. The closest bus stops are located south and south-east of the proposal site on Lenore Drive, and service bus route 835.

Route 738 is operated by Busways and is a loop service between Mount Druitt and Horsley Park via Wallgrove Road, Old Wallgrove Road and Roberts Road. Route 738 operates at a frequency of two buses per hour during the weekday morning and evening peak periods.

Route 835 is operated by Transit Systems and travels between Western Sydney University Kingswood and Prairiewood via Lenore Drive, Old Wallgrove Road and Wallgrove Road. Route 835 operates at a frequency of two buses per hour in each direction during the weekday morning and evening peak periods.

Bus priority lanes are provided at the intersections of Old Wallgrove Road and Telopea Place, Eastern Creek Drive and Southbridge Street.

### Active transport

Pedestrian activity within the immediate vicinity of the proposal is low given the industrial land uses present. Footpaths are provided on both sides of Old Wallgrove Road between Telopea Place and Wallgrove Road and include a shared user path on the northern side of the road. A shared user path is provided on the northern side of Lenore Drive, however there is no footpath on the southern side.

The cycle network in the vicinity of the proposal site is well established, with a number of off-road shared user paths. Shared user paths are provided on Lenore Drive and Old Wallgrove Road, providing connections to the regional cycle network via the M7 Motorway shared user path.

### 8.2.3 Potential impacts

#### Haulage routes

Site access and egress to and from the proposal site would be right-in, left-out via Lenore Drive, and left-in, right out via the temporary haul route prior to the completion of the first stage of the planned Archbold Road upgrade and extension (subject to separate approval). Haulage routes would generally be via arterial roads, minimising impacts to local roads in residential areas.

Haulage routes would travel east of the proposal site, generally via arterial roads, during construction and operation as follows:

- From the proposal site along the extended Archbold Road (or temporary haul road prior to the completion of the first stage of Archbold Road) to Lenore Drive
- Lenore Drive to Old Wallgrove Road
- Old Wallgrove Road to Wallgrove Road
- Old Wallgrove Road to M7 Motorway.

The haulage routes are shown in Figure 8-5.

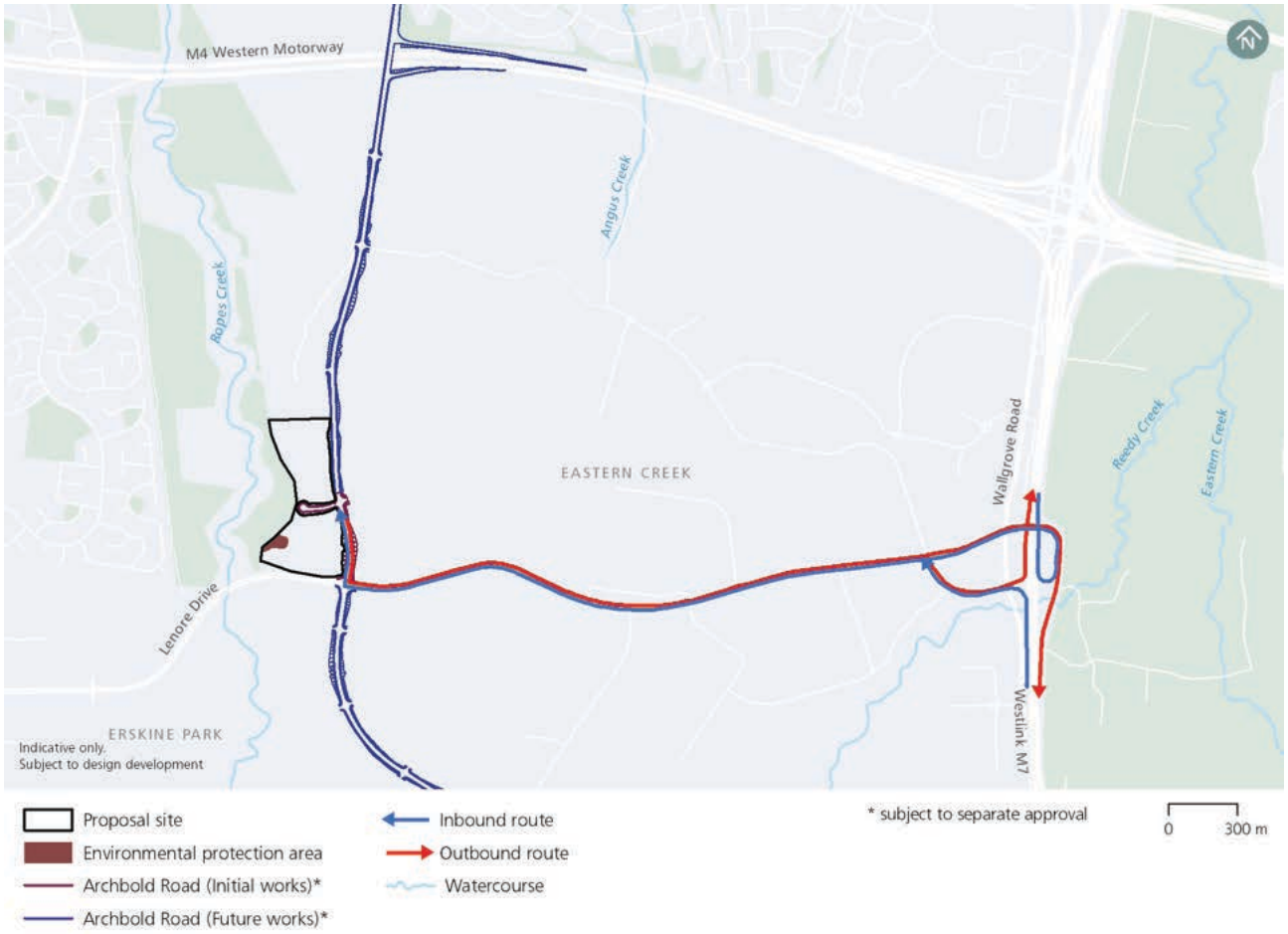


Figure 8-5: Proposed haulage routes

#### Construction

##### Road network performance

Overall, the introduction of construction traffic is anticipated to have a negligible impact on the operation of the surrounding road network.

Access and egress by the majority of construction vehicles would generally be during standard construction hours. The light vehicles modelled in the construction scenario account for the construction workers travelling to and from the proposal site as they would be arriving and exiting the site during peak periods thus representing the worst-case scenario.

During the peak construction year (2022) the forecast number of construction vehicles to and from the proposal site at each facility would be:

- **Light vehicles**: 60 vehicles (per facility) arriving in the hour before the start of shifts (6.00am to 7.00am) and 60 vehicles (per facility) leaving in the hour after the end of shifts (6.00pm to 7.00pm)
- **Heavy vehicles**: maximum of 10 heavy vehicles (per facility) per hour during standard construction hours (7.00 am to 6.00 pm).

The majority of plant and equipment would be stored at the proposal site within the laydown areas. If required, mobilisations of large plant and equipment would be carried out at evening or night-time outside of peak traffic times, subject to Transport for NSW standard requirements for out-of-hours work.

Modelling indicates that intersections used by construction vehicles would continue to perform at the same level of service with or without construction vehicles (refer to Table 8-13). Average intersection delays (measured in seconds per vehicle) would either not change or would temporarily increase by up to two seconds, which is considered to have a negligible impact on the road network. Intersection delays by two seconds would occur only at M7 Motorway northbound ramps / Wallgrove Road / Mini Link Road.

Modelled intersection performance at Old Wallgrove Road / Roberts Road, Old Wallgrove Road / Eastern Creek Drive and Old Wallgrove Road / Southridge Street intersections indicate that the level of service would improve slightly with construction traffic from the proposal. This is due to the reallocation of modelled signal phasing times at signalised intersections in response to additional traffic demand. However, intersection performance with construction traffic is expected to perform at a similar level as the scenario without construction traffic. Additional intersection performance indicators are provided in Appendix C (Traffic and Transport Assessment).

Table 8-13: Modelling peak hour intersection performance (2022) without and with the proposal – construction

| Intersection | Peak hour | Level of service (without proposal) | Level of service (with proposal) |
|---|---|---|---|
| **Old Wallgrove Road / Lenore Drive / Telopea Place** | Morning | C | C |
| | Evening | C | C |
| **Old Wallgrove Road / Roberts Road** | Morning | A | A |
| | Evening | A | A |
| **Old Wallgrove Road / Eastern Creek Drive** | Morning | A | A |
| | Evening | A | A |
| **Old Wallgrove Road / Southridge Street** | Morning | B | B |
| | Evening | B | B |
| **Old Wallgrove Road / Mini Link Road** | Morning | B | B |
| | Evening | B | B |
| **M7 Motorway southbound ramps / Wallgrove Road / Old Wallgrove Road** | Morning | C | C |
| | Evening | C | C |
| **M7 Motorway northbound ramps / Wallgrove Road / Mini Link Road** | Morning | C | C |
| | Evening | C | C |

### Parking and property access

There would be no impact on existing parking during construction of the proposal. Provision for parking during construction would be provided within the proposal site. There would also be no impact on property access during construction of the proposal.

### Public and active transport network

Potential impacts to bus services would be negligible. No impacts are anticipated on the operation of bus stops. Wallgrove Road and Old Wallgrove Road / Lenore Drive are serviced by buses and form part of the proposed construction vehicle route. Negligible impacts on bus services are anticipated and would be limited to a potential temporary minor increase in travel time due to the additional construction vehicles on the road network.

Prior to construction of the first stage of the planned Archbold Road upgrade and extension, and installation of traffic signals at the Archbold Road / Lenore Drive intersection, heavy vehicles would be required to cross the shared user path on the northern side of Lenore Drive to access the proposal site. Although pedestrian and cyclist volumes on these shared user paths are low, mitigation and management measures to minimise these impacts would be applied as outlined in Section 8.2.4.

It is anticipated that the planned Archbold Road upgrade and extension between Lenore Drive and the proposal site access would be open to traffic by mid-2022. Following the opening of the planned Archbold Road upgrade and extension, no impacts to pedestrians and cyclists are anticipated given that footpaths and shared user paths in the vicinity of the proposal site would remain open during construction of the proposal. Impacts to pedestrian and cyclist safety are not anticipated given that the Archbold Road / Lenore Drive intersection would be signalised. Moreover, shared paths run along the length of the haulage route with minimal volumes of pedestrians and cyclists.

### Operation

#### Road network performance

Overall, the introduction of operational traffic is anticipated to have a negligible impact on the operation of the surrounding road network. The operational traffic assessment considers the concurrent operation of the northern and southern precast facilities.

The hours that were modelled for the operation scenario represent the maximum number of vehicles on the road network and coincide with workers travelling to and from the proposal site, as well as heavy vehicle movements. Modelling the maximum number of vehicles on the road network represents the worst-case scenario. The forecast number of operation vehicles to and from the proposal site at each facility would be:

- **Light vehicles**: 60 vehicles (per facility) arriving in the hour before the start of shifts (indicatively 6.00 am to 7.00 am for day shifts and 6.00 pm to 7.00 pm for night shifts) and 60 vehicles (per facility) leaving in the hour after the end of shifts (indicatively 5.00 pm to 6.00 pm for day shifts and 5.00 am to 6.00 am for night shifts)
- **Heavy vehicles**: maximum of 12 heavy vehicles (per facility) per hour between 7.00 am to 6.00 pm
- **Heavy vehicles**: maximum of six heavy vehicles (per facility) per hour between 6.00 pm to 7.00 am.

Modelling indicates that the majority of intersections would continue to perform at the same level of service with or without operational vehicles associated with the proposal (refer to Table 8-13). The Old Wallgrove Road / Lenore Drive / Telopea Place intersection would experience a decrease in level of service in the morning peak hour from C to D, however this is associated with a two second increase in average delay, which is considered negligible.

Modelled intersection performance at Old Wallgrove Road / Roberts Road and Old Wallgrove Road / Eastern Creek Drive intersections indicate that the level of service would improve slightly with operational traffic from the proposal. This is due to the reallocation of modelled signal phasing times at signalised intersections in response to additional traffic demand. However, intersection performance with operation traffic is expected to perform at a similar level as the scenario without operation traffic. Additional intersection performance indicators are provided in Appendix C (Traffic and Transport Assessment).

Table 8-14: Modelling peak hour intersection performance (2026) without and with the proposal – operation

| Intersection | Peak hour | Level of service (without proposal) | Level of service (with proposal) |
|---|---|---|---|
| **Old Wallgrove Road / Lenore Drive / Telopea Place** | Morning | C | D |
| | Evening | D | D |
| **Old Wallgrove Road / Roberts Road** | Morning | A | A |
| | Evening | B | B |
| **Old Wallgrove Road / Eastern Creek Drive** | Morning | A | A |
| | Evening | A | A |
| **Old Wallgrove Road / Southridge Street** | Morning | B | B |
| | Evening | B | B |

| Intersection | Peak hour | Level of service (without proposal) | Level of service (with proposal) |
|---|---|---|---|
| **Old Wallgrove Road / Mini Link Road** | Morning | B | B |
| | Evening | C | C |
| **M7 Motorway southbound ramps / Wallgrove Road / Old Wallgrove Road** | Morning | C | C |
| | Evening | C | C |
| **M7 Motorway northbound ramps / Wallgrove Road / Mini Link Road** | Morning | C | C |
| | Evening | D | D |

#### Parking and property access

There would be no impact on existing parking during operation of the proposal. Provision for staff and visitor parking during operation would be provided within the proposal site.

There would also be no impact on property access during operation of the proposal.

#### Public and active transport network

Potential impacts to bus services would be minor and would be limited to a potential minor increase in travel time due to the additional operational vehicles on the road network. No impacts are anticipated on the operation of bus stops in the vicinity of the proposal site.

No impacts to pedestrians and cyclists are anticipated given that footpaths and shared user paths in the vicinity of the proposal site would not be affected during operation of the proposal. Impacts to pedestrian and cyclist safety are not anticipated given that the Archbold Road / Lenore Drive intersection would be signalised, shared user paths run along the majority of the haulage route and the minimal volumes of pedestrians and cyclists.

### 8.2.4 Management and mitigation measures

The Sydney Metro West Construction Traffic Management Framework would be applied to the construction and operation of the proposal. The framework provides an overall strategy and approach for construction traffic management, and an outline of the traffic management requirements and processes that would be applied, and interactions with relevant stakeholders. It establishes the traffic management processes and acceptable criteria to be considered and followed when managing impacts to the road network. Although the Construction Traffic Management Framework is typically applied to the construction phase of projects, it is proposed to also adopt this framework for the operational phase of the precast facilities considering their role in supporting construction of Sydney Metro West and their use by the tunnelling contractors.

The mitigation measures that would be implemented to address potential traffic, transport and access impacts are listed in Table 8-15.

Table 8-15: Management and mitigation measures – traffic, transport and access

| Reference | Impact/issue | Mitigation measure |
|---|---|---|
| **T1** | Traffic incidents | In the event of a traffic-related incident, coordination would be carried out with Transport Coordination and/or other parts of Transport for NSW. |
| **T2** | Emergency vehicles access | Access to properties for emergency vehicles would be provided at all times. |
| **T3** | Road safety | All trucks would enter and exit the proposal site in a forward direction, where feasible and reasonable. |
| **T4** | Staff parking | All staff parking would be provided on-site and not on surrounding local streets. |
| **T5** | Road safety | The driver induction process would include safety awareness in relation to all road users, particularly pedestrians and cyclists at the proposal site access point at Archbold Road / Lenore Drive during construction. |

## 8.3 Landscape and visual character

A landscape and visual impact assessment has been undertaken to assess the potential impact of the proposal on the surrounding landscape and visual character. This assessment is attached as Appendix D (Landscape and Visual Impact Assessment) of this REF. The methodology and results of this assessment are summarised in this section.

### 8.3.1 Methodology

The landscape and visual amenity impact assessment involved:

- Undertaking visual inspections of the proposal site and surrounds, including photographs from key viewpoints (in April and June 2020)
- Identifying the existing landscape and visual conditions of the proposal site and surrounds
- Assessing the potential landscape impacts of the proposal during construction and operation
- Assessing the potential daytime and night-time visual impacts of the proposal during construction and operation
- Identifying mitigation measures to minimise impacts to landscape and visual amenity.

**Landscape impact assessment**

Landscape refers to the overall character and function of a place. It includes all elements within the public realm and the interrelationship between these elements and the people who use them.

To identify impacts to landscape character, the assessment identified the sensitivity of the landscape to change and the magnitude of change expected from the proposal, and then made an overall assessment of the level of impact expected.

The degree of sensitivity of the landscape to change was identified as either neighbourhood, local, regional, state or national. The magnitude of change to the landscape is identified as considerable reduction or improvement, noticeable reduction or improvement, and no perceived reduction or improvement.

Table 8-16 provides a description of landscape sensitivity and modification. To assess the landscape character impact of the proposal, the sensitivity of the landscape and likely magnitude of change are combined. The landscape impact matrix is provided in Table 8-17.

Table 8-16: Landscape sensitivity levels and magnitude of change

| Landscape assessment | |
|---|---|
| **Landscape sensitivity** | |
| **National** | Landscape feature protected under national legislation or international policy. There are no nationally sensitive landscapes within this assessment. |
| **State** | Landscape feature that is heavily used and/or is iconic to the State. There are no state sensitive landscapes within this assessment. |
| **Regional** | Landscape feature that is heavily used and valued by residents of a major portion of the city or a non-metropolitan region. There are no regionally sensitive landscapes within this assessment. |
| **Local** | Landscape feature valued and experienced by concentrations of residents and/or local recreational users. Provides a considerable service to the community. For example, it provides a place for local gathering, recreation, sport, street use by cafes and/or shade and shelter in an exposed environment. Local examples include Ropes Creek or Peppertree Reserve, Erskine Park. |
| **Neighbourhood** | Landscape feature valued and appreciated primarily by a small number of residents, for example, street trees in a local street. Provides a minor service to the community. For example, it provides a seat or resting place, passive recreation and/or some shade and shelter in a local street. |

| Landscape assessment | |
|---|---|
| **Landscape magnitude of change** | |
| **Considerable reduction or improvement** | A substantial portion of the landscape is changed.<br>This may include substantial changes to vegetation cover, the area of open space or public realm area, accessibility, permeability, legibility and wayfinding, comfort and amenity, activation and safety, and diversity of the public realm. |
| **Noticeable reduction or improvement** | A portion of the landscape is changed.<br>This may include some alteration to vegetation cover, the area of open space or public realm area, accessibility, permeability, legibility and wayfinding, comfort and amenity, activation and safety, and diversity of the public realm. |
| **No perceived reduction or improvement** | Either the landscape quality is unchanged or if it is, it is largely mitigated by proposed public realm improvements.<br>Does not alter or not noticeably alter the vegetation cover, the area of open space or public realm area, accessibility, permeability, legibility and wayfinding, comfort and amenity, activation and safety, and diversity of the public realm. |

Table 8-17: Landscape impact level

| Landscape modifications | Landscape sensitivity | | | | |
|---|---|---|---|---|---|
| | **National** | **State** | **Regional** | **Local** | **Neighbourhood** |
| **Considerable reduction** | Very high adverse | Very high adverse | High adverse | Moderate adverse | Minor adverse |
| **Noticeable reduction** | Very high adverse | High adverse | Moderate adverse | Minor adverse | Negligible |
| **No perceived change** | Negligible | Negligible | Negligible | Negligible | Negligible |
| **Noticeable improvement** | Very high beneficial | High beneficial | Moderate beneficial | Minor beneficial | Negligible |
| **Considerable improvement** | Very high beneficial | Very high beneficial | High beneficial | Moderate beneficial | Minor beneficial |

### Visual impact assessment

Construction and operational visual impacts were considered for both daytime and night-time.

The assessment of daytime visual impacts involved identifying existing visual conditions, views that are representative of these conditions, the sensitivity of the views and the magnitude of change expected during construction and operation of the proposal.

Table 8-18 provides a description of visual sensitivity and magnitude of change for daytime. An overall assessment was then made of the level of impact expected (based on the matrix in Table 8-19).

Table 8-18: Visual sensitivity and magnitude of change – daytime

| Visual impact assessment | |
|---|---|
| **Visual sensitivity** | |
| **National** | Heavily experienced view to a national icon, for example the view to the Sydney Opera House from Circular Quay. There are no nationally sensitive views within this assessment. |
| **State** | Heavily experienced view to a feature or landscape that is iconic to the State, e.g. views to Old Government House from within Parramatta Park. There are no state sensitive views within this assessment. |

| Visual impact assessment | |
|---|---|
| **Regional** | Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or an important view from an area of regional open space, e.g. view from George Maunder Lookout over Prospect Reservoir. There are no regional sensitive views within this assessment. |
| **Local** | High quality view experienced by concentrations of residents and/or local recreational users, local commercial areas and/or large numbers of road or rail users. Views with local visual features and/or landmarks. |
| **Neighbourhood** | Views where visual amenity is appreciated by a small number of residents rather than particularly valued by the wider community. Viewers whose interest is not specifically focused on views e.g. workers. |
| **Visual magnitude of change** | |
| **Considerable reduction or improvement** | A substantial part of the view is altered.<br>The proposal is not compatible and/or contrasts substantially with the surrounding landscape. |
| **Noticeable reduction or improvement** | A small to moderate part of the view is altered.<br>The proposal contrasts with the surrounding landscape. |
| **No perceived reduction or improvement** | Either the view is unchanged or if it is, the change in the view is generally unlikely to be perceived by viewers or unlikely to result in a change in the amenity of the view. The proposal does not contrast with the surrounding landscape. |

Table 8-19: Visual impact levels – daytime

| Magnitude of change | Visual sensitivity | | | | |
|---|---|---|---|---|---|
| | National | State | Regional | Local | Neighbourhood |
| **Considerable reduction** | Very high adverse | Very high adverse | High adverse | Moderate adverse | Minor adverse |
| **Noticeable reduction** | Very high adverse | High adverse | Moderate adverse | Minor adverse | Negligible |
| **No perceived change** | Negligible | Negligible | Negligible | Negligible | Negligible |
| **Noticeable improvement** | Very high beneficial | High beneficial | Moderate beneficial | Minor beneficial | Negligible |
| **Considerable improvement** | Very high beneficial | Very high beneficial | High beneficial | Moderate beneficial | Minor beneficial |

The visual magnitude of change at night are described, as relevant, in terms of:

- **Sky glow** – which is the brightening of the night sky
- **Glare** – which is the condition of vision in which there is discomfort or a reduction in ability to see
- **Light spill** – which is the light emitted by a lighting installation that falls outside of the design area.

Environmental zones defined in standard AS/NZS 4282:2019 – Control of the obtrusive effects of outdoor lighting describe the existing night-time visual conditions of the proposal site. These zones are typical night-time settings and reflect the predominant light level of the proposal site and surrounds. Table 8-20 provides a description of each environmental zone and visual magnitude of change at night. The proposal site has been assessed as A3 as it is in a setting of medium district brightness.

AS/NZS 4282:2019 identifies four main potential effects of lighting, which are, the effects on residents, transport system users, transport signalling systems and astronomical observations. Of relevance to this assessment is the effects of lighting on the visual amenity of residents and transport system users. The night-time visual impact matrix is provided in Table 8-21.

Table 8-20: Environmental zone sensitivity and modification level – night-time

| **Visual impact assessment** | | |
|---|---|---|
| **Environmental zone sensitivity (Source AS/NZS 4282:2019)** | | |
| **Sensitivity level** | **Description** | **Examples** |
| Very high | A0: Intrinsically dark | • UNESCO Starlight Reserve<br>• Major optical observatories |
| High | A1: Dark | • Relatively uninhabited rural areas |
| Moderate | A2: Low district brightness | • Sparsely inhabited rural and semi-rural areas |
| Low | A3: Medium district brightness | • Suburban areas in towns and cities |
| Negligible | A4: High district brightness areas<br>TV: High district brightness | • Town, city centres and other commercial areas<br>• Residential areas abutting commercial areas |
| **Magnitude of change levels** | | |
| **Considerable reduction or improvement** | Substantial change to the level of sky glow, glare or light intrusion would be expected.<br>The lighting of the proposal would contrast substantially with the surrounding landscape at night. | |
| **Noticeable reduction or improvement** | Alteration to the level of sky glow, glare or light intrusion would be clearly visible.<br>The lighting of the proposal would contrast with the surrounding landscape at night. | |
| **No perceived reduction or improvement** | Either the level of sky glow, glare and light intrusion is unchanged or if it is altered, the change is generally unlikely to be perceived by viewers or compatible with the intended future use of the area. | |

Table 8-21: Visual impact levels – night-time

| **Magnitude of change** | **Visual sensitivity** | | | | |
|---|---|---|---|---|---|
| | **Very high** | **High** | **Moderate** | **Low** | **Negligible** |
| **Considerable reduction** | Very high adverse | Very high adverse | High adverse | Moderate adverse | Minor adverse |
| **Noticeable reduction** | Very high adverse | High adverse | Moderate adverse | Minor adverse | Negligible |
| **No perceived change** | Negligible | Negligible | Negligible | Negligible | Negligible |
| **Noticeable improvement** | Very high beneficial | High beneficial | Moderate beneficial | Minor beneficial | Negligible |
| **Considerable improvement** | Very high beneficial | Very high beneficial | High beneficial | Moderate beneficial | Minor beneficial |

### 8.3.2 Existing environment

The existing visual environment of the proposal site and surrounds consists of a mix of urban, industrial, commercial, land uses and areas of vegetation. This existing broader visual environment consists of a range of industrial and commercial developments (to the north, east and south) and low-density residential development (to the west). The areas immediately to the north and east of the proposal site are undeveloped greenfield sites, including the area to the south across Lenore Drive. Further to the east is a recycling and recovery facility and a range of large-scale industrial uses, including warehouses and distribution centres with office premises (part of the Eastern Creek Industrial Precinct).

The landform surrounding the proposal site is gently undulating, consisting of a series of hills and valleys created by South Creek and its tributaries. A locally prominent ridgeline which runs north to south is located to the east of the proposal site. The landform falls from this ridge towards Ropes Creek to the western boundary of the proposal site. An area of Coastal Valley Grassy Woodlands extends into the proposal site. However, it does not include any identified valuable scenic areas. The riparian vegetation along the creek is relatively low-lying and provides a green buffer between the proposal site and the residential area of Erskine Park further west. This residential area includes mainly low density lots on landform which rises to another local highpoint, where Erskine Park High School and James Erskine Public School are located.

The planned Archbold Road Upgrade and Extension, on full completion, would be located immediately east of the proposal site, with the Western Access Road located between the northern and southern precast facilities (subject to separate approval). The landscaping of the proposal would be coordinated with any landscaping undertaken as part of the Archbold Road project.

The landscape and visual features of the proposal site and surrounding areas are shown in Figure 8-6.

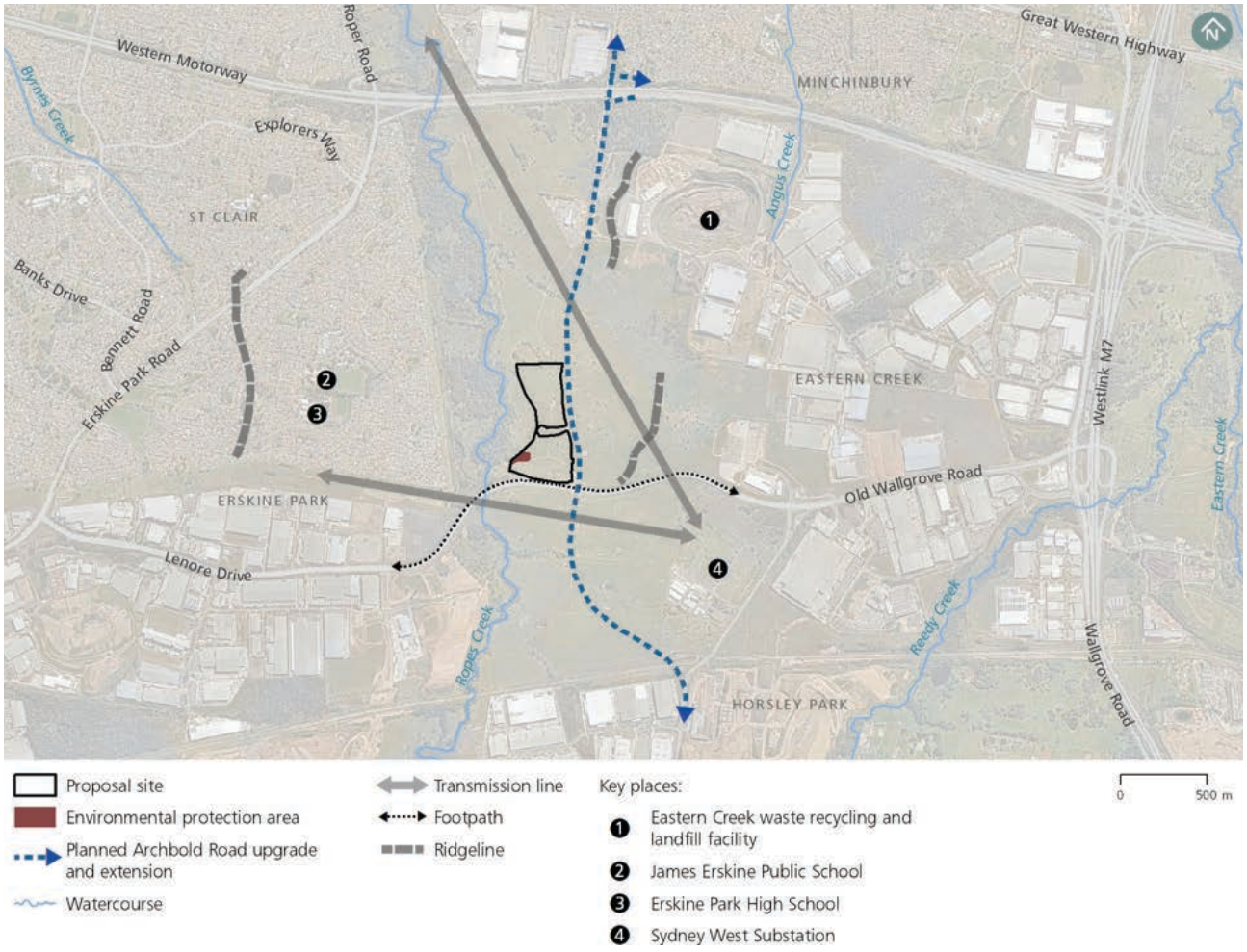


Figure 8-6: Landscape and visual features of the proposal site and surrounds

### 8.3.3 Potential impacts

#### Construction – Landscape character impacts

Overall, there would be a negligible landscape impact during construction.

The proposal site is not open to public use, however, there are some unauthorised recreational uses taking place. The site is located adjacent to the Ropes Creek corridor and is considered to have a 'neighbourhood landscape sensitivity'. There are no landscapes or public realm areas within the proposal site area which would be impacted by construction of the proposal. The proposal site would be transformed from a predominantly open landscape to a working construction site. However, earthworks and vegetation removal would be relatively minor and the scale of the construction activities would be generally consistent with the adjacent working industrial areas to the east. This would result in a noticeable reduction in the quality and character of this landscape, which is of neighbourhood landscape sensitivity, resulting in a negligible landscape impact during construction. Notwithstanding this, potential impacts during construction would be temporary in nature.

#### Construction – Visual amenity impacts

Six representative viewpoints to assess visual amenity impacts from the proposal are shown on Figure 8-7 and include the following:

- Viewpoint 1: View south from the M4 Western Motorway
- Viewpoint 2: View south-west from Hanson Place
- Viewpoint 3: View north-west from future upgraded and extended Archbold Road / Lenore Drive intersection
- Viewpoint 4: View north-east from Lenore Drive at the Ropes Creek crossing
- Viewpoint 5: View east from Aquarius Crescent, Erskine Park
- Viewpoint 6: View east from Park on Sennar Road, Erskine Park.

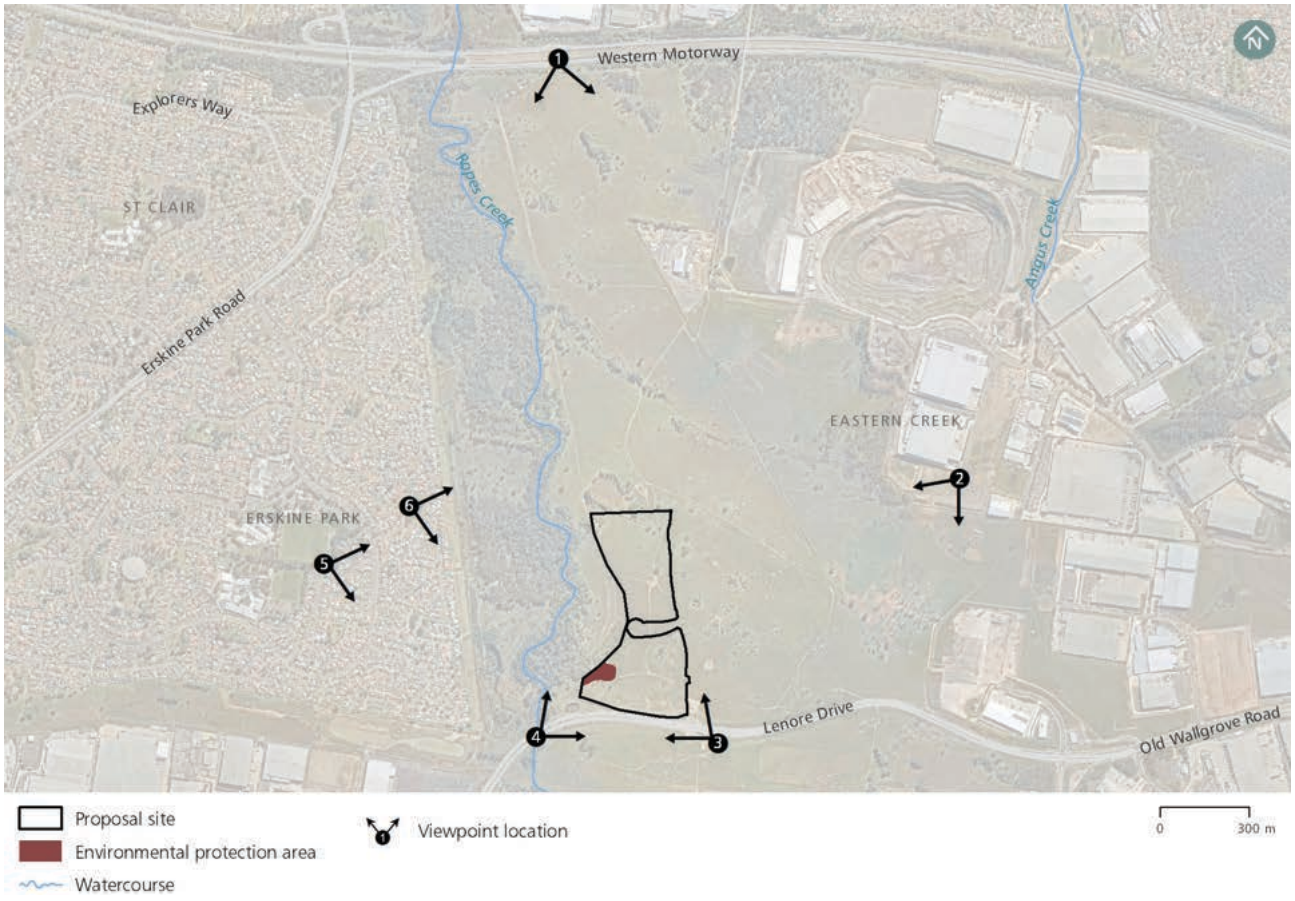


Figure 8-7: Representative viewpoints around the proposal site

Generally there would be negligible to minor adverse potential temporary visual impacts during construction. The proposal site has a relatively limited visual catchment due to the local landform and existing vegetation. An existing ridgeline blocks views from the industrial areas at the east which in turn limits broader views to the proposal site from further east.

Views from Erskine Park residential area west of the proposal site would mostly be limited by vegetation along Ropes Creek corridor. However, the proposal site would be visible in the background of views from the more elevated residential areas further west at Erskine Park. Views to the proposal site from the M4 Western Motorway, located about 1.5 kilometres to the north, would be limited by intervening vegetation, landform, and distance.

There is a view into the proposal site from the intersection of Lenore Drive and the planned Archbold Road upgrade and extension, where there is a break in the mounding present along Lenore Drive. Apart from this section of Lenore Drive, views from the south are limited, due to the lack of public access to the area.

During construction at night there would be a negligible temporary visual impact. Works would generally be scheduled during standard construction hours and any minor lighting associated with the proposal would be absorbed into the broader industrial setting, resulting in no perceived reduction in the amenity of views in the local area, which has a moderate sensitivity level.

The anticipated daytime visual impacts on representative viewpoints as a result of construction of the proposal are outlined below and summarised in Table 8-22.

### Viewpoint 1: View south from the M4 Western Motorway

This view is experienced by road users traveling at speed along the M4 Western Motorway as shown in Figure 8-8. Due to the distance and visual compatibility of the construction work with the character of the emerging industrial precinct surrounding the proposal site, there would be no perceived change in the amenity of this view. This is a view of local sensitivity and there would be a temporary negligible visual impact during construction.


Figure 8-8: Viewpoint 1 – View south from the M4 Western Motorway

### Viewpoint 2: View south-west from Hanson Place

Views from this location would generally be experienced by staff and visitors within the industrial area. As shown in Figure 8-9, there is limited visibility to the proposal site and a high visual absorption capacity for the temporary construction activity due to the existing industrial scale uses. Equipment used during construction would be filtered by patches of native trees along the ridgeline in the middle ground of view. This would result in a noticeable reduction in the amenity of this view, however given that the view is of neighbourhood visual sensitivity, this would result in a temporary negligible visual impact during construction.


Figure 8-9: Viewpoint 2 – View south-west from Hanson Place

### Viewpoint 3: View north-west from the future upgraded Archbold Road / Lenore Drive intersection

Views from this location would be experienced by vehicles travelling at speed along Lenore Drive and users of the adjacent shared path along this road as shown in Figure 8-10. The view from the north-west from the future upgraded Archbold Road / Lenore Drive intersection is to a relatively open landscape with a vegetated backdrop which would be converted into a large construction site (refer to Figure 8-11). Due to the proximity and intensity of temporary construction activities, this would result in a noticeable reduction in the amenity of this view, which has local sensitivities, and therefore a temporary minor adverse visual impact.

Figure 8-10: Viewpoint 3 – Existing view north-west from future upgraded Archbold Road / Lenore Drive intersection

Figure 8-11: Viewpoint 3 – View north-west from future upgraded Archbold Road / Lenore Drive intersection, indicative extent of proposal site (shown by yellow shading)

### Viewpoint 4: View north-east from Lenore Drive at the Ropes Creek crossing

Views from this location would be experienced from the users of the footpath, cyclists and vehicles travelling along Lenore Drive as shown in Figure 8-12. The existing vegetation along Lenore Drive would filter views into the proposal site, however, construction activities on the southern area of the proposal site would be seen in the centre of this view. The northern area of the proposal site would be screened by the existing vegetation alongside Ropes Creek which encloses this view. There would be a noticeable reduction in the amenity of this view, which is of local visual sensitivity, and a temporary minor adverse visual impact during construction.


Figure 8-12: Viewpoint 4 – View north-east from Lenore Drive at the Ropes Creek crossing

Figure 8-13: Viewpoint 4 – View north-east from Lenore Drive at the Ropes Creek crossing (indicative location of proposal site shown in yellow)

### Viewpoint 5: View east from Aquarius Crescent, Erskine Park

This view would be experienced by a concentration of residents and visitors in the vicinity of the adjacent schools. The lower elements of the proposal site would be screened by vegetation along Ropes Creek as shown in Figure 8-14. Some construction plant and equipment (e.g. cranes and acoustic sheds) would rise above the vegetation along Ropes Creek and would be partially visible in the background of this view. This would result in a noticeable reduction in the amenity of this view, however given that the view is of neighbourhood visual sensitivity, this would result in a temporary negligible visual impact during construction.


Figure 8-14: Viewpoint 5 – View east from Aquarius Crescent, Erskine Park

### Viewpoint 6: View east from Park on Sennar Road, Erskine Park

This view would be experienced by recreational users of the park and playground. Similar to Viewpoint 5, the lower elements of the proposal site would be screened by vegetation along Ropes Creek (Figure 8-15). Some construction plant and equipment (e.g. cranes and acoustic sheds) would rise above the vegetation along Ropes Creek and would be partially visible in the background of this view (Figure 8-16). This would result in a noticeable reduction in the amenity of this view, which is of local visual sensitivity, and a temporary minor adverse visual impact during construction.

Figure 8-15: Viewpoint 6 – Existing view east from park on Sennar Road, Erskine Park

Figure 8-16: Viewpoint 6 – View east from Park on Sennar Road, Erskine Park, indicative extent of the proposal site (shown by yellow shading)

Table 8-22: Summary of visual amenity impacts (construction)

| Location | Sensitivity | Magnitude | Impact |
|---|---|---|---|
| **Daytime** | | | |
| **Viewpoint 1: View south from the M4 Western Motorway** | Local | No perceived change | Negligible |
| **Viewpoint 2: View south-west from Hanson Place** | Neighbourhood | Noticeable reduction | Negligible |
| **Viewpoint 3: View north-west from future from future upgraded Archbold Road / Lenore Drive intersection** | Local | Noticeable reduction | Minor adverse |
| **Viewpoint 4: View north-east from Lenore Drive at the Ropes Creek crossing** | Local | Noticeable reduction | Minor adverse |
| **Viewpoint 5: View east from Aquarius Crescent, Erskine Park** | Neighbourhood | Noticeable reduction | Negligible |
| **Viewpoint 6: View east from park on Sennar Road, Erskine Park** | Local | Noticeable reduction | Minor adverse |
| **Night-time** | | | |
| **Proposal site** | Low | No perceived change | Negligible |

**Operation – Landscape character impacts**

During operation the proposal would result in a negligible landscape impact.

The proposal would be consistent with the industrial landscape character of the surrounding area – including planned industrial areas surrounding the proposal site and existing industrial areas further from the site. These areas include large scale warehouses, depots and storage facility buildings. Overall, there would be a noticeable reduction in the landscape character of the site, which is of neighbourhood landscape sensitivity, resulting in a negligible landscape impact during operation.

### Operation – Visual amenity impacts

Similar to construction, there would generally be negligible to minor adverse potential visual impacts during operation as the proposal site has a relatively limited visual catchment due to the local landform and existing vegetation.

During night-time, the operation of the proposal would have a minor adverse visual impact. Some lighting would be contained in the sheds, however, there would be additional light sources within the proposal site, at ground level, that would add to the brightness of the site. This additional lighting would be viewed in the context of lighting along Lenore Drive and along the future upgraded and extended Archbold Road.

There may be additional skyglow in views from the residential areas of Erskine Park, which could visible above the proposal site. However, this additional lighting would be seen in the context of the surrounding industrial areas and brightly lit roads such as Lenore Drive. Therefore, it is unlikely that there would be a perceived change in the amenity of views from this location. Overall, there would be a noticeable reduction in the amenity of views at night during the operation of the proposal. As this is a location of low sensitivity, this would result in a minor adverse visual impact at night.

The anticipated daytime visual impacts on representative viewpoints as a result of operation of the proposal are outlined below and summarised in Table 8-23.

#### Viewpoint 1: View south from the M4 Western Motorway

Due to the distance and compatibility of the proposal with the desired future character of the surrounding area (zoned IN1 General Industrial) there would be no perceived change in the amenity of this view. During operation, taller elements of the proposal may be visible in the background, such as the upper parts of sheds, silos and gantry cranes. This is a view of local sensitivity and there would be a negligible visual impact as a result of the operation of the proposal.

#### Viewpoint 2: View south-west from Hanson Place

During operation, upper parts of stacked piles of precast segments and taller elements of the proposal may be visible from this view, however they would be partly screened by the intervening landform and filtered by existing trees. Due to the limited visibility of the proposal and the compatibility with the existing and intended future industrial uses in the surrounding area, there would be a minor reduction in the amenity of this view, which is of neighbourhood visual sensitivity, resulting in a negligible visual impact during operation.

#### Viewpoint 3: View north-west from future upgraded and extended Archbold Road / Lenore Drive intersection

During operation, vehicles accessing the site and features of the proposal site would be visible from this viewpoint. Due to the proximity of the proposal site, constant movement of machinery and vehicles, and obstruction of the vegetated background to this view, there would be a noticeable reduction in visual amenity, however this would be generally compatible with surrounding planned industrial uses (refer to Figure 8-11). This is a view of local visual sensitivity and this would result in a minor adverse visual impact during operation.

#### Viewpoint 4: View north-east from Lenore Drive at the Ropes Creek crossing

During operation, areas of the southern precast facility would be visible from this location, however much of the proposal site would be screened by existing vegetation along Ropes Creek. Due to the limited visibility and visual compatibility of the proposal with the intended future industrial use of the proposal site, there would be a noticeable reduction in the amenity of this view (refer to Figure 8-13). This view is of local visual sensitivity, and this would result in a negligible visual impact as a result of the operation of the proposal.

#### Viewpoint 5: View east from Aquarius Crescent, Erskine Park

During operation, the southern precast facility would be visible in the background of view, however activity at ground level and lower sections of the structures would be screened by the vegetation along Ropes Creek. Due to the limited visibility and compatibility of the proposal with the intended future industrial use of the proposal site, there would be a noticeable reduction in the amenity of this view. This view is of neighbourhood visual sensitivity, and this would result in a negligible visual impact during operation of the proposal.

#### Viewpoint 6: View east from Park on Sennar Road, Erskine Park

During operation, activity at ground level and lower sections of structures would be screened by the vegetation along Ropes Creek. Elements of the southern precast facility (e.g. gantry cranes, upper parts of the shed) would be visible in the background of view through gaps in the vegetation along Ropes Creek. Due to the limited visibility and compatibility of the proposal with the intended future industrial use of the proposal site, there would be a noticeable reduction in the amenity of this view (refer to Figure 8-16). This view is of local visual sensitivity, and this would result in a minor adverse visual impact as a result of the operation of the proposal.

Table 8-23: Summary of visual amenity impacts (operation)

| Location | Sensitivity | Magnitude | Impact |
|---|---|---|---|
| **Daytime** | | | |
| **Viewpoint 1: View south from the M4 Western Motorway** | Local | No perceived change | Negligible |
| **Viewpoint 2: View south-west from Hanson Place** | Neighbourhood | Noticeable reduction | Negligible |
| **Viewpoint 3: View north-west from future upgraded and extended Archbold Road / Lenore Drive intersection** | Local | Noticeable reduction | Minor adverse |
| **Viewpoint 4: View north-east from Lenore Drive at the Ropes Creek crossing** | Local | Noticeable reduction | Minor adverse |
| **Viewpoint 5: View east from Aquarius Crescent, Erskine Park** | Neighbourhood | Noticeable reduction | Negligible |
| **Viewpoint 6: View east from park on Sennar Road, Erskine Park** | Local | Noticeable reduction | Minor adverse |
| **Night-time** | | | |
| **Proposal site** | Low | Noticeable reduction | Minor adverse |

### 8.3.4 Management and mitigation measures

Landscape and visual amenity impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework, which includes visual amenity management objectives to minimise impacts on landscape features and reduce visual impacts (including lighting).

The management and mitigation measures that would be implemented to address potential landscape and visual impacts are listed in Table 8-24.

Table 8-24: Management and mitigation measures – landscape and visual

| No. | Impact | Environmental management and mitigation measures |
|---|---|---|
| **LV1** | Visual impacts – construction | Where feasible and reasonable, the elements within the construction site would be located to minimise visual impacts (for example storing materials and machinery behind fencing). |
| **LV2** | Landscape and visual impact – operation | Sheds would be finished in a colour which aims to minimise visual impacts, if visible from areas external to the site. |
| **LV3** | Lighting impacts during operation | Lighting of the sites would be orientated to minimise glare and light spill impacts on adjacent receivers in accordance with AS4282:2019. |

## 8.4 Non-Aboriginal heritage

A non-Aboriginal heritage assessment was prepared to assess the potential impacts of the proposal to non-Aboriginal heritage. This assessment is attached as Appendix F (Statement of Heritage Impact) of this REF. The results of the assessment are summarised below.

Cumulative non-Aboriginal heritage impacts associated with nearby projects are discussed in Section 8.16 (Cumulative impacts).

### 8.4.1 Methodology

The non-Aboriginal heritage assessment involved:

- Identifying heritage items within and adjacent to the proposal site through a search of the following registers and databases in March 2020:
  - World Heritage List
  - Commonwealth Heritage List
  - National Heritage List
  - NSW State Heritage Register
  - Blacktown LEP
  - Section 170 heritage and conservation registers
  - NSW State Heritage Inventory database
  - National Trust Register
- Undertaking two proposal site inspections (on 8 April 2020 and 18 June 2020) to identify any potential unlisted heritage items and identify evidence of archaeological remains
- Describing the existing environment, historical context and identified heritage values within the proposal site
- Assessing the potential impacts of the proposal to the heritage significance, including:
  - Potential physical impacts, resulting in the demolition or alteration of fabric of heritage significance or significant archaeological remains
  - Potential visual impacts, resulting in changes to the setting or curtilage of heritage items or places, historic streetscapes and landscapes, visual amenity or views
  - Potential impacts from vibration and settlement
- Assessing the potential for archaeological deposits to remain within the proposal site and potential impacts associated with the proposal
- Identifying a management approach to minimise impacts to non-Aboriginal heritage items and identifying any approvals required for the proposed works.

The assessment of potential heritage impacts, and heritage and archaeological significance of the proposal site was completed in accordance with the following relevant guidelines:

- Statement of Heritage Impact (NSW Heritage Office, 2002) guideline, contained within the NSW Heritage Manual
- Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013 (Burra Charter) (ICOMOS (Australia), 2013)
- NSW Heritage Division's Assessing Significance for Historical Archaeological Sites and Relics (NSW Heritage Division, 2009).

### 8.4.2 Existing environment

#### Historical context

The proposal site forms part of the Prospect area. European exploration in the Prospect area began in 1788, extending to Prospect Hill (about 10 kilometres east of the proposal site). Within early years of European settlement, Governor Arthur Phillip placed a farming settlement of about 12 families in the area encircling Prospect Hill in 1791.

The land on which the proposal site is located, formed part of 1100 acres of land granted to John Thomas Campbell in 1819. Campbell named the property 'Mount Philos' after the Philo Free trial of 1817. By 1820, most of the land within and around the proposal site had been cleared, and a number of further land grants made.

In 1832, land ownership was transferred to Charles Roberts, until 1856 when he sold the land to the Shepherd Brothers. They combined the land with their portion of the Erskine Park Estate to the west of Ropes Creek and opened Chatsworth Nursery.

The Shepherd Brothers nursery was one of the earliest commercial nurseries in Australia. They were instrumental in the development of landscape gardening and horticulture and promoted a wide range of exotic plants for use in Australian colonial gardens. The Shepherd Brothers sold the land during the 1890s economic depression.

In 1909, a portion of the land on which the proposal site is located was sold to Thomas Baker, a grazier. After he passed away in 1934, portions of the land were sold and amalgamated. In 1950, Burfield Pty Ltd (renamed Ray Fitzpatrick Pty Ltd) bought the land on which the proposal site is located.

The early land grants at the Prospect area led to an influx of free settlers living in the area. This brought the development of transport, infrastructure, and services. The Prospect area shifted from agricultural land to livestock rearing following the collapse of the cereal grain industry during the 1870s. Nevertheless, the land within and around the proposal site continued to be utilised for agricultural purposes throughout the remainder of the nineteenth and into the twentieth century. Development was limited to a number of rural properties, which included residential properties, outbuildings, barn structures, open paddocks and crop fields.

#### Archaeological potential

The significance assessment for the archaeological potential of remains that may be present within the proposal site was undertaken against the NSW heritage significance criteria (NSW Heritage Division 2009).

The assessment of archaeological potential has been divided into the following historical phases:

- **Phase one** – early land use and grants (c1819 – mid-19th century)
- **Phase two** – horticultural and agricultural development, the Chatsworth Estate (mid-19th century – mid-20th century)
- **Phase three** – cattle grazing and current landscape (mid-20th century – present).

A shed and yard complex associated with twentieth century rural history and development of the local area was identified at the north-eastern portion of the proposal site (see Figure 8-17). The majority of the complex is located outside of the proposal site however the former fenced paddocks associated with the complex are partially located within the proposal site.

A small rubbish dump is located about 75 metres south of the shed and yard complex where further historic remains were identified. This rubbish dump contains a variety of metal and brick debris, including remains of a metal fridge as well as several fence posts and star pickets.

Potential archaeological remains associated with phases two and three may be present within the proposal site. Areas of historical archaeological potential relating to phases two and three are relevant to the shed and yard complex, while the rubbish dump only contains archaeological remains associated with phase three. However, these remains are not expected to reach the threshold for local significance as they also do not fulfil the NSW heritage significance criteria.

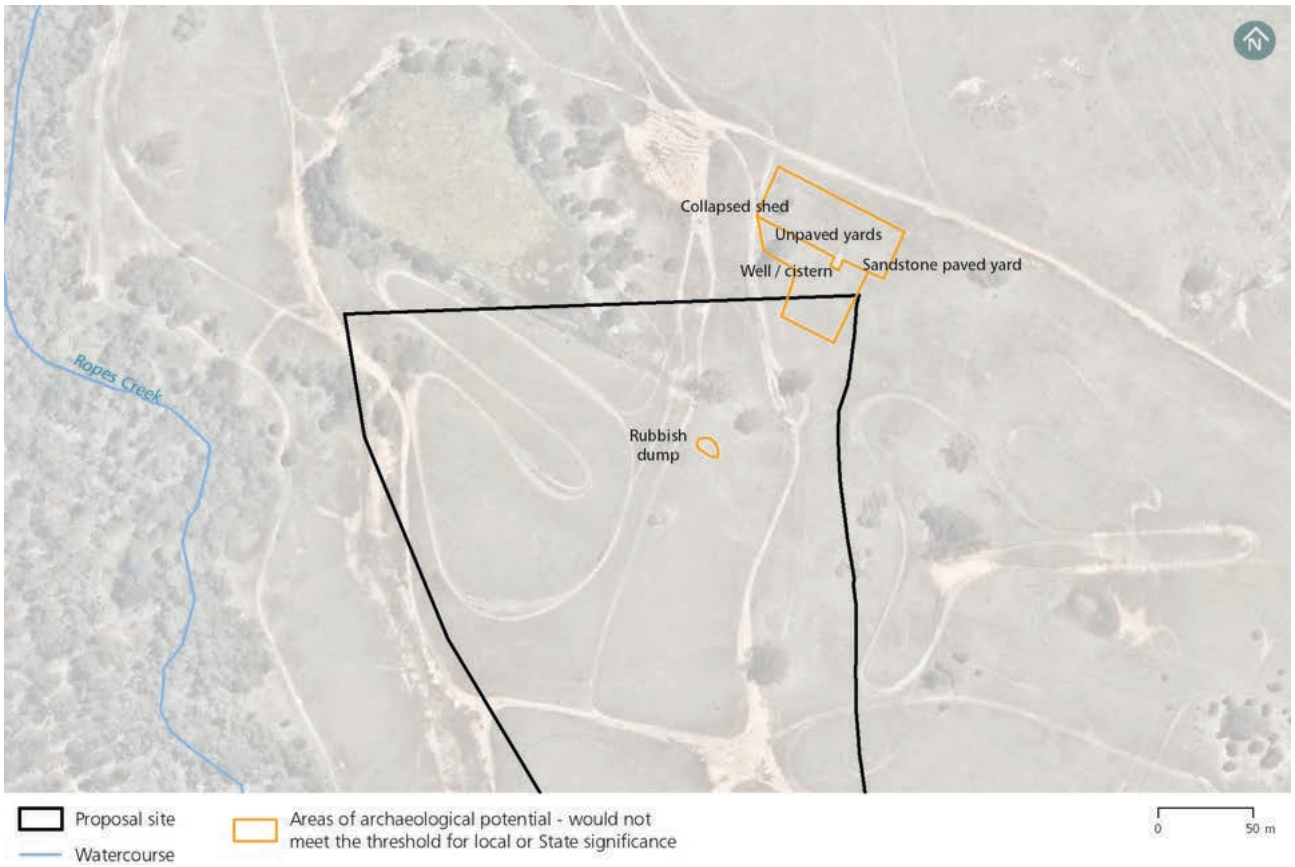


Figure 8-17: Areas of historical archaeological potential relating to phases two and three at the proposal site

A summary of the archaeological potential and significance is outlined in Table 8-25.

Table 8-25: Summary of archaeological potential and heritage significance

| Phase | Potential remains | Significance | Potential |
|---|---|---|---|
| **Phase one (c1819 – mid-19th century)** | Evidence of early land grants and subdivisions, land clearance, agricultural use | N/A | Nil |
| **Phase two (mid-19th century – mid-20th century)** | Evidence of horticultural and agricultural activities, evidence of fence lines | N/A | Nil |
| | Shed and yard complex | Nil | High |
| **Phase three (mid-20th century – present)** | Shed feature, formalised and continued use at the shed and yard complex, rubbish dump, existing development | Nil | High |

### 8.4.3 Potential impacts

#### Heritage impact assessment

There are no listed heritage items or potential heritage items identified within the proposal site and immediate surrounds. As such, there would be no physical or visual impacts to known heritage items as a result of the proposal and no impacts from vibration or settlement.

#### Archaeological impact assessment

There would be no archaeological impacts to items of non-Aboriginal significance as a result of the proposal.

The proposal site overlaps with the paddocks associated with the shed and yard complex in the north-eastern corner of the proposal site as well as a small rubbish dump (refer to Figure 8-17). However, as previously stated, these potential archaeological remains are not expected to reach the threshold for local significance.

The remainder of the proposal site has been assessed as having nil to low potential for archaeological remains. Potential archaeological remains which may be identified across the remainder of the proposal site are not expected to reach the threshold for local significance.

**Statement of heritage impact**

A statement of heritage impact has been prepared with reference to the NSW Heritage Division guidelines (NSW Office of Environment and Heritage, 2002) as outlined in Table 8-26.

Table 8-26: Statement of heritage impact for the proposal

| Development | Discussion |
|---|---|
| **What aspects of the proposal respect or enhance the heritage significance of the study area?** | The proposal is in a location which avoids locally significant structural remains associated with the former Chatsworth Estate to the north. The proposal site does not have identified heritage significance. No heritage items have been identified as subject to visual impacts associated with the proposed development. |
| **What aspects of the proposal could have a detrimental impact on the heritage significance of the study area?** | The proposal would have a physical impact on potential archaeological remains within the north-eastern corner of the proposal site. However, these potential remains are not expected to reach the threshold for local significance. No listed heritage items or areas of archaeological potential which may reach the local significance threshold have been identified within the proposal site. Therefore, there would be no detrimental impacts to the heritage significance of the proposal site. |
| **Have more sympathetic options been considered and discounted?** | The proposal would not have a physical or visual impact on heritage listed items or significant remains, so consideration of more sympathetic options was not required. |

### 8.4.4 Management and mitigation measures

Non-Aboriginal heritage impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework. The Construction Environmental Management Framework includes heritage management objectives to minimise impacts on items or places of heritage value, avoid accidental impacts on heritage items, and maximise workers' awareness of non-Aboriginal heritage.

The Construction Environmental Management Framework also includes:

- Procedures for unexpected heritage finds
- Heritage monitoring requirements.

Table 8-27: Management and mitigation measures - Non-Aboriginal heritage

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **NAH1** | Unexpected finds | An Unexpected Finds Procedure, to be implemented in the event that potential non-Aboriginal heritage objects are exposed during construction, would be prepared that complies with the *Heritage Act 1977*. |

As there would be no impacts to built non-Aboriginal heritage items and no archaeological items of non-Aboriginal heritage significance are expected to occur on the site, the potential impacts would be adequately managed through the Construction Environmental Management Framework and no further mitigation measures are required.

## 8.5 Aboriginal heritage

An Aboriginal Archaeological Survey Report was prepared to assess the potential impacts of the proposal to Aboriginal heritage. The assessment is attached as Appendix F (Archaeological Survey Report) of this REF. The methodology and results of the assessment are summarised below.

Cumulative Aboriginal heritage impacts associated with nearby projects are discussed in Section 8.16 (Cumulative impacts).

### 8.5.1 Methodology

The Aboriginal heritage assessment involved:

- Undertaking a desktop review of archaeological literature and databases to identify listed Aboriginal sites and places within the proposal site, including:
  - A search of the Aboriginal Heritage Information Management System (AHIMS) for listed Aboriginal sites, carried out on 27 March 2020
  - An assessment of the archaeological context of the proposal site, including previous archaeological work in the area
- Undertaking archaeological surveys on 8 April 2020 (Artefact) and 18 June 2020 (Artefact and Deerubbin Local Aboriginal Land Council)
- Developing a predictive model to assist in determining archaeological potential
- Assessing the significance of the archaeological potential in accordance with the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (Office of Environment and Heritage 2011)
- Assessing the potential impacts of the proposal
- Identifying management and mitigation measures to manage impacts to Aboriginal items or areas of Aboriginal cultural sensitivity.

The assessment of Aboriginal heritage was undertaken in accordance with the requirements of the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010a).

The archaeological survey was delineated into three survey units based on landform, breaks in the landscape and evidence of former disturbances as shown in Figure 8-18.

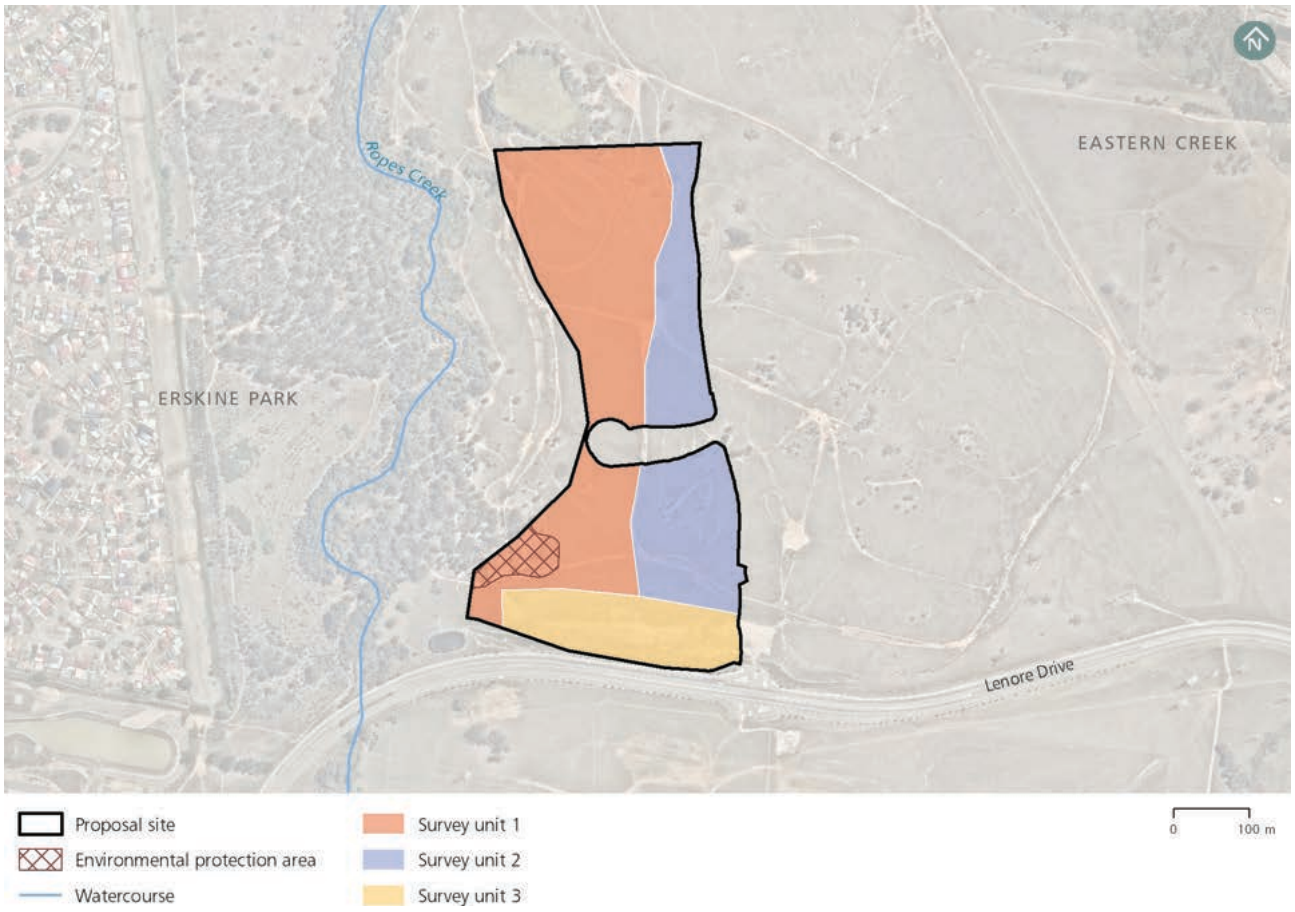


Figure 8-18: Survey units within the proposal site

Survey coverage has been undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010a).

### 8.5.2 Existing environment

#### Aboriginal historical and archaeological context

The proposal site is located in the Cumberland Plain, which would have been a suitable location for Aboriginal occupation, surrounded by valuable natural features, close to water sources, near hills and cliffs, and close to raw materials (e.g. silcrete) suitable for the construction of stone tools.

The Cumberland Plain was home to a number of different Aboriginal groups. The predominant language group spoken on the Cumberland Plain is known as Darug. British rural settlement began in the western Cumberland Plain around 1791, and several Aboriginal groups remained in the area despite the tensions between Aboriginal people and colonisers.

The first parcels of land granted to an Aboriginal person were located about eight kilometres north of the proposal site, between Richmond Road and Plumpton Ridge along Bells Creek. This land was granted to Colebee and Nurragingy in 1819. Nurragingy inhabited the land until 1920 when it was resumed by the Aboriginal Protection Board. The area remains significant for its historical, archaeological and social values. Descendants of the Darug language group continue to live in Western Sydney along with Aboriginal people from other areas of NSW.

Ropes Creek is a major watercourse in the region and first order waterline with smaller tributaries that branch from Ropes Creek, including one first order tributary across the northern portion of the proposal site. Previous archaeological investigations have identified some particularly high concentrations of artefacts in raised areas adjacent to Ropes Creek. While the presence of artefacts is noted surrounding first order waterlines, their prevalence appears to decrease with increasing distance from Ropes Creek.

Silcrete has been identified as the predominant raw material found in proximity to the proposal site, including in Erskine Park (about 3.7 kilometres west of the proposal site) and Plumpton Ridge (about 8.2 kilometres northeast of the proposal site).

### Previously registered Aboriginal heritage sites

An extensive search of the AHIMS database was undertaken on 27 March 2020 (AHIMS search ID 491998). The search area was about 3.6 kilometres by 3.9 kilometres.

A total of 112 Aboriginal sites were identified in the AHIMS search area. The majority of the recorded site features are artefacts (107 in total).

A substantial number of sites are located within and in close proximity to the open grassland areas adjacent to Ropes Creek. Sites located to the north of the proposal site include a density of artefact sites associated with slope and crest landforms.

Nine sites have been previously recorded either within or in the immediate vicinity of the proposal site. Five sites are within the proposal site, two are partially within, and two are in close proximity. A preliminary assessment of the sites within close proximity to the proposal was undertaken to confirm if their site boundaries extend into the proposal site. Those sites which do not extend into the proposal site are not further considered in the assessment as they would not be subject to impacts.

### Aboriginal sites recorded during investigations

Recorded Aboriginal sites and additional sites identified during the archaeological survey within or partially within the proposal site are outlined in Table 8-28. This included seven previously recorded sites and three newly identified sites.

Table 8-28: Recorded Aboriginal sites and additional sites

| Site name | Site type | Location | Description |
|---|---|---|---|
| **Previously recorded sites** | | | |
| **Blacktown Southwest 11 (AHIMS ID 45-5-0563)** | Artefact scatter | Within the proposal site | The coordinates of the registered site recorded on AHIMS did not match description of the landform within the site card (used to record Aboriginal sites in NSW). The registered site coordinates were approximately 45 m north of the drainage line identified within the site card, therefore it is assumed the site coordinates are incorrect. No Aboriginal objects were located within the registered site coordinates or assessed site location. |
| **Blacktown Southwest 7 (AHIMS ID 45-5-0559)** | Artefact scatter | Partially within the proposal site | The registered site has been partially destroyed by the installation of a Sydney Water pipeline for the St Mary's Wastewater System Augmentation project associated with a previous AHIP (AHIP C0000501) in 2014. Salvage excavation prior to the installation of the pipeline resulted in the recovery of 1,346 artefacts from a 25 $m^2$ salvage area. Following salvage excavation, these artefacts were reburied throughout the wider site extent of the proposal site.<br>The archaeological survey identified five new artefacts within the former AHIPC0000501 boundary, including three pink silcrete flakes, one red silcrete flake and an orange mudstone multi-platform core. High grasses obscured the remainder of the site extent.<br>Additional evidence of disturbance was noted with sandstone-based fill material spread across the wider extent of the registered site. Examination of exposures confirmed that visible soils within this portion of the project site were relatively intact. The site extent was modified to encompass the entirety of the localised rise associated with this landform. |

| Site name | Site type | Location | Description |
|---|---|---|---|
| **RCIF 2 (AHIMS ID 45-5-3159)** | Artefact scatter, Potential Archaeological Deposit (PAD) | Partially within the proposal site | The original site recording noted an isolated mudstone flake located within an eroding creek gully with the likely presence of additional artefacts including sub-surface deposits. Salvage excavation of the registered site was undertaken as a condition of AHIP C0000501 in 2014 which recovered 463 artefacts from 25 $m^2$ of excavation. Artefacts recovered from the salvage excavation were reburied within the registered site extent. The archaeological survey undertaken for this assessment identified nine additional artefacts within the former AHIP boundary and the proposal site, which included two pink silcrete flakes, three yellow silcrete flakes and four red silcrete flakes.<br>During the archaeological survey it was identified that the landscape to the east and west of the original recorded extent of the registered site was relatively intact, with limited evidence of disturbance, and was associated with the same drainage line as the original site recording. As a result, the registered site extent was reassessed and extended with areas of potential identified to the east and west (of the original registered site extent). |
| **RCAS 4 (AHIMS ID 45-5-3162)** | Artefact scatter | Within the proposal site | This registered site was previously recorded as an artefact scatter comprised of seven artefacts located within a vehicle track exposure. The registered site consisted of four red silcrete flakes, two grey silcrete flakes and one quartz flake.<br>The registered site is heavily vegetated by thick grasses. No Aboriginal objects were identified during the archaeological survey within the registered site due to limited visibility. |
| **RCAS 5 (AHIMS ID 45-5-3163)** | Artefact scatter | Within the proposal site | This registered site was previously recorded as an artefact scatter eroded from the surrounds of a dam located along the original course of a tributary of Ropes Creek. The registered site was recorded as three red silcrete flakes scattered along an 8 m area.<br>The coordinates of the registered site recorded on AHIMS did not match the description of the landform within the site card, therefore the site location was reassessed. The dam was heavily overgrown with grasses. No Aboriginal objects (either previously recorded or additional) were located. |
| **AIF-06 (AHIMS ID 45-5-4599)** | Isolated find | Within the proposal site | The registered site was comprised of a red silcrete flake. No evidence of surface disturbance since the original registered site recording has been identified, suggesting that the artefact may remain on the ground surface in this area. However, the artefact was not located during the archaeological survey due to lack of surface visibility. |
| **AIF-05 (AHIMS ID 45-5-4605)** | Isolated find | Within the proposal site | The registered site was comprised of a yellow silcrete distal flake. No evidence of surface disturbance since the original registered site recording has been identified, suggesting that the artefact may remain on the ground surface in this area. However, the artefact was not located during the archaeological survey due to lack of surface visibility. |
| **Newly identified sites** | | | |
| **RCAS 09 (AHIMS ID 45-5-5355)** | Artefact scatter, PAD | Within the proposal site | This registered site comprises eight silcrete artefacts and an area of PAD located within a wide exposure associated with intersecting vehicle tracks running parallel to Ropes Creek. Artefacts observed across the site are considered likely to have been subject to some level of post depositional movement through erosion caused by former vehicle use. The RCAS 09 site is considered to contain limited subsurface potential. |

| Site name | Site type | Location | Description |
|---|---|---|---|
| **RCAS 10 (AHIMS ID 45-5-5354)** | Artefact scatter | Within the proposal site | This registered site comprises an artefact scatter located within a vehicle track exposure running perpendicular to Ropes Creek. A total of three silcrete artefacts were located within the site extent over a 15 m length of the vehicle track. Artefacts present included a single platform core, a complete flake and a proximal flake fragment. |
| **RCAS 11 (AHIMS ID 45-5-5353)** | Artefact scatter | Within the proposal site | This registered site comprises an artefact scatter within an exposure associated with an unauthorised trail bike track. A total of three artefacts were located within the site extent over a 10 m length of the trail bike track. Artefacts present included an indurated mudstone/tuff proximal flake fragment, a silcrete distal flake fragment and a silcrete proximal flake fragment. A large silcrete cobble was also identified within the wider site extent however, as it was partially buried, it could not be fully examined for evidence of knapping. |

### Aboriginal archaeological significance assessment

A summary of archaeological significance for the above Aboriginal sites within the proposal site is presented in Table 8-29.

Table 8-29: Summary of archaeological significance

| Site name and AHIMS ID | Research potential | Representative value | Rarity | Education potential | Overall archaeological significance |
|---|---|---|---|---|---|
| **Blacktown Southwest 11 (AHIMS ID 45-5-0563)** | Moderate | Low | Low | Low | Low |
| **Blacktown Southwest 7 (AHIMS ID 45-5-0559)** | Moderate-high | High | High | High | High |
| **RCIF 2, (AHIMS ID 45-5-3159)** | Moderate-high | High | High | High | High |
| **RCAS 4, (AHIMS ID 45-5-3162)** | Moderate | Low | Low | Low | Low |
| **RCAS 5, (AHIMS ID 45-5-3163)** | Moderate | Low | Low | Low | Low |
| **AIF-06, (AHIMS ID 45-5-4599)** | Low | Low | Low | Low | Low |
| **AIF-05, (AHIMS ID 45-5-4605)** | Low | Low | Low | Low | Low |
| **RCAS 09 (AHIMS ID 45-5-5355)** | Moderate | Moderate | Low | Low | Moderate |
| **RCAS 10 (AHIMS ID 45-5-5354)** | Low | Low | Low | Low | Low |
| **RCAS 11 (AHIMS ID 45-5-5353)** | Low | Low | Low | Low | Low |

### Aboriginal cultural significance

No specific areas of cultural significance were identified during the site survey which was undertaken with a representative of Deerubbin Local Aboriginal Land Council. Further assessment of the cultural significance of proposal site would be undertaken during preparation of the ACHAR for the proposal.

### 8.5.3 Potential impacts

#### Construction

Test excavation would be undertaken, in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010a), in order to determine whether subsurface Aboriginal objects are present within the expanded site extent of RCIF 2 (AHIMS ID 45-5-3159), Blacktown Southwest 11 (AHIMS ID 45-5-0559), and the area of PAD identified within Ropes Creek Artefact Scatter 09 (AHIMS ID pending). Test excavation would confirm the extent of subsurface artefacts, their association with other sites in the area and their significance. An AHIP would be required as the Aboriginal objects identified within the proposal site are not currently subject to an AHIP.

Earthworks undertaken during construction activities would result in partial to total removal of Aboriginal sites identified within the proposal site. A portion of RCIF 2 (AHIMS ID 45-5-3159) would be preserved as it extends across the environmental protection area in the south-west of the proposal site which would not be directly impacted by the proposal. Blacktown Southwest 7 (AHIMS ID 45-5-0559) extends past the proposal site boundary and a portion of this registered site would also remain intact.

A summary of impacts on identified Aboriginal sites is outlined in Table 8-30.

Table 8-30: Summary of impacts on identified Aboriginal sites

| Site name and AHIMS ID | Type of harm | Degree of harm | Consequence of harm |
|---|---|---|---|
| **Blacktown Southwest 11, (AHIMS ID 45-5-0563)** | Direct | Total | Total loss of value |
| **Blacktown Southwest 7, (AHIMS ID 45-5-0559)** | Direct | Partial | Partial loss of value |
| **RCIF 2, (AHIMS ID 45-5-3159)** | Direct | Partial | Partial loss of value |
| **RCAS 4, (AHIMS ID 45-5-3162)** | Direct | Total | Total loss of value |
| **RCAS 5, (AHIMS ID 45-5-3163)** | Direct | Total | Total loss of value |
| **AIF-06, (AHIMS ID 45-5-4599)** | Direct | Total | Total loss of value |
| **AIF-05, (AHIMS ID 45-5-4605)** | Direct | Total | Total loss of value |
| **RCAS 09 (AHIMS ID 45-5-5355)** | Direct | Total | Total loss of value |
| **RCAS 10 (AHIMS ID 45-5-5354)** | Direct | Total | Total loss of value |
| **RCAS 11 (AHIMS ID 45-5-5353)** | Direct | Total | Total loss of value |

Aboriginal site AIF-06 (AHIMS ID 45-5-4599) is also within the boundary of the planned Archbold Road upgrade and extension. Sydney Metro would liaise with other relevant parts of Transport for NSW regarding overlapping impacts to Aboriginal site AIF-06 (AHIMS ID 45-5-4599) and coordinating further assessment and management. Sydney Metro and other relevant parts of Transport for NSW would coordinate any future ACHAR and AHIP application(s).

#### Operation

There is not expected to be additional impacts on Aboriginal heritage significance during operation of the proposal as earthworks would be restricted to the construction phase.

### 8.5.4 Management and mitigation measures

Aboriginal heritage impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework. The Construction Environmental Management Framework includes heritage management objectives to minimise impacts on items or places of heritage value, avoid accidental impacts on heritage items, and maximise workers' awareness of Aboriginal heritage.

The Construction Environmental Management Framework also includes:

- Procedures for undertaking any recordings of heritage items prior to works commencing
- Procedures for unexpected heritage finds
- Heritage monitoring requirements.

The management and mitigation measures that would be implemented to address potential Aboriginal heritage impacts are listed in Table 8-31.

Table 8-31: Management and mitigation measures - Aboriginal heritage

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **AH1** | Test excavation | Archaeological test excavation would be limited to the proposal site and undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010a) to confirm the geographic extent of RCIF 2 (AHIMS ID 45-5-3159), Blacktown Southwest 11 (AHIMS ID 45-5-0559) and the area of PAD identified within Ropes Creek Artefact Scatter 09 (AHIMS ID 45-5-5355).<br>Test excavation would be limited to areas subject to potential impacts by the proposal, and outside the area already salvaged and subject to impacts by the St Mary's Wastewater System Augmentation project. Archaeological test excavation would be undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010a). |
| **AH2** | Consultation | As part of the preparation of the test excavation methodology and ACHAR, comprehensive Aboriginal stakeholder consultation would be carried out in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010b) and the National Parks and Wildlife Regulation 2019. |
| **AH3** | Aboriginal heritage | An AHIP would be submitted to the NSW DPC for those portions of the proposal site subject to impacts once test excavation is completed. The AHIP application would be supported by an ACHAR and test excavation report. |
| **AH4** | Overlapping impact | Sydney Metro would liaise with Transport for NSW regarding overlapping impacts to Aboriginal site AIF-06 (AHIMS ID 45-5-4599) and coordinating further assessment and management. |
| **AH5** | Unexpected finds | In the event that suspected Aboriginal ancestral remains are exposed during construction, the requirements of Section 3.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010) would be implemented. |

## 8.6 Land use, property and socio-economic

This section assesses the potential land use, property and socio-economic impacts of the proposal.

### 8.6.1 Methodology

The land use, property and socio-economic impact assessment involved:

- Describing the existing environment with reference to existing land uses and planning controls, based on a review of aerial photography and land use zones specified by applicable environmental planning instruments including the WSEA SEPP
- Describing the existing social environment using population and demographic data for the Rooty Hill – Eastern Creek Statistical Area 2 (SA2) from the Australian Bureau of Statistics and identifying the existing regional, district and local social infrastructure
- Reviewing relevant strategy and policy documentation to identify future land use priorities and developments
- Assessing the potential impacts of construction and operation of the proposal on existing community, social environment, property and land use in and around the proposal site
- Identifying a management approach to avoid or manage potential impacts to land use, property, community values and commercial values of the proposal site and surrounds.

### 8.6.2 Existing environment

**Land use**

The proposal would be located at Eastern Creek within the Blacktown City Council LGA between Lenore Drive/ Old Wallgrove Road to the south, M4 Western Motorway further north, Ropes Creek to the west and the planned Archbold Road upgrade and extension to the east (subject to separate approval by other parts of Transport for NSW). The proposal site is under the ownership of Sydney Metro as noted in Chapter 5 (Description of the proposal).

The proposal site is a relatively cleared greenfield site which has been historically used for agricultural/farming purposes. More recently, the proposal site has been subject to uses such as unauthorised off-roading and illegal depositing of waste. There is no public access to the proposal site.

The proposal site is zoned IN1 General Industrial under the WSEA SEPP as outlined in Figure 4-2.

Land to the immediate north and east is undeveloped land, zoned for industrial use under the WSEA SEPP and owned by the Office of Strategic Lands (refer to Chapter 1 (Introduction) for more details). Other land uses surrounding the proposal site include:

- The Minchinbury industrial area and Dagara Badu Reserve are located across the M4 Western Motorway about 1.7 kilometres to the north of the proposal site
- Lenore Drive is located to the immediate south with undeveloped greenfield land (zoned RE1 public recreation under the Blacktown LEP 2015) located further south and the TransGrid Sydney West electrical substation located even further south-east
- The wider Eastern Creek Industrial Precinct is located to the east. About 800 metres to the north-east is an asphalt and bitumen paving plant and recycling facility
- Ropes Creek is located to the west and is surrounded by existing riparian vegetation, with Erskine Park residential area located further west which is classified as low density development. These are the closest residential properties and are located about 375 metres away.

Development within the WSEA is prescribed by the WSEA SEPP as noted in Chapter 4 (Statutory and planning considerations). Subject to surrounding future development, the proposal site would be located within an industrial area (zoned IN1 General Industrial under the WSEA SEPP) and integrated within the broader development of the WSEA. The WSEA provides businesses in the region with land for industry and employment, for a range of uses such as transport, logistics, warehousing and office space. The Blacktown LSPS further supports the growth and use of the surrounding sites for industrial purposes as outlined in Chapter 2 (Need for the proposal).

#### Community profile

The proposal site is located within the Rooty Hill – Eastern Creek SA2 (Australian Bureau of Statistics, 2016). The key demographics from the census of 2016 for this statistical area were:

- A total population of 15,532 with an average household size of 3.33 people
- A median age of 34, with the largest age group between 35 to 39 years old (7.6 per cent)
- An unemployment rate of seven per cent which is slightly higher compared to Greater Sydney (six per cent)
- A median weekly household income of $1,747 which is comparable to Greater Sydney ($1,745)
- A demographic composition comprised of skilled professionals, clerical and administrative workers, and machinery operators and drivers. In combination, these three occupations accounted for about 47 per cent of the total employed resident population
- The three main industry sectors included health care and social assistance (15 per cent), retail trade (10.8 per cent) and manufacturing (9.5 per cent). In combination, these three industries employed 35.3 per cent of the total resident population within the statistical area.

#### Community values

As noted in Chapter 2 (Need for the proposal), the Community Strategic Plan – Our Blacktown 2036 (Blacktown City Council, 2017) reflects Blacktown City's growing population and the changing needs of the community. The Community Strategic Plan has been prepared based on extensive community engagement and provides insight into issues important to the community.

Key community priorities identified include community aspirations for a vibrant inclusive community, a clean sustainable and healthy environment, a smart and prosperous economy, a growing city supported by accessible infrastructure, a sporting and active city, and a leading city.

#### Social infrastructure

There is no existing social infrastructure within the immediate vicinity of the proposal site. A greenfield area (zoned RE1 Public Recreation) is located to the west of the proposal site, however this area is not publicly accessible. Social infrastructure within the Erskine Park residential area to the west of the proposal site includes:

- Peppertree Reserve (about 800 metres from the proposal)
- Erskine Park Community Centre and Hall (about one kilometre from the proposal)
- Iglesia Ni Cristo Church (about one kilometre from the proposal)
- James Erskine Public School (about one kilometre from the proposal)
- Erskine Park High School (about one kilometre from the proposal)
- Phoenix Reserve (about one kilometre from the proposal).

### 8.6.3 Potential impacts

#### Construction

As identified in Chapter 5 (Description of the proposal), the proposal site has recently been acquired by Sydney Metro. No additional acquisition of property would be required for the proposal.

The proposal provides for a positive socio-economic impact by stimulating the local economy through the creation of temporary employment during construction. A workforce of about 60 staff per facility (during peak construction period) would be employed during the construction of the proposal.

The construction of the proposal would be unlikely to cause any negative social or economic impacts to surrounding social infrastructure due to the distance to the proposal site. The proposal has the potential to cause temporary minor disruptions to the surrounding locality. These would mostly be due to minor traffic delays, noise and air emissions, and visual amenity.

Potential temporary impacts and corresponding management and mitigation measures related to noise and vibration, traffic, transport and access, landscape and visual, and air quality are discussed in Section 8.1 (Noise and vibration), Section 8.2 (Traffic and transport, Section 8.3 (Landscape and visual character) and Section 8.13 (Air quality) respectively.

#### Operation

The proposal would be located on land zoned IN1 General Industrial under the WSEA SEPP. The proposal would be consistent with the objectives of this land use zoning as outlined in Chapter 2 (Need for the proposal).

The proposal would alter currently unused land for a use that is consistent with the zoning provisions and the planned surrounding land uses, while minimising impacts to surrounding industrial and residential receivers. The proposal would not preclude the establishment of the immediately surrounding industrial area and the ongoing use of the Ropes Creek and Eastern Creek Precinct, and, as the first development of the land for industrial use, may provide a catalyst for the development of the surrounding industrial zoned land.

The proposal has the potential to have a positive socio-economic impact by stimulating the local economy through the creation of employment during operation of the precast facilities. About 120 personnel (60 for each precast facility) would be working on the proposal site at any one time. Operation of the proposal would also potentially provide indirect employment through demand for industries that provide resources or waste management services.

Management and mitigation measures regarding potential impacts to adjacent land uses during the operation of the proposal, such as noise and vibration, traffic and transport, landscape and visual and air quality are discussed in Section 8.1 (Noise and vibration), Section 8.2 (Traffic and transport), Section 8.3 (Landscape and visual character) and Section 8.13 (Air quality) respectively.

### 8.6.4 Management and mitigation measures

Management and mitigation measures regarding potential impacts to adjacent land uses during construction and operation, such as noise and vibration, traffic, transport and access, landscape and visual and air quality are discussed in Section 8.1 (Noise and vibration), Section 8.2 (Traffic and transport), Section 8.3 (Landscape and visual character) and Section 8.13 (Air quality) respectively. These measures would minimise the potential social impacts of the proposal.

Given the minor impact of the proposal on existing land uses and the surrounding social infrastructure, no specific management and mitigation measures are required during construction or operation of the proposal. However, ongoing engagement with the community and affected stakeholders regarding the proposal would be carried out (refer to Chapter 6 (Stakeholder and community consultation)).

## 8.7 Flooding

A hydrology and flooding assessment has been prepared for the proposal. This assessment is attached as Appendix G (Hydrology and Flooding Technical Paper) of this REF. The methodology and results of this assessment are summarised in this section.

Cumulative hydrology and flooding impacts associated with multiple works being completed near the proposal site (or based on other criteria) are discussed in Section 8.16 (Cumulative impacts).

### 8.7.1 Methodology

The hydrology and flooding assessment involved:

- Undertaking a desktop review of available flood study reports from Blacktown City Council and other sources to characterise existing flooding conditions at the proposal site and the surrounding area. Parameters considered include:
  - The topography in the vicinity of the sites and presence of flow paths and watercourses, using aerial laser survey data
  - Flood depths and levels
  - Flood hazard
  - Flood hydraulic categories including floodway and flood storage
- Undertaking flood modelling to determine flooding conditions where adequate existing flood information was not available. Flood modelling was estimated using hydrologic modelling in XP-RAFTS and hydraulic modelling in TUFLOW software
- Assessing the potential hydrology and flooding impacts associated with the proposal during construction and operation
- Identifying management and mitigation measures to address potential impacts associated with hydrology and flooding.

### 8.7.2 Existing environment

**Hydrologic context**

Ropes Creek is located to the west of the proposal site, flowing from south to north. As seen in Figure 8-19, two main overland flow paths in the north and south of the proposal site originate at the east of the proposal site on land with moderate slope. A minor, shallow flow path is also present in the central section of the proposal site.

The flow path at the north drains in a north-westerly direction into a large dam which straddles the northern boundary of the proposal site, which then discharges to Ropes Creek at the north of the proposal site. There is a second, smaller dam on the northern flow path located about 300 metres upstream of the first dam and situated outside of the proposal site.

The southern flow path drains in a westerly direction through the southern portion of the proposal site, about 100 metres north of Lenore Drive, and discharges to Ropes Creek at the south-western boundary of the proposal site. There is an existing dam on the southern flow path, located within the proposal site.

The riparian corridor along Ropes Creek is moderately to densely vegetated. There is little to no existing riparian vegetation along the flow paths within the proposal site.

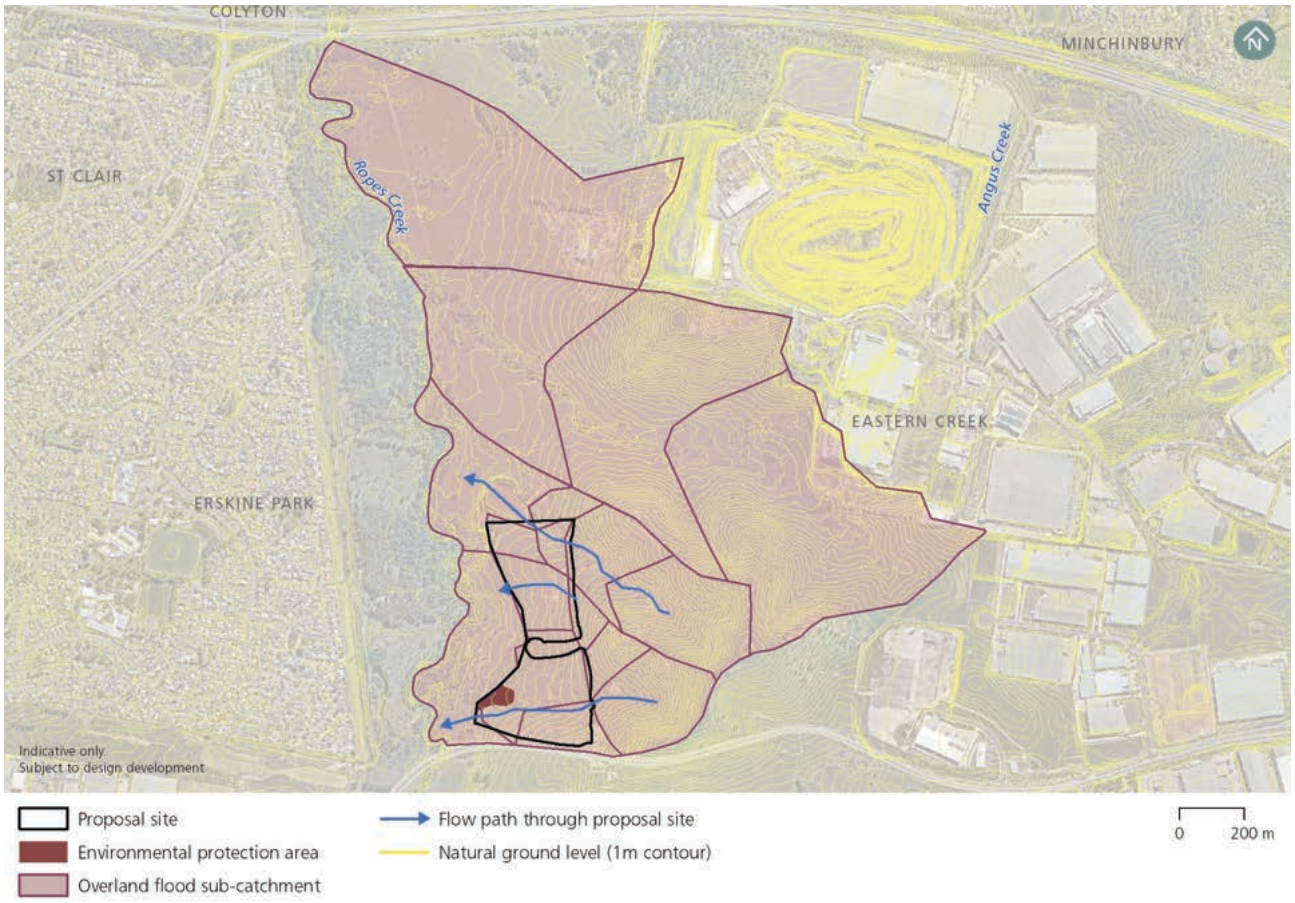


Figure 8-19: Terrain and hydrologic sub-catchments at the proposal site and surrounds

### Flooding

#### Ropes Creek mainstream flooding

The South Creek Flood Study (Worley Parsons, 2015) provides an assessment of the flooding conditions in Ropes Creek at the proposal site, including flood levels, depths, hazards and hydraulic categories.

The existing case mainstream flooding conditions at the proposal site include:

- The majority of the proposal site is not affected by Ropes Creek flooding in the probable maximum flood (PMF), with exception of an encroachment of 15 metres at the south-western corner. The maximum depth is about 0.1 metres at the south-western corner.
- The entire proposal site is not affected by events up to and including the one per cent Annual Exceedance Probability (AEP), and therefore does not encroach on the Ropes Creek floodway area. The north-western section of the proposal site approaches the fringe of the one per cent AEP flood extent, however this area is not included within the proposal site.

#### Overland flow flooding

The existing dams, including the dam at the northern boundary of the proposal site, were assumed full in the hydrologic modelling. Peak flows at key locations are summarised in Table 8-32 (refer to Appendix J (Hydrology and Flooding Technical Paper) for further detail).

Table 8-32: Existing peak flows and critical storm duration at selected locations in the proposal site

| Location | Total catchment area | 0.5 Exceedances per Year | 1% AEP |
|---|---|---|---|
| **Upstream of southern precast facility** | 10.8 ha | 0.52 $m^3/s$<br>6 hours critical duration | 3.7 $m^3/s$<br>15 minutes critical duration |
| **Discharge point of southern precast facility** | 31.9 ha | 1.21 $m^3/s$<br>6 hours critical duration | 8.25 $m^3/s$<br>45 minutes critical duration |

| Location | Total catchment area | 0.5 Exceedances per Year | 1% AEP |
|---|---|---|---|
| **Main flow path upstream of northern precast facility** | 16.9 ha | 0.72 $m^3/s$<br>6 hours critical duration | 4.44 $m^3/s$<br>45 minutes critical duration |
| **Discharge point of northern precast facility** | 37.5 ha | 1.37 $m^3/s$<br>6 hours critical duration | 7.95 $m^3/s$<br>45 minutes critical duration |

The one per cent AEP flood event was analysed to define the overland flooding conditions around the proposal site. The coincident flood event in Ropes Creek was assumed to be the five per cent AEP event, in line with Australian Rainfall and Runoff 2019 guidelines.

Figure 8-20 shows the overland flood depths at the proposal site and surrounds, the main northern and southern overland flow paths, the minor central overland flow path, and the Ropes Creek one per cent AEP flood extent as defined in the South Creek Flood Study (Worley Parsons, 2015).

Overland flow depths in the northern flow path are typically around 0.4 – 0.6 metres in the existing case. Depths of water in the existing dam are over 0.6 metres. However, these are anticipated to be deeper, as the model topography shows the dam water surface rather than the actual bed level of the dam.

Flow depths in the southern flow path are typically 0.4 – 0.7 metres deep in the main flow path. There are some shallow overflows from the main flow path up to 0.1 metres deep.

The minor central flow path exhibits shallow dispersed flow (less than 0.05 metres depth), with some deeper ponding within an access track which is in cut below the surrounding ground level.

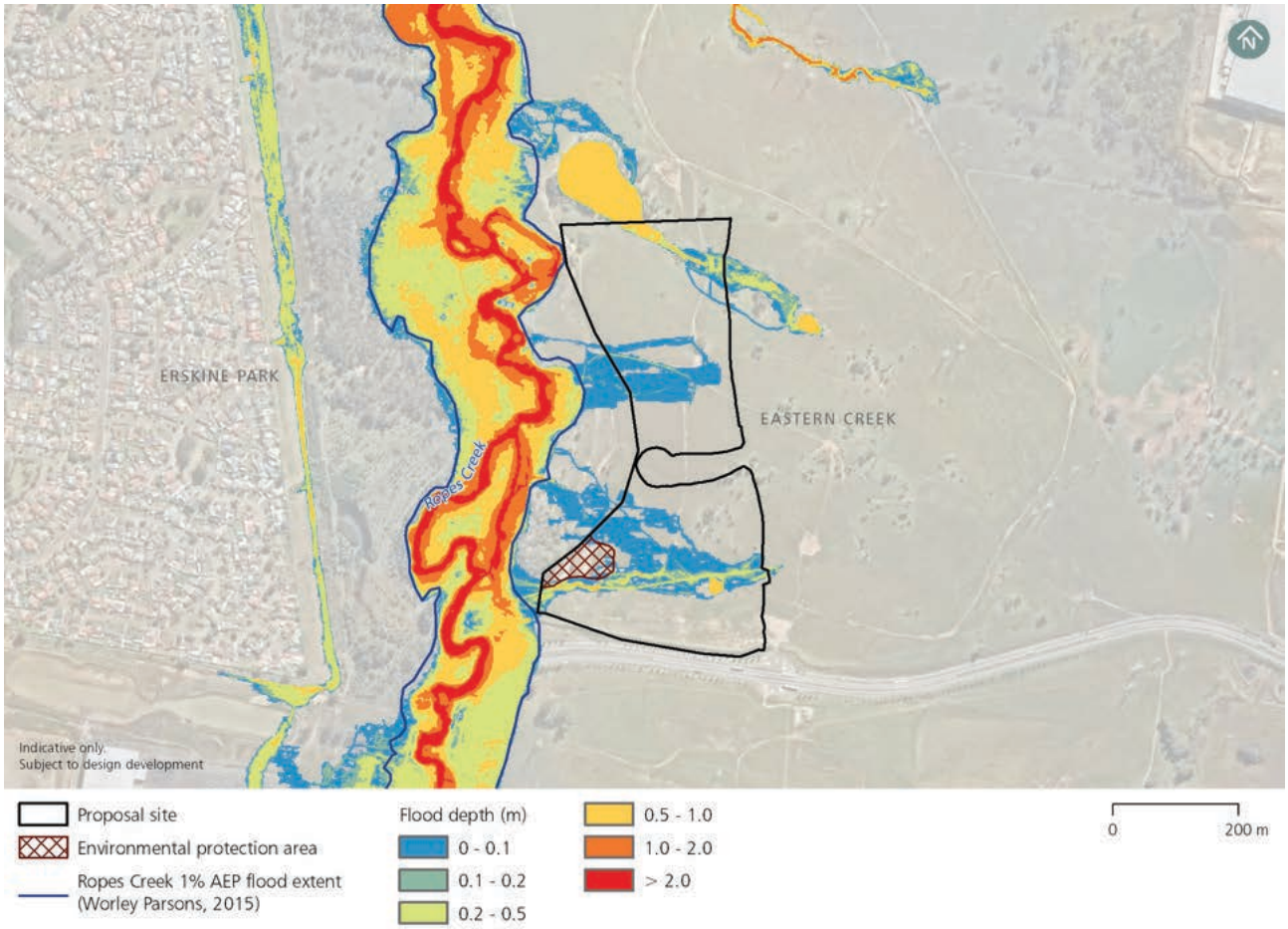


Figure 8-20: Overland flood depths at the proposal site and surrounds (Ropes Creek one per cent AEP event)

### 8.7.3 Potential impacts

#### Construction

There would be no flood impacts in events up to and including the one per cent AEP event as the entire site is above the one per cent AEP flood level and any filled embankments would be outside of the flood extent. Potential impacts in the PMF would be negligible due to the minor encroachment in the south-western corner, subject to the implementation of the mitigation measures included in Section 8.7.4. There would be no flooding impacts in other portions of the proposal site as these are above the PMF level and any filled embankments would be outside the PMF flood extent.

The proposal may impact on peak flow rates and volumes into Ropes Creek as a result of increased impervious areas on the proposal site from its currently undeveloped condition. The potential increase in peak flows has been quantified in the hydrologic modelling undertaken for the proposal. A comparison of the existing and developed case peak flows (for both construction and operation) is presented in Table 8-33. The developed case is representative of worst-case impacts during both construction and operation (i.e. after the hardstand areas have been established).

While the increase in flow rates as a result of the proposal are considered to be minimal in comparison with the existing flow rates at Ropes Creek, the potential impacts of the proposal combined with other external developments (without mitigation) may increase downstream flooding. Potential impacts due to the increase in mainstream peak flood flows would be appropriately managed as outlined in Section 8.7.4. Mitigation measures, such as on-site stormwater detention/flood detention facilities would be required in any case for the 0.5 exceedance per year event and potentially other flood events.

Table 8-33: Comparison of existing and developed (no mitigation) case peak flows and critical storm duration at selected locations[1]

| Location | Scenario | 0.5 Exceedances per Year | 1% AEP |
|---|---|---|---|
| **Discharge point of the southern precast site (including diverted external flows)** | Existing | 1.21 $m^3/s$<br>6 hours critical duration | 8.25 $m^3/s$<br>45 minutes critical duration |
| | Developed | 1.64 $m^3/s$<br>15 minutes critical duration | 8.75 $m^3/s$<br>45 minutes critical duration |
| **Discharge point of the northern precast site (including diverted external flows)** | Existing | 1.37 $m^3/s$<br>6 hours critical duration | 7.95 $m^3/s$<br>45 minutes critical duration |
| | Developed | 1.44 $m^3/s$<br>20 minutes critical duration | 7.57 $m^3/s$<br>45 minutes critical duration |

*1 The flows at the selected locations includes the proposal site runoff combined with diverted external flows. Flow reporting locations upstream of the proposal site have been omitted due to additional catchment areas diverted to the reporting locations by Archbold Road drainage.*

The proposal site is entirely outside of the one per cent AEP flood extent. The filled sections of the proposal site would not interact with the one per cent AEP flow in Ropes Creek and therefore, changes to creek geomorphology due to obstruction of creek flows are not anticipated.

Design coordination of drainage arrangements for the proposal and the planned Archbold Road upgrade and extension would be undertaken to mitigate potential impacts on the drainage of the overland flows and road drainage discharge points. Flows discharged from the proposed Archbold Road drainage structures would be conveyed in the natural overland flow paths through the proposal site. Potential cumulative impacts from the planned Archbold Road upgrade and extension are outlined in Section 8.16 (Cumulative impacts).

#### Operation

The potential hydrologic and flooding impacts of the proposal in the operational phase are expected to be similar to the potential construction phase impacts.

It is anticipated that there would be a minor increase in flood depths and negligible increase in flow velocities in Ropes Creek near the proposal site during operation. Any impacts on flooding in Ropes Creek, resulting from the minor encroachment of the proposal into the PMF floodway, are not expected to increase substantially as a result of climate change.

Runoff rates from the proposal site and external catchments would potentially increase by a minor increment during the operational phase of the proposal as a result of climate change. This would be managed appropriately through the management and mitigation measures in Section 8.7.4, so that there is no net impact downstream of the proposal site.

### 8.7.4 Management and mitigation measures

Hydrology and flooding impacts would be managed in accordance with the Construction Environmental Management Framework. In relation to hydrology and flooding, the Construction Environmental Management Framework identifies that Stormwater and Flooding Management Plans would be prepared where required. These plans would identify the appropriate design standard for flood mitigation based on the duration of construction, proposed works and flood risks.

The management and mitigation measures that would be implemented to address potential hydrology and flooding impacts are listed in Table 8-34.

Table 8-34: Management and mitigation measures – hydrology and flooding

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **F1** | Potential increase in mainstream peak flood flows | Detailed design of the proposal site would include provision of appropriate on-site stormwater detention/flood detention facilities to cater for events up to and including the 1% AEP event. |
| **F2** | Potential geomorphic impacts due to changed flow regime in low flows and frequent flood events | Detailed design of the proposal site would include the provision of appropriate on-site stormwater detention/flood detention facilities. Outlet sizing would be designed to satisfactorily mitigate potential increases in peak flows in frequent events. |
| **F3** | Potential impacts on overland flooding and drainage conditions | Detailed design of the proposal site would include the provision of appropriate flow diversion channels or culverts for management of external flows. |
| **F4** | Potential impacts on overland flooding and drainage conditions | Detailed design would integrate with the planned Archbold Road upgrade and extension cross drainage and road drainage outlets. |
| **F5** | Potential impacts on overland flooding and drainage conditions | Detailed design would provide appropriate scour protection works at channel/culvert discharge points to Ropes Creek. |
| **F6** | Potential impacts on the proposal resulting from flooding | Detailed design would provide filling to a height of at least 0.5m above Ropes Creek 1% AEP flood level. |

Mitigation measures in other chapters that are relevant to the management of potential impacts include:

- Section 8.8 (Soils and surface water quality), specifically measures which address management of surface water quality.

## 8.8 Soils and surface water quality

This section assesses the potential impact of the proposal on surface water.

### 8.8.1 Methodology

The surface water assessment involved:

- Undertaking a desktop review of publicly available data to characterise existing surface water (baseline) conditions at the proposal site including climate, catchment history, topography, hydrology, the soil landscape and environmental values
- Reviewing relevant legislation, plans, policies and guidelines for water management within the Blacktown City Council LGA and NSW
- Conducting a site inspection on 8 April 2020. The site inspection included a visual evaluation of the existing water quality and aquatic habitat condition at assessment sites.
- Identifying the types of surface water impacts which may occur due to the proposal
- Identifying mitigation measures to address potential surface water impacts.

The surface water assessment used a study area (known as the 'surface water study area') boundary that includes the proposal site and a 500-metre buffer around the proposal site, as shown in Figure 8-21. The surface water study area includes the area directly affected by the proposal (the proposal site) and any additional areas potentially affected by the proposal either directly or indirectly.

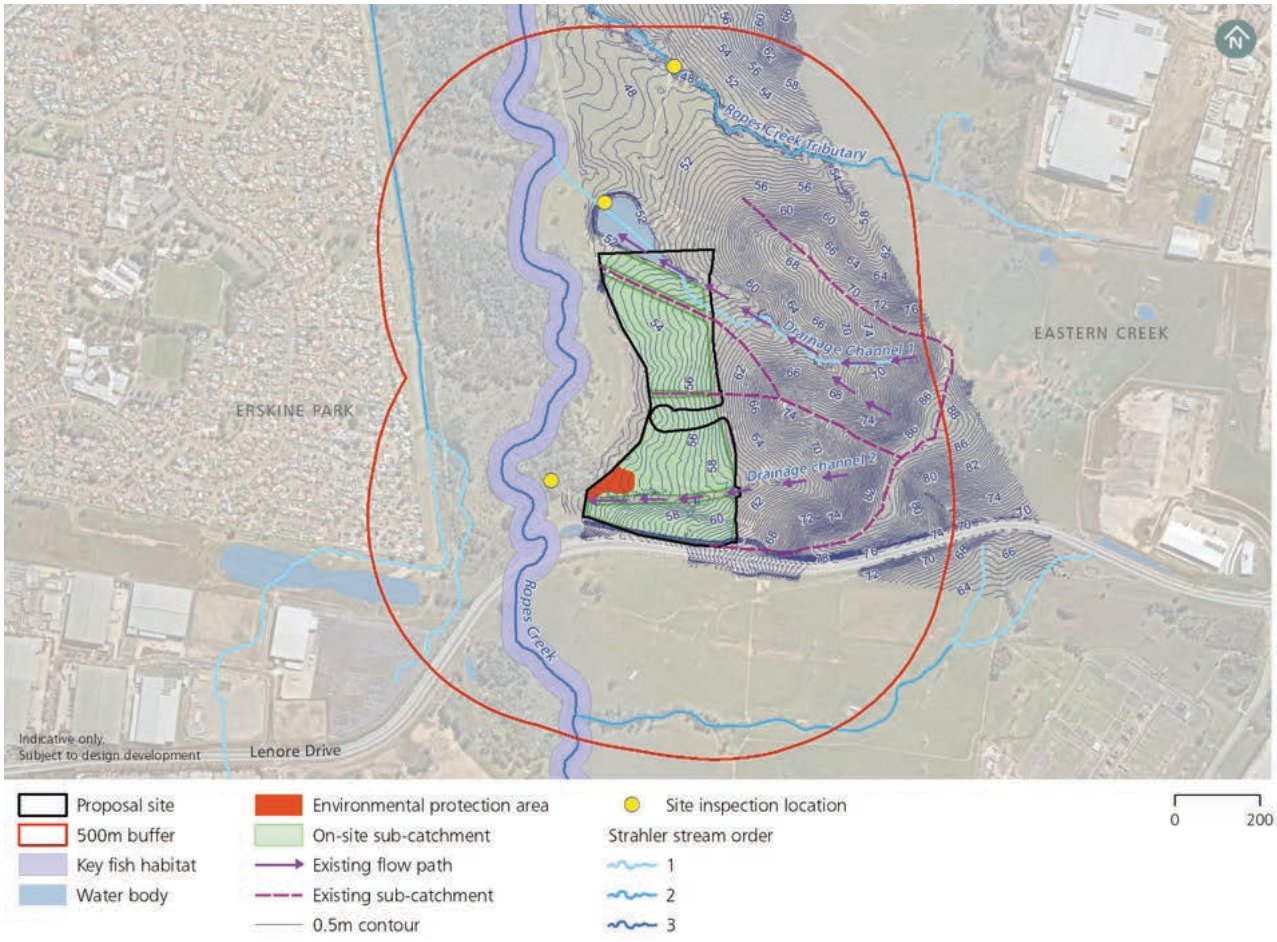


Figure 8-21: Surface water study area

### 8.8.2 Existing environment

#### Soils and geology

Based on the Penrith 1:100,000 surface geology mapping sheet (Clark & Jones, 1991) the eastern portion of the proposal site is underlain by Bringelly Shale of the Wianamatta Group and the western portion of the proposal site is underlain by Quaternary alluvium (adjacent to Ropes Creek).

A review of the Penrith 1:100,000 soil landscape mapping sheet (Chapman and Murphy, 1989) identifies that the eastern portion of the proposal site generally overlies residual soils belonging to the Blacktown Soil Landscape. The area west of the proposal site, adjacent to Ropes Creek, generally overlies alluvial soils belonging to the South Creek Soil Landscape. The Blacktown landscape comprises of gently undulating rises; local relief between 10 and 30 metres with slopes usually less than five per cent; broad rounded crests and ridges with gently inclined slopes; cleared eucalypt woodland and tall open forest. The soil group is constrained by moderately reactive plastic subsoils, low soil fertility, localised salinity and poor soil drainage.

A land capability assessment conducted by WSP Parsons Brinckerhoff (2016) for the contamination study area found the presence of moderate to highly sodic and saline soils, with slight dispersity potential, indicating that the contamination study area contains soils which may be classified as prone to erosion.

#### Acid sulfate soils

Acid sulfate soils are the common name given to naturally occurring sediments and soils containing iron sulfides (principally iron sulfide or iron disulfide or their precursors). Exposure of the sulfide in these soils to oxygen as a result of drainage or excavation leads to the generation of sulfuric acid. Areas of acid sulfate soils are typically found in low-lying and flat locations that are often swampy or prone to flooding.

The Australian Soil Resource Information System's (ASRIS, 2013) online acid sulfate soils risk map indicates the proposal site is mapped within an area considered to have an extremely low probability of acid sulfate soils occurrence, indicating that there is no known or expected occurrence of acid sulfate soils within the construction footprint. Acid sulfate soils are not considered further due to the extremely low probability of occurrence and very low risk.

#### Catchments and watercourses

The proposal site is located within the South Creek sub-catchment of the Hawkesbury-Nepean surface water catchment. The South Creek sub-catchment encompasses most of the Cumberland Plain of Western Sydney and has been extensively modified and disturbed due to land clearing and urbanisation resulting in significant degradation of water quality, habitat and geomorphology. The proposal site is not located within the Sydney drinking water catchment (as defined by the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011) and therefore the water quality provisions of this SEPP do not apply to the proposal.

The catchment is gently undulating, with local relief between 10 and 30 metres. Slopes are generally less than five per cent but occasionally up to 10 per cent. Elevation on the proposal site ranges from 75 metres Australian Height Datum near Ropes Creek to 60 metres Australian Height Datum in the eastern portion of the proposal site. The slope dips in a western direction towards Ropes Creek.

The watercourses located within the surface water study area include:

- Ropes Creek, located west of the proposal site
- An unnamed tributary of Ropes Creek in the northern extent of the surface water study area
- A natural drainage line (Drainage Channel 1) connected to a large farm dam. A portion of the drainage line and dam is situated within the proposal site at the northern extent
- A natural drainage line (Drainage Channel 2) that traverses the southern portion of the proposal site, originating from the eastern boundary of the proposal site.

Ropes Creek is a third order Strahler stream that is perennial in nature and forms a tributary of South Creek. Records taken from WaterNSW water level gauge at Ropes Creek (WaterNSW, 2020), located about 7.5 kilometres downstream of the proposal site, indicate that mean monthly water level varied between 0 to 0.66 metres in depth between January 2014 and March 2020, with fluctuations corresponding largely with rainfall events.

The proposal site is located in the Blacktown soil landscape which is susceptible to localised seasonal waterlogging, localised water erosion hazard and localised surface movement potential (DPIE, 2020). Existing erosion was identified during the site inspection in the southern part of the proposal site along the drainage line and tracks (refer to Figure 8-22 and Figure 8-23). The soil groups that comprise the proposal site are characterised as very slow filtration. As such, runoff potential would be high to very high.

Figure 8-22: Ropes Creek facing upstream

Figure 8-23: Ropes Creek facing downstream

### Water quality

A review of available existing water quality data indicates that the southern portion of Ropes Creek is generally in poor condition and representative of a heavily urbanised system. In general, Blacktown City Council has reported the southern portion of Ropes Creek to have poor water quality, according to the Waterway Health Report Cards for 2017 – 2018 (Blacktown City Council, 2018) and 2018 – 2019 (Blacktown City Council, 2019). Both reports state that water quality indicators remain within guideline limits 70 per cent of the time, and that results remained consistent to previous years with high nutrient levels.

The NSW Water Quality and River Flow Objectives (DECCW, 2006) provide a number of environmental values for NSW's surface water. The Hawkesbury-Nepean catchment is also subject to water quality objectives outlined in the Healthy Rivers Commission guidelines. The Healthy Rivers Commission guidelines classifies the region in which the proposal site is located as 'Predominantly Urban' and assigns the following environmental/regional values for the waterways within the surface water study area:

- Protection of aquatic ecosystems
- Visual amenity
- Secondary contact recreation.

Water quality objectives that provide guideline levels to help manage water quality have been developed for each catchment in NSW (Department of Environment and Conservation, 2006). These objectives include community-based values, long term goals, and their associated national criteria drawn from ANZECC/ARMCANZ (2000) guidelines. The objectives aim to improve poor water quality and maintain existing good water quality (Department of Environment and Conservation, 2006). The relevant water quality objectives, trigger values and/or criteria for the Hawkesbury-Nepean Catchment and the environmental/ regional values assigned to the surface water study area are provided in Table 8-35.

In modified environments such as the South Creek sub-catchment there is the potential for the current water quality to not meet the existing guidelines and trigger values for protecting nominated environmental values.

### Sensitive receiving environments

Ropes Creek is located about 150 metres west of the proposal site and has been identified as the only 'sensitive receiving environment' within the surface water study area due to its classification as a key fish habitat (DPI, undated). However, a field assessment determined Ropes Creek to be 'Type 3 – Minimally sensitive key fish habitat' (DPI, 2013) based on aquatic habitat quality and water quality identified in the field. Further, the ecological assessment (refer to Section 8.11 (Biodiversity)) determined that Ropes Creek is considered to be in moderately to highly degraded condition and unsuitable for the presence of threatened fish.

### 8.8.3 Potential impacts

#### Construction

##### Saline soils

Any potential salinity impacts would be managed in accordance with Book 4 Dryland Salinity: Productive Use of Saline Land and Water (NSW DECC, 2008). Excavation and earthworks during construction of the proposal, if not managed appropriately, may cause salinity impacts where there is disturbance of saline soils, often associated with changes to the surface water system. Salinity impacts may include locally severe salt scalding across landscape elements, damage to buildings and infrastructure, fluvial and sheet erosion, high instream salinity, localised waterlogging, flood hazard, and a potential decline in water quality.

##### Soil erosion

With the implementation of erosion and sediment control and other mitigation measures, the risks to degradation of surface water quality during construction would be low.

The proposal would incorporate erosion and sediment control measures such as sediment basins and diversion drains so that external 'clean' runoff does not enter and mix with site runoff, and internal 'dirty' runoff is conveyed to the proposed sediment basin for treatment. The location and sizing of the sediment basins would be determined during detailed design.

Construction activities have potential for the following temporary impacts on surface water:

- Potential to temporarily increase the risk of erosion and sedimentation resulting in the mobilisation of soils into stormwater runoff and nearby watercourses (including Ropes Creek) as a result of vegetation clearing, drainage and surface works
- Potential increased sedimentation in the waterways resulting in increased turbidity, reducing dissolved oxygen levels and increasing the concentration of nutrients and heavy metals as a result of earthworks and excess spoil
- Potential mobilisation of contamination by stormwater runoff and subsequent transportation to downstream watercourses, potentially increasing contaminant concentrations in the receiving environment. Potential contamination risk is assessed in Section 8.10 (Soils and contamination)
- Potential increase in pH of the downstream water quality and harming aquatic life as a result of concrete dust, concrete slurries or concrete washout water
- Potential for contaminants being transported downstream to receiving waters as a result of accidental spills or leaks from the maintenance or on-site re-fuelling of construction plant and equipment machinery, or from vehicle/truck incidents travelling to and from the proposal site. Potential contamination risk is assessed in Section 8.10 (Contamination).

Table 8-35 outlines the water quality objectives relevant to the proposal (refer to Section 8.8.2) and the potential impacts as a result of the proposal in relation to the objectives.

Table 8-35: Assessment of the proposal against the relevant water quality objectives

| Water quality objective | Indicator | Guideline value | Impact of the proposal |
|---|---|---|---|
| **Protection of aquatic ecosystems** | | | |
| **Maintaining or improving the ecological condition of waterbodies and riparian zones over the long term** | Total phosphorus | 25µg/L | Wastewater from the proposal would be treated and standard erosion and sediment control measures would be implemented for all surface works areas to minimise pollutant loading to the downstream waterways during construction (refer to Section 8.8.4). Wastewater would be treated to comply with the ANZECC/ARMCANZ (2000) and ANZG (2018) guidelines and runoff from the proposal would be designed to meet the standards outlined in the Blue Book (Landcom, 2004).<br>With the implementation of these management measures, pollutant loading to the receiving waterways would be low and possibly of better quality where existing water quality does not meet the ANZECC/ARMCANZ (2000) and ANZG (2018) guidelines.<br>Therefore, the proposal would not impact aquatic ecosystems of receiving waterways. |
| | Total nitrogen | 350µg/L | |
| | Chlorophyll-a | 3µg/L | |
| | Turbidity | 6-50NTU | |
| | Salinity (electrical conductivity) | 125-2200µS/cm | |
| | Dissolved oxygen | 85-110% saturation | |
| | pH | 6.5-8.5 | |
| | Toxicants | As per Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) (2018) toxicant default guideline values (95% level of protection for slightly to moderately disturbed ecosystems and 99% level of protection for toxicants that bioaccumulate). | |
| **Visual amenity** | | | |
| **Aesthetic qualities of waters** | Visual clarity and colour | Natural visual clarity should not be reduced by more than 20%.<br>Natural hue of water should not be changed by more than 10 points on the Munsell Scale.<br>The natural reflectance of the water should not be changed by more than 50%. | Wastewater from the proposal would be treated and standard erosion and sediment control measures implemented for all surface works areas to minimise pollutant loading to the downstream waterways during construction (refer to Section 8.8.4). Wastewater would be treated to comply with the ANZECC/ARMCANZ (2000) and ANZG (2018) guidelines and runoff from the proposal would be designed to meet the standards outlined in the Blue Book (Landcom, 2004).<br>Spill kits would be in place as well as measures so that oils and petrochemicals do not impact on the visual nature of the waterway (refer to Section 8.10 Contamination).<br>With the implementation of these management measures, pollutant loading to the receiving waterways would be low and possibly of better quality where existing water quality does not meet the ANZECC/ARMCANZ (2000) and ANZG (2018) guidelines.<br>Therefore, the proposal would not reduce the aesthetic quality of the receiving waterways. |
| | Surface films and debris | Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour.<br>Waters should be free from floating debris and litter.<br>No quantitative value is specified. | |
| | Nuisance organisms | Macrophytes, phytoplankton scums, filamentous algal mats, blue-green algae, sewage fungus and leeches should not be present in unsightly amounts.<br>No quantitative value is specified. | |

| Water quality objective | Indicator | Guideline value | Impact of the proposal |
|---|---|---|---|
| **Secondary contact recreation** | | | |
| **Maintaining or improving water quality of activities such as boating and wading, where there is a low probability of water being swallowed** | Faecal coliforms, enterococci, algae and blue-green algae | As per the National Health and Medical Research Council (NHMRC) 2008 Guidelines for managing risks in recreational water. | Wastewater from the proposal would be treated and standard erosion and sediment control measures would be implemented for all surface works areas to minimise pollutant loading to the downstream waterways (refer to Section 8.8.4). Wastewater would be treated to comply with the ANZECC/ARMCANZ (2000), ANZG (2018) and NHMRC (2008) guidelines and runoff from the proposal would be designed to meet the standards outlined in the Blue Book (Landcom, 2004).<br>With the implementation of these management measures, pollutant loading to the receiving waterways would be low and possibly of better quality where existing water quality does not meet the NHMRC (2008) guidelines.<br>Therefore, the proposal would not reduce the ability of downstream waterways to be used as secondary contact recreation. |
| | Nuisance organisms | As per the visual amenity guidelines ANZECC/ARMCANZ (2000).<br>Large numbers of midges and aquatic worms are undesirable. | |
| | Chemical contaminants | Waters containing chemicals that are either toxic or irritating to the skin or mucous membranes are unsuitable of recreation.<br>Toxic substances should not exceed values in Table 9.3 of NHMRC (2008) guidelines. | |

**Operation**

Overall, surface water would be captured on-site and managed so that any runoff leaving the site would not pollute nearby land or waterways. The implementation of mitigation measures would ensure the water quality objectives outlined in Table 8-35 are met during the operation of the proposal.

With the implementation of mitigation measures, the risks to degradation of surface water quality during operation of the proposal would be low. The proposal would involve the establishment of new permanent impervious surfaces, therefore the potential for erosion and sediment transport would be reduced.

If not managed properly, potential water quality impacts associated with operation of the proposal may include:

- Potential increased sedimentation in the waterways resulting in increased turbidity, reducing dissolved oxygen levels and increasing the concentration of nutrients and heavy metals as a result of stormwater runoff containing pollutants from vehicles and machinery being discharged to nearby watercourses
- Potential contaminants being mobilised and transported downstream to receiving waters due to an accidental spill. Potential contamination risk is assessed in Section 8.10 (Contamination)
- Potential increase in pH of the downstream water quality and harming aquatic life due to concrete works
- Potential changes to current hydrological regimes from site discharge.

### 8.8.4 Management and mitigation measures

Surface water impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework, which includes objectives to minimise the impacts to surface water. The Construction Environmental Management Framework aims to minimise surface water pollution through erosion and sediment control, maintain existing water quality of surrounding water courses, and prioritise the use of non-potable water sources where feasible and reasonable. The Construction Environmental Management Framework specifically requires the preparation of a Soil and Water Management Plan and progressive erosion and sediment control plans that would be updated as needed to reflect the site conditions.

Specific mitigation measures that would be implemented to minimise potential impacts to surface water quality are listed in Table 8-36.

Table 8-36: Mitigation measures - surface water quality

| No. | Impact | Environmental management and mitigation measures |
|---|---|---|
| **SW1** | Soil salinity | Prior to ground disturbance in high probability salinity areas, testing would be carried out to determine the presence of saline soils. If salinity is encountered, excavated soils would not be reused or it would be managed in accordance with Book 4 Dryland Salinity: Productive Use of Saline Land and Water (NSW DECC, 2008). Erosion controls would be implemented in accordance with Blue Book (Landcom, 2004). |
| **SW2** | Potential erosion and sedimentation | Erosion and sediment measures would be implemented in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004) and Volume 2D (DECCW, 2008), commonly referred to as the 'Blue Book'. Additionally, any water collected from the proposal site would be appropriately treated and discharged to avoid any potential contamination or local stormwater impacts.<br>Temporary sediment basins would be designed in accordance with Managing Urban Stormwater: Soils and Construction and Managing Urban Stormwater, Volume 2D: Main Road Construction (DECC, 2008). |
| **SW3** | Wastewater discharge | Prior to discharge, wastewater would be treated to a level that is compliant with the ANZECC/ARMCANZ (2000) and ANZG (2018) default guidelines for 95 per cent species protection.<br>For the purposes of this management measure, during operation wastewater is defined as process water from operation of the precast facility and does not include surface runoff or stormwater. |

Mitigation measures in other chapters that are relevant to the management of potential impacts include:

- Section 8.10 (Contamination), specifically measures which address the disturbance of contaminated land and measures to minimise the likelihood and potential impact of accidental spills or leaks.

## 8.9 Groundwater

This section assesses the potential impact of the proposal on groundwater.

### 8.9.1 Methodology

The groundwater assessment involved:

- Undertaking a desktop review of publicly available data to characterise existing groundwater conditions at the proposal site including climate, geology, soils, topography and groundwater conditions, including groundwater dependent ecosystems (GDEs), and salinity conditions
- Identifying the types of groundwater impacts which may occur due to the proposal
- Outlining baseline, construction and operational phase groundwater monitoring requirements
- Identifying a management approach to address potential groundwater impacts.

The groundwater assessment used a study area (known as the 'groundwater study area') which includes a boundary of a one kilometre radius around the proposal site, as shown on Figure 8-24. The groundwater study area boundary was selected to include:

- A reasonable quantity of existing groundwater bores to increase the amount of bore data available for investigation of existing groundwater conditions
- Potential groundwater level impacts of the proposal.

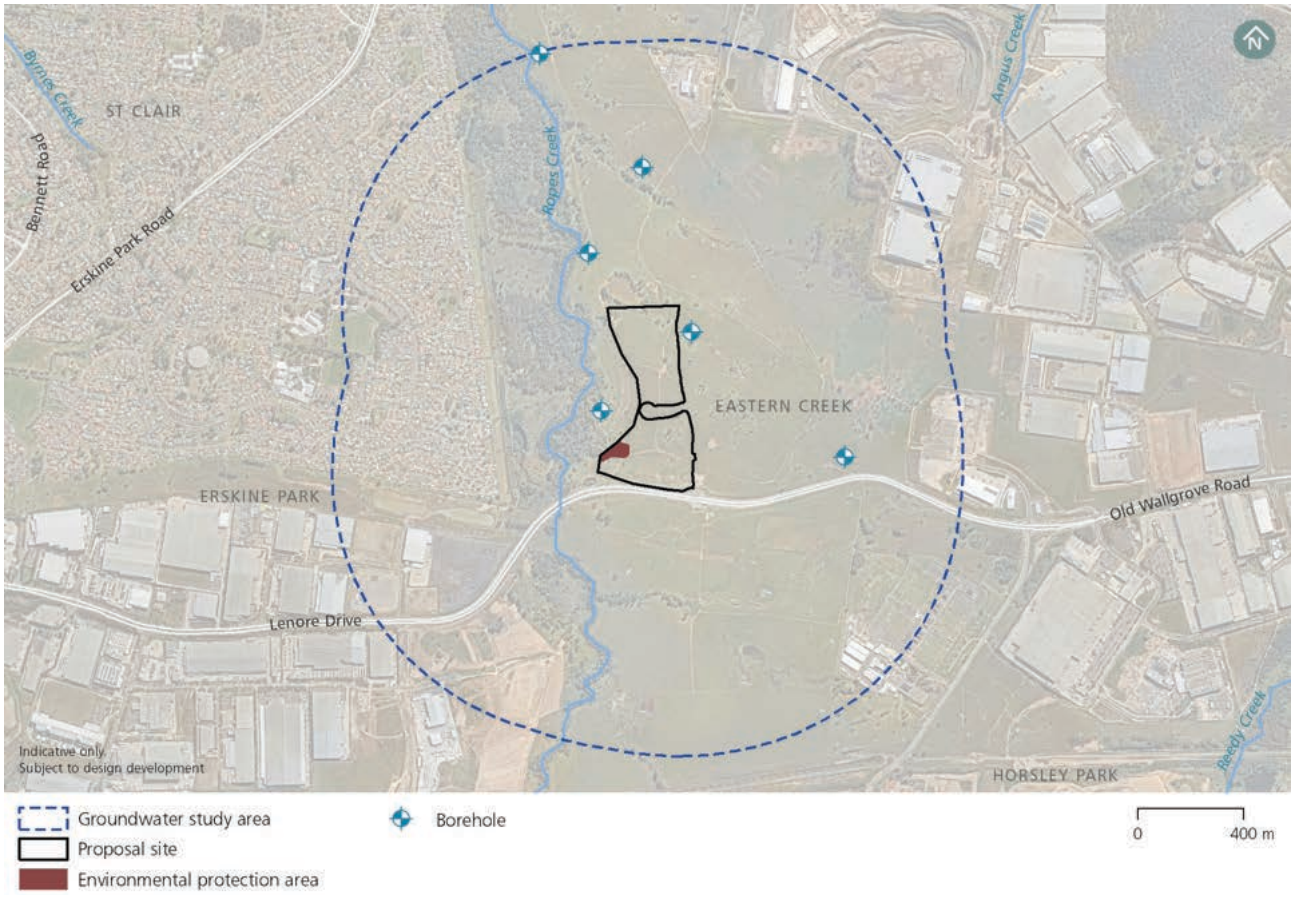


Figure 8-24: Groundwater study area

### 8.9.2 Existing environment

WSP Parsons Brinckerhoff (2016) undertook hydrogeological field investigations in and around the groundwater study area in 2016. There have been no significant changes in the proposal site or surrounds that would impact on the applicability of these investigations and results to this assessment. Groundwater levels measured in six bores across the groundwater study area ranged between one metre below ground level and over 5.5 metres below ground level (refer to Figure 8-24). The groundwater table is typically in Bringelly Shale. Any perched groundwater table in the clayey residual soils, if present, is intermittent and/or localised.

The recorded groundwater levels indicated a westerly and north-westerly direction of flow. Groundwater is likely to move relatively slowly through the shale due to a low hydraulic gradient, resulting in a high residence time. The permeability of overlying residual soils is also expected to be relatively low.

The groundwater on the proposal site is generally near neutral pH, oxygenated, moderate to high conductivity and moderately saline. The conductivity is indicative of the salinity potential in the landscape. The Salinity Potential in Western Sydney 2002 map (Department of Infrastructure, Planning and Natural Resources, 2003) maps the entire proposal site as having 'moderate salinity potential'. West of the proposal site, in the general area of Ropes Creek, is mapped as 'high salinity potential'. The distance from the proposal site to the mapped 'high salinity potential' area typical ranges from 40 metres to 80 metres. However, in a small area in the north-west, it occurs immediately west of the proposal site.

It is possible that groundwater at the proposal site is contaminated from historical and surrounding site use. Refer to Section 8.10 (Contamination) for details on potential existing groundwater contamination.

#### Groundwater Dependent Ecosystems

There are no mapped aquatic GDEs in the groundwater study area. Refer to Section 8.11 (Biodiversity) for further details.

### 8.9.3 Potential impacts

#### Construction

##### Groundwater level changes

Overall, the proposal is unlikely to intercept the water table or result in any changes to groundwater levels. Excavation would involve a maximum depth of about two metres and is anticipated to generally occur in areas of relatively higher elevation with deeper depths to groundwater. As a result, there is not anticipated to be any adverse environmental impact or drawdown at existing licenced bores.

Other potential groundwater impacts during construction include:

- Construction of hardstand areas and modifications to ground conditions during earthworks have the potential to increase runoff and reduce groundwater recharge, however any potential change would be negligible considering the relative size of the proposal site
- Earthworks and imported fill would likely temporarily increase soil permeability and groundwater recharge in filled areas during bulk earthworks. However, this contribution would be negligible given that:
  - Surface water would be directed away from earthworks and other construction areas
  - Underlying in-situ soils and bedrock are of low permeability
  - Filled areas would ultimately be compacted and sealed.

##### Groundwater quality

With the implementation of the environmental management approach outlined in Section 8.9.4 the risks to groundwater quality would be low. The following construction activities have the potential to lead to altered groundwater quality or contamination:

- Excavation of saline soils and bedrock, and re-use as fill could result in the release of additional salts in groundwater
- Accidental spills or leakages of hazardous materials (such as fuels, lubricants and hydraulic oils) have the potential to result in groundwater contamination through runoff and subsequent recharge.

#### Operation

##### Groundwater level changes

Operation of the proposal is not likely to cause groundwater level drawdown as there would be no long-term penetration of aquifers.

Reduced groundwater recharge due to increased areas of hardstand associated with the proposal is possible. However, the total increase in impermeable areas (hardstand) is about 15.5 hectares, representing about three per cent of the total size of the about 500-hectare regional surface water catchment. Accordingly, the estimated net reduction in regional groundwater recharge is expected to be negligible and groundwater baseflow to creeks is not expected to change appreciably.

### Impacts to groundwater quality

With the implementation of the environmental management approach outlined in Section 8.9.4, the risks to groundwater quality would be low. Potential groundwater quality impacts during operation would include migration to groundwater of any accidental leaks or spills of fuels, oils and other hazardous materials used or stored at the proposal site during operation.

## 8.9.4 Management and mitigation measures

Potential groundwater impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework, which includes the following objectives for groundwater management:

- Reduce the potential for drawdown of surrounding groundwater resources
- Prevent the pollution of groundwater through appropriate controls
- Reduce the potential impacts on groundwater dependent ecosystems.

As the potential groundwater impacts of the proposal are low, no specific mitigation measures are proposed.

Mitigation measures in other chapters that are relevant to the management of potential groundwater impacts include:

- Section 8.8 (Soils and surface water quality), specifically measures which address treated water discharge
- Section 8.10 (Contamination) specifically measures which address the management of potential contamination in groundwater including spill management.

## 8.10 Contamination

A preliminary contaminated site investigation assessment has been undertaken to assess the potential risk for contamination and the potential contamination impacts to construction and operation of the proposal. This assessment is attached as Appendix H (Preliminary Site Contamination Investigation) of this REF. The methodology and results of this assessment are summarised in this section.

### 8.10.1 Methodology

The contamination assessment involved the following:

- Undertaking a desktop review of available information sources and observations from site inspections to understand the existing environment and potential risk for contamination within the contamination study area
- Undertaking a site walkover inspection, conducted on 8 April 2020 by an experienced contamination specialist
- Undertaking a high-level prioritisation exercise including identification of areas of environmental interest (with respect to contamination) and assessment of potential impacts to construction and operation from contamination (with no mitigation measures) to environmental and human receptors in the context of proposed construction activities
- Identifying appropriate mitigation and management measures, or where further investigation or contaminated land remediation may be required.

**Risk prioritisation**

A high-level risk prioritisation exercise was carried out to assess the potential impact from construction to expose contamination to human and/or ecological receptors. The prioritisation exercise considered source-pathway-receptor relationships in accordance with a conceptual site model as defined by the National Environment Protection (Assessment of Site Contamination) Measure 1999, as revised 2013 (NEPM, 2013). The prioritisation exercise considered the severity and extent of contamination sources (refer to Table 8-37), and the potential pathways from contamination sources to human and ecological receptors (refer to Table 8-38) for each media, that is soil, groundwater and vapour.

Table 8-37: Contamination severity and extent categories

| Contamination severity and extent category | Description |
|---|---|
| **SE1** | Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and is limited in spatial extent |
| **SE2** | Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and is limited in spatial extent |
| **SE3** | Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially spatially widespread |
| **SE4** | Known contamination present in the media of concern at concentrations above the relevant assessment criteria and limited in spatial extent |
| **SE5** | Known contamination present in the media of concern at concentrations above the relevant assessment criteria and spatially widespread |

Table 8-38: Contamination pathways and receptor categories

| Pathways and receptors category | Description |
|---|---|
| **PR1** | Media of concern is unlikely to coincide with or otherwise impact on the proposal and/or there is no or an unlikely exposure pathway for human or ecological receptors during construction and/or operation |
| **PR2** | Media of concern may intersect the proposal and exposure pathway for human or ecological receptors that could be present and complete during construction and/or operation |

| Pathways and receptors category | Description |
|---|---|
| **PR3** | Media of concern would intersect the construction and exposure pathway for human or ecological receptors that could be present and complete during construction and/or operation |

To provide the overall potential contamination risk for the proposal, a matrix was used to combine the consideration of contamination severity and extent with contamination pathways and receptors as provided in Table 8-39.

Table 8-39: Potential contamination risk categories

| | | Contamination severity and extent | | | | |
|---|---|---|---|---|---|---|
| **Pathways and receptors** | | **SE1** | **SE2** | **SE3** | **SE4** | **SE5** |
| | **PR1** | Very low | Low | Low | Moderate | Moderate |
| | **PR2** | Low | Moderate | Moderate | High | High |
| | **PR3** | Moderate | Moderate | High | High | Very high |

### Contamination study area

The contamination study area for the preliminary contaminated site investigation was defined as the proposal site and surrounding land within a one-kilometre buffer.

The extent of the contamination study area is shown in Figure 8-25.

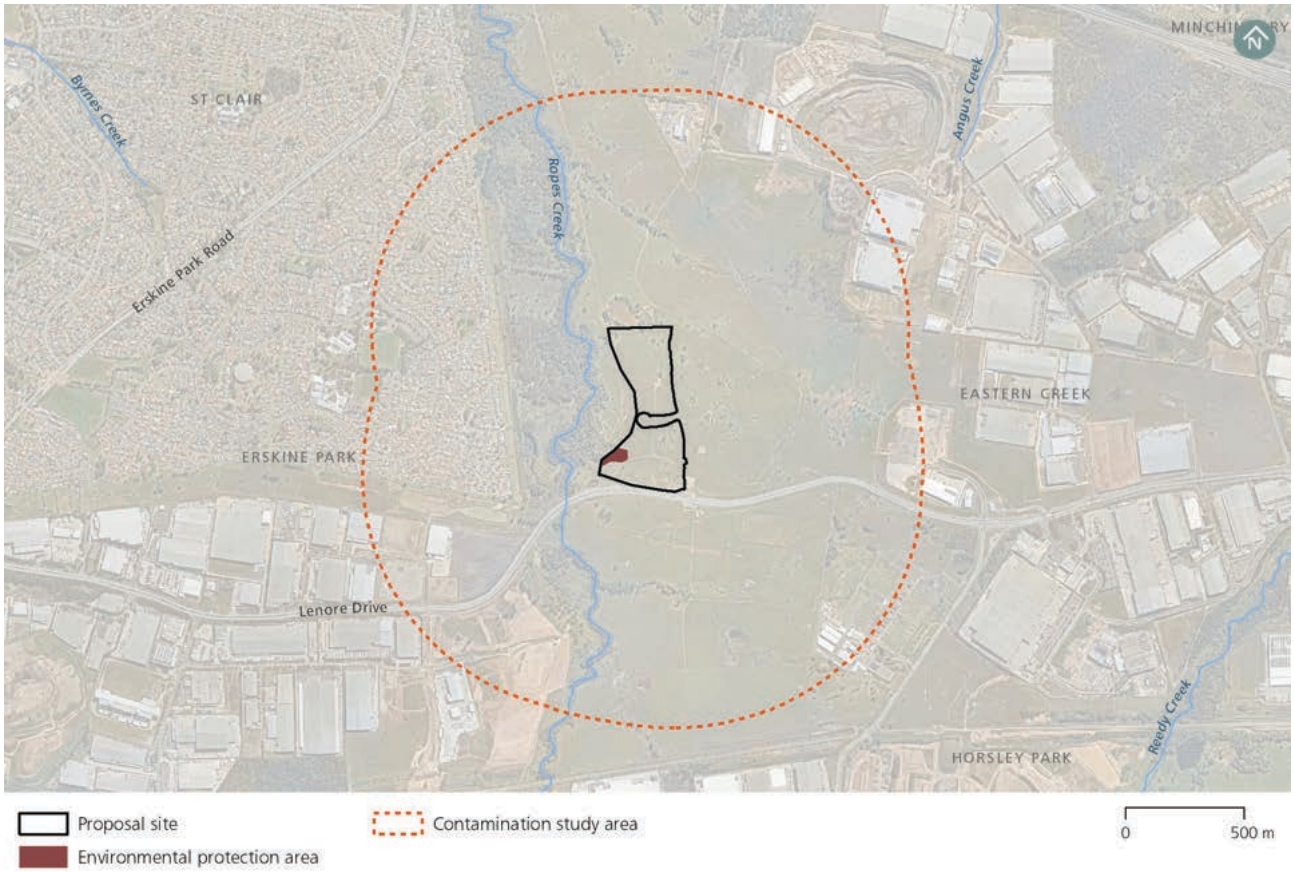


Figure 8-25: Contamination study area

### 8.10.2 Existing environment

#### Site history

Land uses in the area surrounding the proposal site since the 1950's include agricultural, residential and industrial premises. Historical aerial photography shows that the proposal site has previously been used for agricultural purposes and has included a large dam, drainage lines, and a small dam possibly constructed within the southern drainage line. More recently, increased tracks throughout the proposal site indicate there has been unauthorised off-roading.

Review of the historic aerial imagery and topographic maps has identified a number of potential sources of contamination in the contamination study area, including:

- The degradation and potentially inappropriate demolition of structures within the contamination study area containing hazardous building materials
- Sediments within the dam partially located in the northern portion of the proposal site (potential contaminant sink)
- Previous general agricultural use including localised contamination associated with chemical use / storage and waste disposal and more diffuse contamination associated with pesticide / herbicide use
- Substation operations (about 700 metres south-east from the proposal site) including transformer oils and the use / storage of aqueous film forming foam
- Potential use of overburden (material of unknown quality) to the north and east of the proposal site.

Further detail on the site history as relevant to the contamination assessment is provided in Appendix H (Preliminary Site Contamination Investigation).

#### Database searches

A search of the NSW EPA Contaminated Sites Record of Notices (under section 58 of the CLM Act) and the list of contaminated sites notified to the NSW EPA (under section 60 of the CLM Act) in May 2020 indicated that there was one site registered with the NSW EPA within one kilometre of the proposal site that was either regulated, formerly regulated or had been notified. The site is Fulton Hogan Industries, located about 700 metres east of the proposal site on Honeycomb Drive, Eastern Creek. The site contains land that has been notified to the EPA as being potentially contaminated however regulation under the CLM Act is not required.

A search of the NSW EPA POEO Act public register indicated there are three sites within one kilometre of the proposal site that have current environment protection licenses:

- NSW Electricity Networks Operations Pty Ltd, located about 700 metres south-east of the proposal site at 200 Old Wallgrove Road, Eastern Creek, with a current environment protection licence held by Transgrid for the activity 'waste storage hazardous, restricted solid, liquid, clinical and related waste and asbestos waste'
- Dial-a-Dump Pty Ltd, located about one kilometre north-east of the proposal site on Honeycomb Drive, Eastern Creek, with several current environment protection licences held by Genesis Recycling Facility for the activities 'waste disposal by application to land', 'waste storage – other types of waste', 'composting', and 'recovery of general waste'
- Fulton Hogan Industries, located about 700 metres east of the proposal site on Honeycomb Drive, Eastern Creek Pty Ltd, with a current environment protection licence held by Fulton Hogan Industries Pty Ltd for the activities 'recovery of general waste' and 'waste storage – other types of waste'.

#### Site inspection

Based on the observations made during the site inspection, there were potential contamination sources identified on the proposal site as shown in Figure 8-26. These included potential filling of the earthen embankment adjacent to Lenore Drive, the bund of the stormwater retention pond located partially within the northern area of the proposal site and isolated occurrences of fly tipped (illegal dumping) waste materials.

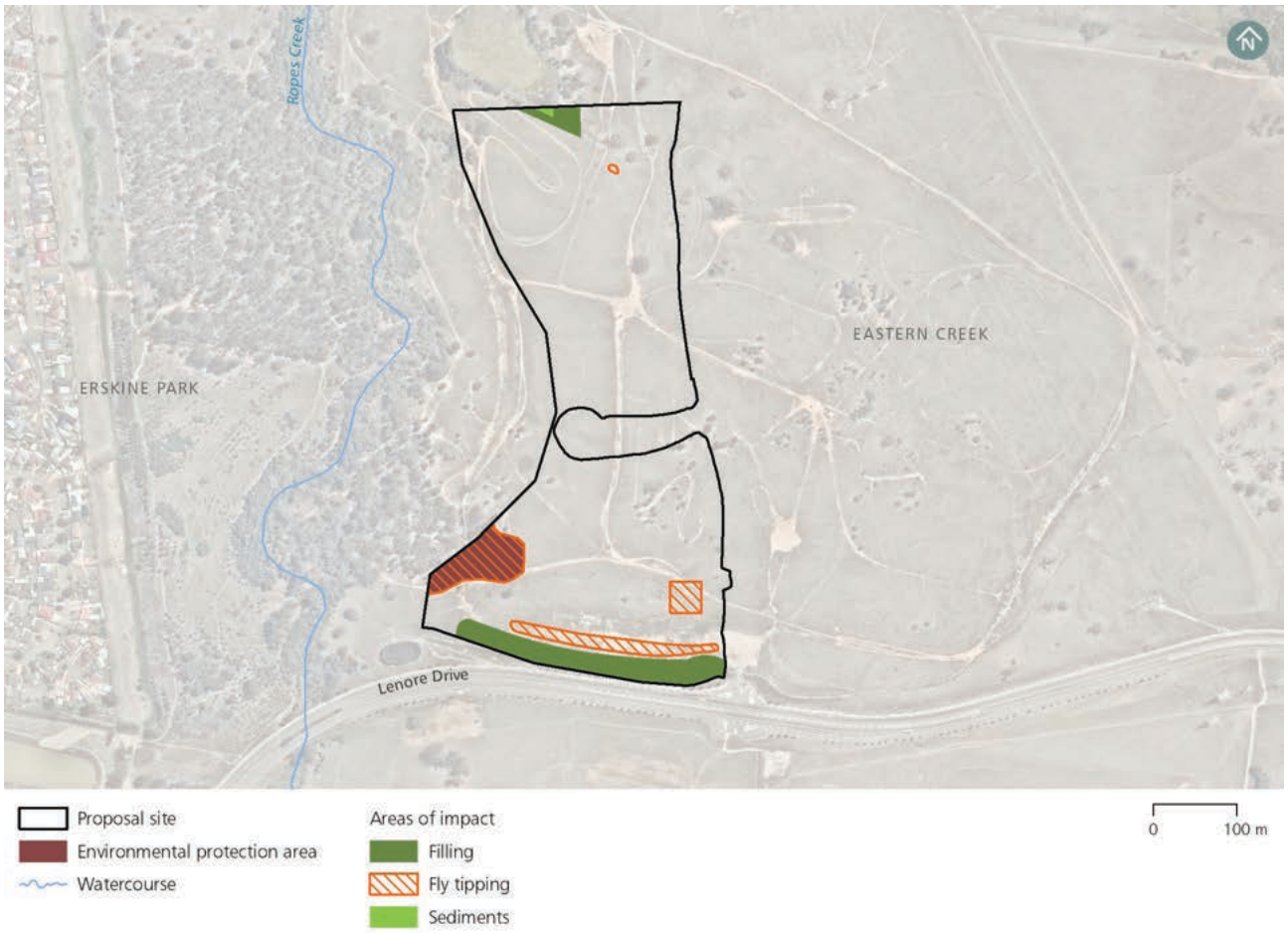


Figure 8-26: Key areas of potential contamination within the proposal site

### 8.10.3 Potential impacts

#### Contaminated land

Although there is a moderate potential contamination risk in certain areas across the proposal site during construction, with further investigation and appropriate management of these potential contamination risks the overall risk is considered low. Mitigation measures to manage construction risks and impacts associated with contamination are described in Section 8.10.4.

Contamination risks and impacts during construction can be broadly divided into two categories:

- Those that already exist on the proposal site from previous activity
- Those that may be introduced or created from construction and operation of the proposal.

The exposure of any contaminated materials during construction may increase the potential for contaminant mobilisation and may create additional exposure pathways to sensitive receivers (including environmental receptors), surface water bodies and groundwater bodies.

If earthworks during construction of the proposal intersect identified areas of potential contamination without appropriate management and/or remediation the following impacts could occur:

- Contaminant exposure risk to construction personnel through direct contact, ingestion and inhalation
- Site contamination could be mobilised into stormwater such that it affects sensitive receiving ecological environments (within the proposal site and in surrounding areas due to migration)
- Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds
- Contamination of otherwise clean spoil and areas of the site
- Direct contact with and discharge of potentially contaminated groundwater during any dewatering activities.

Potential sources of contamination identified as having moderate potential contamination risk include:

- Filling (material of unknown quality) used for the embankment adjacent to Lenore Drive and the bund of the stormwater retention pond
- Historical and current land use including inappropriate chemical storage and use, and miscellaneous waste disposal
- Sediments within onsite dams/stormwater retention pond.

An overview of the potential contamination risk is provided within Table 8-40.

Table 8-40: Potential contamination risk

| Areas of interest | Contamination severity and extent assessment | | | Pathways and receptors<br>Assessment of relationship to proposal footprint and scope | | | | Potential contamination risk without mitigation |
|---|---|---|---|---|---|---|---|---|
| | Media and CoPCs | Contamination status | Rating | Relative location | Potential for contamination to be intersected | Potential exposure pathways | Rating | |
| **Filling (material of unknown quality) – earthen embankment adjacent to Lenore Drive (southern precast site) and the bund of the stormwater retention pond (northern precast site).** | Soils (to the depth of filling).<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), pesticides, phenols, asbestos. | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. | SE2 | Within the northern and southern precast sites. | Soils would be exposed during construction.<br>Contaminated deeper soils (if present) may remain below the site during operation. | Without the identified mitigation measures:<br>• Construction workers and site users could be exposed to contamination via contact (direct contact, ingestion, inhalation) with contaminated soils and dust<br>• Adjacent site users could be exposed to contamination via dust emissions (inhalation), namely asbestos. | PR3 | Moderate |
| | Groundwater.<br>Heavy metals, nutrients, hydrocarbons (TRH, BTEX, PAH). | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. Any groundwater contamination from fill areas would be limited to the northern and southern extents of the proposal site. | SE2 | | Contaminated groundwater (if present) from overlying fill material could be intersected during construction. If encountered, is likely to represent relatively small volumes.<br>Contaminated groundwater (if present) may remain below the proposal site during operation. | Without the identified mitigation measures:<br>• Construction workers and site users could be exposed to contamination via contact (direct contact, ingestion) with contaminated groundwater. | PR2 | Low |
| **Historical/current land use (including agricultural land use) – inappropriate chemical storage and use, miscellaneous waste disposal etc.** | Surface soil.<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), pesticides, herbicides, asbestos. | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. | SE2 | Within the northern and southern precast sites. | Soils would be exposed during construction.<br>No residual contaminated surface soils likely to be present during operation. | Without the identified mitigation measures:<br>• Construction workers could be exposed to contamination via contact (direct contact, ingestion, inhalation) with contaminated soils and dust<br>• Adjacent site users could be exposed to contamination via dust emissions (inhalation), namely asbestos. | PR3 | Moderate |
| **Former and existing structures – hazardous building materials within or from buildings / structures (including transmission towers) within the contamination study area, demolition wastes.** | Surface soil.<br>Heavy metals, hydrocarbons (TRH, PAH), pesticides, asbestos. | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. | SE2 | Min. of 100m north, east and south of the proposal site (not located within the proposal site). | Surficial contamination (if present) from adjoining structures unlikely to migrate and be exposed during construction or operation. | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors. | PR1 | Low |
| **Sediments within on-site dams / stormwater retention pond (potential contaminant sink).** | Sediments.<br>Heavy metals, hydrocarbons (TRH, PAH), pesticides, microbiological, nutrients. | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. | SE2 | Within the northern precast site. | Sediments would be exposed during construction.<br>No sediments likely to be present during operation. | Without the identified mitigation measures:<br>• Construction workers could be exposed to contamination via contact (direct contact, ingestion, inhalation) with contaminated sediments. | PR3 | Moderate |

| Areas of interest | Contamination severity and extent assessment | | | Pathways and receptors<br>Assessment of relationship to proposal footprint and scope | | | | Potential contamination risk without mitigation |
|---|---|---|---|---|---|---|---|---|
| | Media and CoPCs | Contamination status | Rating | Relative location | Potential for contamination to be intersected | Potential exposure pathways | Rating | |
| **Fly tipping (illegal dumping) of wastes.** | Wastes and surface soils.<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), pesticides, phenols, asbestos. | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. | SE2 | Within the northern and southern precast sites. | Wastes and soils would be exposed during construction.<br>No residual fly tipped wastes likely to be present during operation. | Without the identified mitigation measures:<br>Construction workers could be exposed to contamination via contact (direct contact, ingestion, inhalation) with contaminated soils and dust.<br>Adjacent site users could be exposed to contamination via dust emissions (inhalation), namely potential asbestos. | PR3 | Moderate |
| **Waste management facility – offsite migration of chemicals (via infiltration into underlying groundwater or surface water discharge).** | Surface water and groundwater.<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), organic contaminants, PFAS. | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. | SE2 | About 1 km north-east of the proposal site (not within the proposal site). | Contaminated groundwater (if present) from the landfill is unlikely to be present beneath the proposal site because of the spatial separation, the quarry void is not filled and current void would act as a groundwater sink – groundwater would flow towards and not away from the void, cross gradient locations and geological conditions.<br>Groundwater is unlikely to be exposed during operation.<br>Surface water could be intersected during construction (potentially during dewatering on on-site stormwater retention pond). | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors | PR1 | Low |
| | Landfill gas.<br>Methane, hydrogen sulphide, carbon dioxide. | Low potential for contamination to be present at concentrations above the relevant assessment criteria and limited in extent. | SE1 | | Landfill gas only likely to be an issue following completion of landfilling activities. | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors. | PR1 | Very low |
| **Historical commercial / industrial use within locality – inappropriate chemical storage and use, industrial operations, waste disposal and management etc.** | Surface soil.<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH). | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. | SE2 | Minimum of 300m north-east of the proposal site (not within the proposal site). | Surficial contamination (if present) from adjoining source sites unlikely to migrate and be exposed during construction or operation. | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors. | PR1 | Low |
| | Groundwater.<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC. | Contamination possibly present at concentrations above the relevant assessment criteria and widespread. | SE3 | | Contaminated groundwater (if present) from these land uses is unlikely to be present beneath the proposal site because of the spatial separation and geological conditions.<br>Groundwater is unlikely to be exposed during operation.<br>Contaminated groundwater (if present) may remain below the proposal site during operation. | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors. | PR1 | Low |
| **Substation – transformer oils and potential firefighting activities.** | Surface soils.<br>Polychlorinated biphenyls (PCB) and PFAS. | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. | SE2 | About 700m south-east of the proposal site (not within the proposal site). | Surficial contamination (if present) from adjoining source site unlikely to migrate and be exposed during construction or operation. | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors. | PR1 | Low |
| | Groundwater.<br>PFAS. | Contamination possibly present at concentrations above the relevant assessment criteria and widespread. | SE3 | | Contaminated groundwater (if present) from the substation are unlikely to be exposed during construction or operation (site is likely to be cross-gradient with groundwater flows for the substation). | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors. | PR1 | Low |

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#### Accidental spills

Due to the implementation of site management controls, the likelihood of a major spill incident occurring is negligible. Major spills could potentially impact the quality and chemistry of the soil landscape or geology. They may also migrate off-site to affect adjacent properties and waterbodies such as Ropes Creek.

The more likely risk would be localised small spills occurring due to poor practices. The corresponding activities taking place within the proposal site with the greatest risk of accidental spillage would include:

- Ground excavation work
- Spoil excavation, transfer and management
- Waste removal off-site (e.g. haulage)
- Material delivery to site (e.g. haulage)
- Loading and unloading.

With the implementation of site management controls, the impact of accidental spills or leaks would be low within the proposal site.

#### Other potential operational impacts

All water would be captured on site during operation of the precast facilities. Captured water would be managed to ensure that any discharge leaving the site would not adversely pollute nearby land or waterways.

### 8.10.4 Management and mitigation measures

Potential contamination impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework, which includes objectives to minimise the impacts of contamination. The Construction Environmental Management Framework includes a requirement to prepare a Soil and Water Management Plan which would include management measures for contaminated material (soils, water and building materials) and a contingency plan in the case of unanticipated discovery of contaminated material.

The management and mitigation measures that would be implemented to address potential soils and contamination impacts are listed in Table 8-41.

Table 8-41: Management and mitigation measures – soils and contamination

| No. | Impact | Management and mitigation measures |
|---|---|---|
| C1 | Management of low risk contamination | For areas that have been identified as having moderate contamination impact potential, a further review of data would be performed.<br>Should the additional data review confirm that contamination is likely to have a very low or low impact potential, the areas would then be managed in accordance with the Soil and Water Management Plan for the proposal. This would typically occur where there is minor, isolated contamination that can be readily remediated through standard construction practices such as excavation and off-site disposal. |
| C2 | Detailed Site Investigation | Where data from the additional data review (mitigation measure C1) is insufficient to understand the impact of contamination, a Detailed Site Investigation would be carried out in accordance with the NEPM (2013) and other guidelines made or endorsed by the NSW EPA.<br>The areas requiring Detailed Site Investigation would be confirmed following the additional data review (C1), however on the basis of the PSCI, it is anticipated that a Detailed Site Investigation would be required to characterise fill materials, and sediment from dam / retention pond for on-site reuse and/or off-site disposal. Fly tipped wastes and deposited wastes (from former land use) would need to be characterised for off-site disposal. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **C3** | Remediation | Where data from additional data review (mitigation measure C1) or the Detailed Site Investigation (mitigation measure C2) confirms that contamination would have a moderate to very high risk, a Remedial Action Plan (RAP) would be developed for the area of the construction footprint.<br>The RAP would detail the remediation works required to mitigate impacts from contamination throughout and following completion of construction. The RAP would be prepared in accordance with relevant NSW EPA guidelines and where applicable, detail remediation methodologies in accordance with Australian Standards and other relevant government guidelines and codes of practice.<br>Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land.<br>The requirements for a RAP and remediation would be confirmed following the additional data review (mitigation measure C1) and Detailed Site Investigation (mitigation measure C2). |
| **C4** | Site Audit Statement | Where contamination is highly complex, such as significant groundwater contamination; contamination associated with vapour; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction, an accredited Site Auditor would review and approve the RAP and would develop a Site Audit Statement and Site Audit Report upon completion of remediation.<br>The requirement for a Site Audit Statement would be confirmed following preparation of the RAP (mitigation measure C3). |
| **C5** | Residual contamination following construction | Ongoing management and monitoring measures would be documented in an appropriate form and implemented for any areas where minor, residual contamination remains following construction. |
| **C6** | Accidental leaks or spills – operation | The operational environmental management plan (OEMP) for the proposal would include an Emergency Response Plan (or equivalent) which would specify the procedure to be followed in the event of a spill, including the notification requirements and use of absorbent material to contain the spill. |
| **C7** | Contaminated soil – operation | Where contaminated soils are to remain on-site, an appropriate OEMP would be prepared and implemented. The OEMP would include relevant ongoing management requirements developed in accordance with the NEPM (2013) and relevant guidelines made or approved by the NSW EPA. Measures may include but are not limited to, including procedures for excavation works, inspections and audits. |
| **C8** | Contaminated groundwater | Potential impacts from existing groundwater contamination (if present) during operation of the proposal would be managed through management and mitigation measures such as:<br>• Emplacement of appropriate topographic / drainage controls to minimise seepage and ponding of water across the site<br>• Drainage from sealed areas would be directed to stormwater drains (e.g. pipes, swales) via gross pollutant traps and sediment basins (if necessary) to mitigate potential impacts from sediments or wastes on receiving environments. |

Mitigation measures in other chapters that are relevant to the management of potential impacts include:

- Section 8.8 (Soils and surface water quality), specifically measures which address soil erosion and sediment control, and treated water discharge.

## 8.11 Biodiversity

A Biodiversity Assessment Report was prepared for the proposal. This assessment is attached as Appendix I (Biodiversity Assessment Report) of this REF. The methodology and results of this assessment are summarised below.

Potential cumulative biodiversity impacts associated with multiple projects are discussed in Section 8.16 (Cumulative impacts).

### 8.11.1 Methodology

The biodiversity assessment involved:

- Describing the existing environment and landscape features, and identifying threatened species, populations and communities listed under the BC Act and the Commonwealth EPBC Act that may be potentially affected by the proposal. Database searches in March/April 2020 included:
  - BioNet - the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection – 24 March 2020
  - NSW Department of Primary Industries (DPI) Fisheries Spatial Data Portal – 22 April 2020
  - Department of Agriculture, Water and Environment's Protected Matters Search Tool – 23 March 2020
  - BioNet Vegetation Classification Database – 15 April 2020
  - Bureau of Meteorology's Atlas of GDE – 21 April 2020
  - Department of Agriculture, Water and Environment's directory of important wetlands – 21 April 2020
  - NSW DPIE's SEPP (Coastal Management) 2018 maps – 21 April 2020
- Undertaking field surveys (carried out on 9 and 16 April 2020) which involved vegetation surveys, targeted vegetation surveys, targeted fauna surveys and aquatic surveys
- Identifying and assessing likely impacts to biodiversity
- Identifying a management approach and mitigation measures for avoiding, managing or reducing impacts on biodiversity values associated with the proposal site.

### 8.11.2 Existing environment

**Environmental context and landscape features**

The ecological study area for the purpose of the biodiversity assessment is defined as the proposal site with an approximate 50 metre buffer. The ecological study area is shown in Figure 8-27.

The ecological study area is in a highly disturbed landscape that is extensively cleared and modified. Remaining intact vegetation is generally concentrated along waterways and consists of small fragmented bushland remnants and isolated trees. The riparian vegetation and grassy woodland around Ropes Creek forms one of the largest contiguous areas of native vegetation surrounding the ecological study area.

Waterways within the ecological study area include two artificial dams, the largest being located on a mapped unnamed first order stream in the north of the ecological study area and the other on an unmapped drainage line in the south. The proposal site only includes the southern section of the large dam at its northern boundary. These drainage lines are likely naturally formed, however have been highly influenced over time by clearing of woodland vegetation and increasing run-off. Both drainage lines are highly ephemeral, only draining water from the immediate surrounds into Ropes Creek to the west of the ecological study area.

There are no wetlands of significance within the ecological study area or immediate surrounds listed under the State Environmental Protection Policy (Coastal Management 2018) or wetlands under the Directory of Important Wetlands (Department of Agriculture, Water and Environment, 2020). Vegetation surrounding Ropes Creek in the west of the ecological study area has been mapped by the Department of Planning, Industry and Environment as Cumberland Plains Priority Conservation Lands, and has also been identified as a biodiversity corridor of regional significance under the Biodiversity Investment Opportunities Map (NSW Government, 2020).

There are no Areas of Outstanding Biodiversity Value (listed in the BC Act as special areas with irreplaceable biodiversity values important to NSW) within or near the proposal site.

### Plant Community Types

Three Plant Community Types (PCTs) were identified in the ecological study area, including:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)
- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

These PCTs (Figure 8-27) are mostly in poor condition, existing as regenerating canopy over exotic dominated grasses. The remainder of the vegetated areas are classed as exotic grassland.

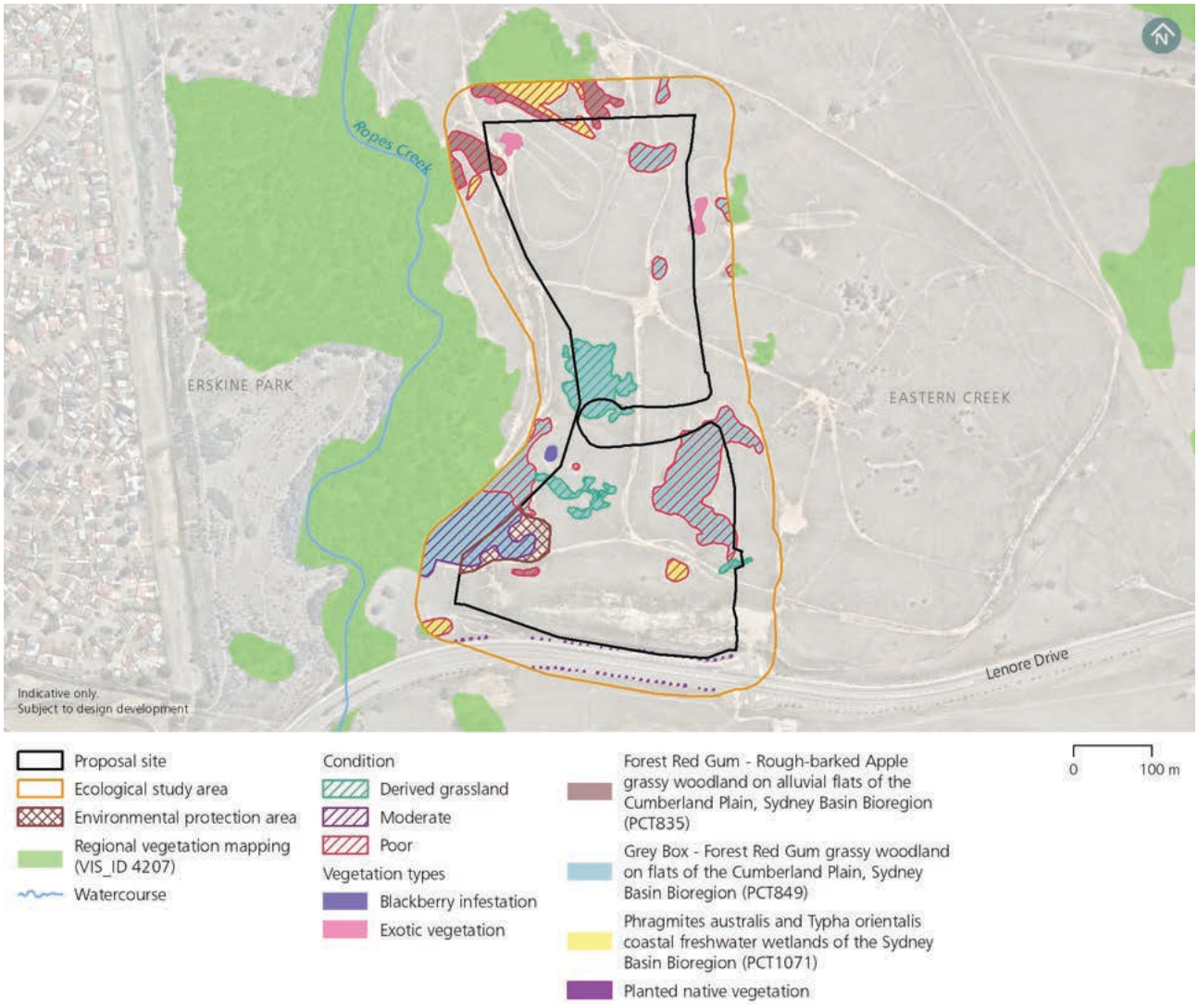


Figure 8-27: Plant Community Types

### Threatened Ecological Communities (BC Act)

Three threatened ecological communities (TECs) listed under the BC Act were identified in the ecological study area and include:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as critically endangered under the BC Act)
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered under the BC Act)
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered under the BC Act).

The distribution of TECs is mapped in Figure 8-28. A subset of these TECs within the study area also meet the definition of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest TEC listed under the EPBC Act. This is further considered in relation to matters of national environmental significance below.

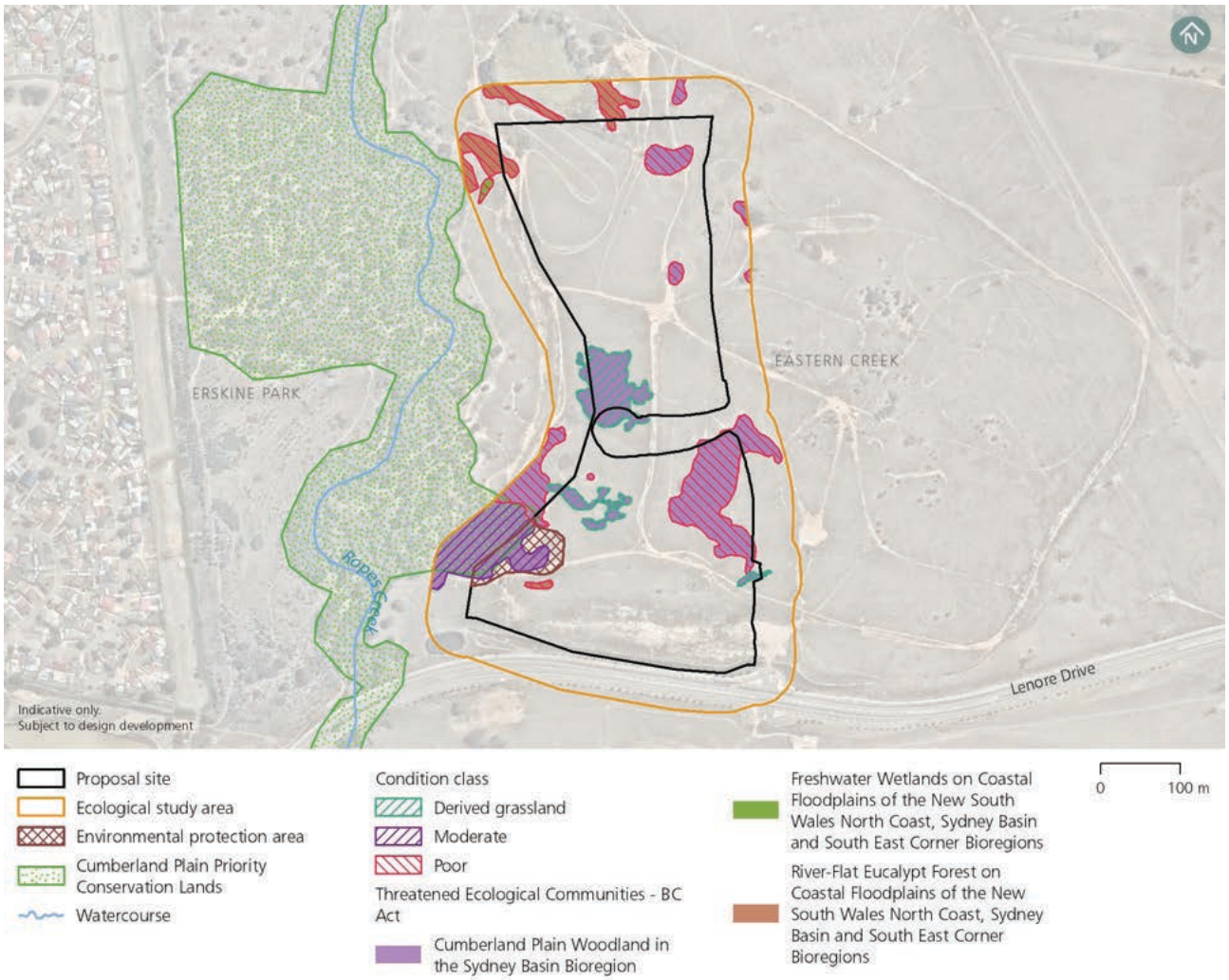


Figure 8-28: Threatened Ecological Communities

### Groundwater Dependent Ecosystems (GDEs)

There are no aquatic GDEs in the ecological study area or immediate surrounds. In addition, the ecological study area is not located within a floodplain alluvial groundwater source. A small area of ponded water in an offshoot of Ropes Creek within the north-west of the ecological study area (outside of the proposal site) may qualify as a GDE, however these wetlands are man-made and exist due to damming of a small catchment of rain and ponding of stormwater next to Lenore Drive. These wetlands do not occur naturally and are due to agricultural activities (e.g. dams) and stormwater management works (e.g. sediment basin).

### Threatened species and populations

#### Grevillea juniperina subsp. Juniperina

One threatened plant species was recorded in the ecological study area during the field survey. This was identified as *Grevillea juniperina* subsp. *Juniperina* (see Figure 8-29 and Figure 8-30). Four plants were identified growing from the southern bank of the large dam in the north of the ecological study area and outside the proposal site. Over 30 plants were also identified to the west of the ecological study area on the edge of Ropes Creek. These individuals are part of the Ropes Creek population. However, no other threatened flora species are considered likely to occur in the ecological study area based on the results of the targeted survey and lack of suitable habitat.

Figure 8-29: *Grevillea juniperina* subsp. *Juniperina* (Location: Along the northern dam bank of the ecological study area and outside the proposal site. View facing west along the southern bank of the large dam)

Figure 8-30: *Grevillea juniperina* subsp. *Juniperina* (Location: Along the northern dam bank of the ecological study area and outside the proposal site (close-up of Figure 8-29))

### Cumberland Plan Land Snail

Live Cumberland Plain Land Snails were found in leaf litter and under rubbish in moderate condition woodland in the west of the ecological study area and outside the proposal site. This is expected to be the most suitable habitat for this species and would be avoided by the proposal as it is outside of the proposal site. The species is considered to be moderately likely to use habitats in the ecological study area.

### Green and Golden Bell Frog

The dense cover of *Typha orientalis* in the dams and small offshoot drain from Ropes Creek are suitable for a range of common frog species and may also be suitable for the threatened Green and Golden Bell Frog. The larger northern dam has been identified as the best quality habitat in the ecological study area for the Green and Golden Bell Frog. Ropes Creek may provide a movement corridor for this species to occur in the habitats within the ecological study area and outside the proposal site however, there have been only three records of this species in the locality since 2000. The most recent record was in 2012 about eight kilometres north of the proposal site on Ropes Creek. This species is highly mobile and may disperse as far as 10 kilometres using the Ropes Creek corridor. Overall the species is considered to be moderately likely to use habitats in the ecological study area.

### Threatened aquatic species

Ropes Creek is mapped as 'Key Fish Habitat' by the NSW DPI, however no suitable habitat for threatened fish is present in the ecological study area and outside the proposal site. There is a lack of permanent flow, weed proliferation, and evidence of physical disturbance in the ecological study area. As such, the aquatic habitats are considered to be in moderately to highly degraded condition. The drainage lines and dams do not have characteristics suitable for any of the threatened aquatic species known or predicted to occur in the locality.

### Other threatened fauna

The ecological study area also provides suitable habitat for other threatened species that have been previously recorded in the locality, including insectivorous bats, woodland birds, nectarivorous birds the Grey-headed Flying Fox and large predatory birds.

Fauna species that are either known to occur in adjacent habitat and/or are considered at least moderately likely to occur in the proposal site based on the presence of suitable habitat are listed in Table 8-42.

Table 8-42: Other threatened fauna

| Threatened fauna species | BC Act status | EPBC Act status |
|---|---|---|
| **Grey-headed Flying-fox (*Pteropus poliocephalus*)** | Vulnerable | Vulnerable |
| **Little Bent-winged Bat (*Miniopterus australis*)** | Vulnerable | Not listed |
| **Large Bent-winged Bat (*Miniopterus orianae oceanensis*)** | Vulnerable | Not listed |
| **Southern Myotis (*Myotis macropus*)** | Vulnerable | Not listed |
| **Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)** | Vulnerable | Not listed |
| **Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)** | Vulnerable | Not listed |
| **Greater Broad-nosed Bat (*Scoteanax rueppellii*)** | Vulnerable | Not listed |
| **Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)** | Vulnerable | Not listed |
| **Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)** | Vulnerable | Not listed |
| **Varied Sittella (*Daphoenositta chrysoptera*)** | Vulnerable | Not listed |
| **Little Lorikeet (*Glossopsitta pusilla*)** | Vulnerable | Not listed |
| **Swift Parrot (*Lathamus discolor*)** | Endangered | Critically endangered |
| **Little Eagle (*Hieraaetus morphnoides*)** | Vulnerable | Not listed |
| **Square-tailed Kite (*Lophoictinia isura*)** | Vulnerable | Not listed |
| **Powerful Owl (*Ninox strenua*)** | Vulnerable | Not listed |
| **Masked Owl (*Tyto novaehollandiae*)** | Vulnerable | Not listed |

The recorded threatened species are mapped in Figure 8-31.

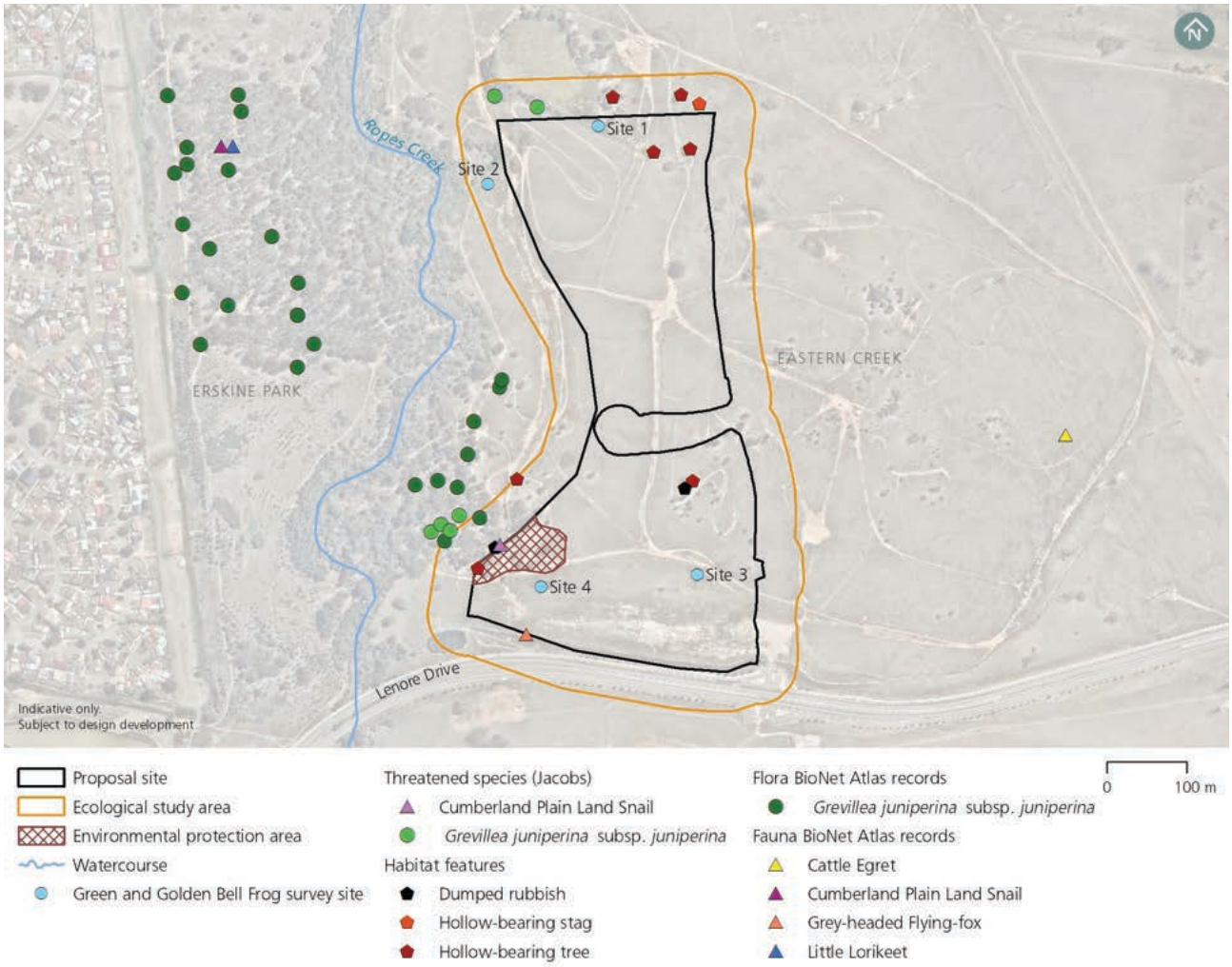


Figure 8-31: Recorded threatened species in the ecological study area

### Wildlife connectivity corridors

Habitats within the ecological study area retain some form of functional north-south connectivity along the Ropes Creek riparian corridor, which is mapped as a biodiversity corridor of regional significance as identified by the BIO Map (NSW Government, 2020) (see Figure 8-32).

The roadways and urban areas within and surrounding the ecological study area do not totally prevent fauna movement between habitat fragments. The permeability of landscapes for different fauna species varies and habitat connectivity for more mobile species (e.g. birds, flying-foxes, insectivorous bats, insects, plants) remains. The connectivity for sedentary species and smaller species such as the Cumberland Plain Land Snail, frogs and reptiles is likely to be minimal.

Depending on the mobility of the species, some may be able to maintain connectivity to other riparian corridors to the east (Eastern Creek, Prospect Nature Reserve and Western Sydney Parklands) and to the west (South Creek). There is likely to be some movement of species and genetic material between the ecological study area and these adjacent habitats. Functional connectivity for many species would exist between the ecological study area and habitats to the east and west despite the level of fragmentation that has occurred across the landscape.

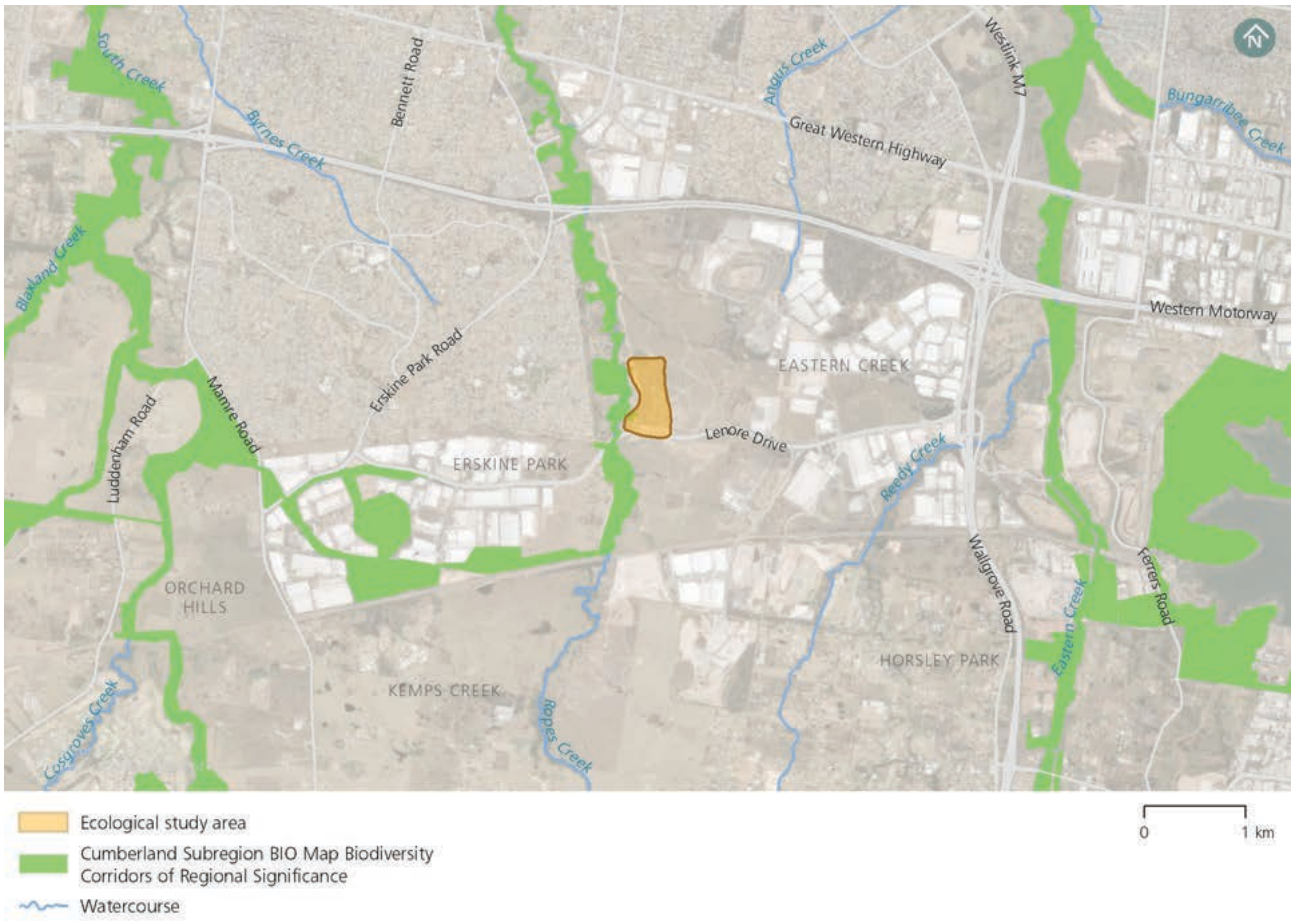


Figure 8-32: Wildlife connectivity corridors in the ecological study area

### Matters of National Environmental Significance

The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest was identified as the only TEC in the ecological study area listed under the EPBC Act (listed as critically endangered under the EPBC Act). The only vegetation that meets the critically endangered ecological communities (CEEC) condition criteria is the moderate condition vegetation that is contiguous with the Ropes Creek riparian corridor (to the west of the proposal site). There is about 0.1 hectares of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community within the ecological study area and <0.001 hectares within the proposal site (refer to Figure 8-33).

Three threatened animal species listed under the EPBC Act are considered moderately likely to use the habitats in the ecological study area for foraging, including the Green and Golden Bell Frog (listed as endangered under the EPBC Act), the Swift Parrot (listed as critically endangered under the EPBC Act) and the Grey-headed Flying-fox (listed as vulnerable under the EPBC Act). As outlined above, there are few recent records of the Green and Golden Bell Frog in the locality and no known populations. The Grey-headed Flying-fox and Swift Parrot are considered moderately likely to occur in the ecological study area on occasion. As detailed in Section 8.11.3, direct impacts to habitat for threatened fauna species would result in a minor reduction in extent of suitable foraging habitat for the Green and Golden Bell Frog (0.11 hectares), Swift Parrot (1.2 hectares) and Grey-headed Flying-fox (1.2 hectares).

No threatened plants listed under the EPBC Act are considered to have a moderate or higher likelihood of occurring.

Two migratory bird species listed under the EPBC Act – the Fork-tailed Swift and White-throated Needletail – are considered moderately likely to fly over the ecological study area however would not use it as habitat. While there is potential that some migratory species of bird use the ecological study area and locality, the ecological study area would not be classed as an 'important habitat' as a nationally significant proportion of the population would not be supported.

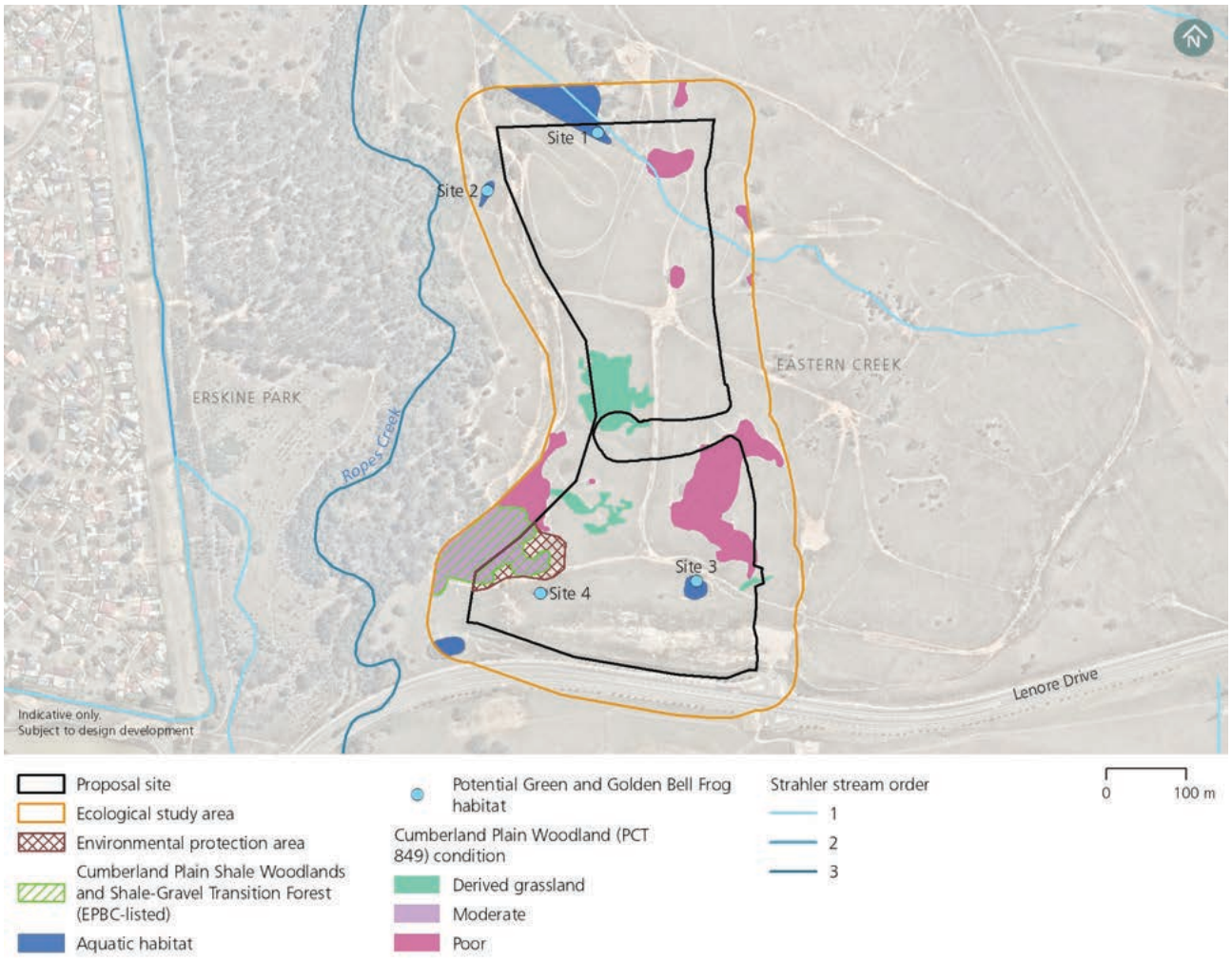


Figure 8-33: Matters of National Environmental Significance

### 8.11.3 Potential impacts

The proposal site layout has been designed to minimise impacts to biodiversity, including through the establishment of an environmental protection area to avoid vegetation clearing in the south-west of the proposal site.

The ecological study area is in a highly disturbed landscape that is extensively cleared and modified. Remaining intact vegetation is generally concentrated along waterways and consists of small fragmented bushland remnants and isolated trees. The generally isolated vegetation within the proposal site is typically of poor quality. One area of moderate quality vegetation exists in the south-west area of the proposal site which would be mostly retained within the environmental protection area.

#### Construction

##### Loss of native vegetation and habitat

The proposal would require the removal of about 1.92 hectares of native vegetation, a subset of which includes the following TECs:

- 1.74 hectares of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered)
- 0.07 hectares of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)
- <0.001 hectares of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 hectares of the associated BC Act listed Cumberland Plain Woodland community.

One threatened flora species, *Grevillea juniperina* subsp. *Juniperina* was identified in the ecological study area (outside the proposal site). No individual plants of this species would directly impacted by the proposal, however 0.06 hectares of potential habitat would be removed.

### Loss of fauna habitat

The native vegetation to be removed provides habitat (or potential habitat) for the species mentioned in Section 8.11.2.

Table 8-43 provides an overview of potential direct impacts of the proposal to potential habitat of threatened fauna species. Assessments of significance against both the BC Act and EPBC Act concluded that a significant impact to any threatened species is considered unlikely.

Table 8-43: Potential impacts to fauna habitat

| Species | BC Act status | EPBC act status | Potential impact |
|---|---|---|---|
| **Cumberland Plain Land Snail (*Meridolum corneovirens*)** | Endangered | Not listed | <0.001 ha of habitat would be removed. The impact to habitat would be the edge of a large high-quality habitat and the proposal would not result in fragmentation or isolation of high-quality habitat. |
| **Green and Golden Bell Frog (*Litoria aurea*)** | Endangered | Endangered | Up to 0.11 ha of potential non-breeding habitat would be removed. This would represent a small proportion of similar quality habitat present in the broader locality. |
| **Grey-headed Flying-fox (*Pteropus poliocephalus*)** | Vulnerable | Vulnerable | Up to 1.2 ha of suitable foraging habitat would be removed. Breeding camps and other important habitat would not be impacted. |
| **Insectivorous bats (cave-roosting)** | | | |
| **Little Bent-winged Bat (*Miniopterus australis*)** | Vulnerable | Not listed | Up to 1.92 ha of foraging habitat would be removed. However, much of this area is considered poor quality habitat. The amount of habitat removal is relatively small in comparison to the amount of higher quality habitat available in the broader locality. |
| **Large Bent-winged Bat (*Miniopterus orianae oceanensis*)** | Vulnerable | Not listed | |
| **Southern Myotis (*Myotis macropus*)** | Vulnerable | Not listed | |
| **Insectivorous bats (hollow-roosting)** | | | |
| **Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)** | Vulnerable | Not listed | Up to 1.92 ha of foraging habitat and four hollow-bearing trees would be removed. However, much of this area is considered poor quality habitat. The amount of habitat removal is relatively small in comparison to the amount of higher quality habitat available in the broader locality. |
| **Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)** | Vulnerable | Not listed | |
| **Greater Broad-nosed Bat (*Scoteanax rueppellii*)** | Vulnerable | Not listed | |
| **Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)** | Vulnerable | Not listed | |
| **Woodland birds** | | | |
| **Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)** | Vulnerable | Not listed | Up to 1.2 ha of foraging habitat would be removed. However, much of this area is considered poor quality habitat. The amount of habitat removal is relatively small when the amount of available habitat in the broader locality is considered. |
| **Varied Sittella (*Daphoenositta chrysoptera*)** | Vulnerable | Not listed | |

| Species | BC Act status | EPBC act status | Potential impact |
|---|---|---|---|
| **Nectarivorous birds** | | | |
| **Little Lorikeet (*Glossopsitta pusilla*)** | Vulnerable | Not listed | Up to 1.2 ha of foraging habitat and four hollow-bearing trees would be removed. However, much of this area is considered poor quality habitat. The amount of habitat removal is relatively small when the amount of available habitat in the broader locality is considered. |
| **Swift Parrot (*Lathamus discolor*)** | Endangered | Critically endangered | |
| **Large predatory birds** | | | |
| **Little Eagle (*Hieraaetus morphnoides*)** | Vulnerable | Not listed | Up to 1.2 ha of foraging habitat would be removed. However, no high-quality habitat is present within the ecological study area for these species and these species may only visit the ecological study area on occasion to hunt. The amount of habitat removal is small when the amount of available habitat in the broader locality is considered. |
| **Square-tailed Kite (*Lophoictinia isura*)** | Vulnerable | Not listed | |
| **Powerful Owl (*Ninox strenua*)** | Vulnerable | Not listed | |
| **Masked Owl (*Tyto novaehollandiae*)** | Vulnerable | Not listed | |

### Assessments of significance

Assessments of significance have been undertaken for threatened species under the BC Act and Matters of National Environmental Significance under the EPBC Act.

An assessment of significance under the BC Act has been conducted for threatened species that have been identified within the ecological study area or that are considered to have a moderate or high likelihood of occurring in the proposal site due to the presence of suitable habitat. The conclusions of the assessments indicate that a significant impact is considered unlikely on any threatened species or threatened ecological communities listed under the BC Act. Further details of the assessment of significance under the BC Act are provided in Appendix I (Biodiversity Assessment Report) of this REF.

The findings of EPBC Act assessments of significance are summarised in Table 8-44. A significant impact is considered unlikely for any Matter of National Environmental Significance and a referral of the proposal for a controlled activity determination under the EPBC Act in relation to biodiversity matters would not be required. Further details of the assessment of significance under the EPBC Act are provided in Appendix I (Biodiversity Assessment Report) of this REF.

Table 8-44: Assessment of significance – EPBC Act

| Threatened species or ecological community | Impacts on important population? | Likely significant impact? | Summary of assessment |
|---|---|---|---|
| **Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest** | Not applicable | No | Based on the estimated construction proposal site, the project may result in the direct clearing of about <0.001 hectares of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. |
| **Grey-headed Flying-fox *(Pteropus poliocephalus)*** | Yes | No | There would be a potential minor reduction in extent of suitable foraging habitat, however breeding camps or other important habitat would not be impacted. The proposal is unlikely to reduce the population size of the species or decrease its reproductive success, and would not contribute to the key threats to this species. |
| **Green and Golden Bell Frog *(Litoria aurea)*** | Yes | No | This species has not been identified in the ecological study area and no individuals are expected to be directly impacted. The potential habitat impacted by the proposal is likely to represent foraging and shelter for individuals dispersing across the landscape and is a small proportion of similar quality habitat present in the broader locality. The proposal would not directly impact on a known breeding site or any habitat critical to the survival of this species. |
| **Swift Parrot (Lathamus discolour)** | Not applicable | No | The proposal would result in a small reduction in extent of potential foraging habitat and loss of potential roosting habitat, however no priority foraging habitat would be impacted. The proposal is unlikely to reduce the population size of the species, decrease its reproductive success or interfere with its recovery. |

### Habitat fragmentation

Overall, potential impacts associated with habitat fragmentation are expected to be negligible.

The proposal site is located within a highly disturbed landscape where most habitat has been cleared. The proposal would not break apart continuous habitats into separate smaller 'fragments'. Functional connectivity for many species would remain in the ecological study area. The proposal could however result in an increase in isolation of habitats as all the vegetation on the site would be removed, which would increase the physical distance between habitat fragments. Local division of some wildlife populations, isolation of key habitat resources, loss of genetic interchange, and loss of population viability for some species may be caused as a result of the proposal.

### Aquatic impacts

There would be no direct impacts to sensitive or key fish habitats associated with the proposal. Potential indirect impacts to aquatic habitat would be of low magnitude and standard mitigation measures would be implemented to manage impacts to surrounding habitats as identified in Section 8.11.4.

### Fauna injury or mortality

Fauna injury or death may potentially occur during construction when undertaking vegetation clearing. The extent of this impact would be proportionate to the removal of vegetation. Less mobile species or those that are nocturnal and nest or roost in trees during the day may find it difficult to rapidly move away from the clearing when disturbed. Mitigation measures designed to reduce potential injury and mortality of fauna are provided in Section 8.11.4.

### Other indirect impacts

The potential for indirect impacts on biodiversity values is considered low given that much of the ecological study area is highly fragmented, subject to strong edge effects, and surrounded by existing roads and barriers. Potential indirect biodiversity impacts are outlined in Table 8-45.

Table 8-45: Potential indirect biodiversity impacts

| Potential indirect impact | Relevance to the proposal |
|---|---|
| **Edge effects** | The proposal would be in an area that is currently subject to a high level of edge effects (changes to ecosystem functioning that occur as a result of sudden and artificial edges, e.g. increased light) from the existing roadways, previous agricultural land use practices and urban development. The proposal is unlikely to cause further impacts from edge effects. No new edge habitats would be created as the ecological study area does not possess large core areas of undisturbed habitat. This impact would be of low magnitude. |
| **Weeds, pathogens and pests** | Weeds would be managed during construction in accordance with mitigation measures outlined in Section 8.11.4. Without mitigation, an increase in weeds would be likely to occur during construction. The ecological study area contains substantial weed growth and no undisturbed weed free habitat exists.<br>While the presence of pathogens has not been identified within the ecological study area, the potential for pathogens to occur would be treated as a risk during construction. Pathogens would be managed within the proposal site in accordance with the *Biosecurity Act 2015*.<br>Construction activities may also have the potential to disperse pest species out of the proposal site across the surrounding landscape (particularly dewatering the dams) however the magnitude of this impact would be low. Management and mitigation measures designed to minimise these impacts are outlined in Section 8.11.4. |
| **Noise and vibration** | There would be temporary noise and vibration impacts during construction and operation within the proposal site and immediate surrounds due to vegetation clearing, ground disturbance, machinery and vehicle movements, and general human presence. The predicted noise and vibration impacts arising from the proposal on other sensitive receivers are assessed in Section 8.1 (Noise and vibration) of the REF.<br>The predicted temporary noise and vibration impacts would potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours in proximity to the proposal site. Some species may be more sensitive to noise emissions than others (e.g. woodland birds). However, the impacts from noise emissions are likely to be localised to the construction areas and are not considered likely to have a significant, long-term, impact on wildlife populations outside the proposal site and immediate surrounds. |
| **Dust** | Dust has the potential to be generated temporarily during periods of substantial earthworks, vegetation clearing, vehicle movements for construction and during adverse weather conditions. However, deposition of dust on foliage is likely to be highly localised, intermittent, and temporary and is therefore not considered likely to be a major impact of the proposal. Dust would be managed through the implementation of measures outlined in Section 8.13 (Air quality). |
| **Contamination** | Localised release of contaminants (i.e. hydraulic fluids, oils, drilling fluids, etc.) into the surrounding environment (including drainage lines) may accidentally occur. The most likely result of contaminant discharge would be the localised contamination of soil and potential direct physical trauma to flora and fauna that encounter contaminants. Management and mitigation measures to minimise potential contamination impacts are outlined in Section 8.10 (Contamination). |

### Operation

The proposal is generally not expected to result in different impacts (from construction) during operation. Key impacts of the proposal would occur during construction and have been assessed above. Management and mitigation measures to reduce these impacts are included in Section 8.11.4.

During operation, there is a chance of fauna mortality through vehicle collision. The impact on threatened species however is expected to be minimal. Based on evidence from other roadways in the locality most vehicle strike impacts can be expected to occur to common mammals such as birds, possums and exotic animals, including foxes.

The proposal would operate 24 hours per day, seven days per week. As such, the proposal site and immediate surrounds would be subject to continuous artificial lighting, essentially creating permanent 'daylight' conditions. Ecological light pollution may potentially affect nocturnal fauna by interrupting their life cycle. Some species (e.g. light tolerant microchiropteran bats) may benefit from the lighting due to increased food availability (insects attracted to lights) around these areas. Due to the frequency and sustained nature of the lighting, it is unlikely that animals would habituate to the light disturbance and a long-term impact around the area of lighting is likely. This impact would be of low magnitude and mitigation measures are not considered necessary.

## 8.11.4 Management and mitigation measures

Biodiversity impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework. The Construction Environmental Framework includes biodiversity management objectives to maximise workers' awareness of biodiversity values and avoid or minimise potential impacts to biodiversity, and requirements for pre-clearing surveys to be completed prior to native vegetation clearing.

The management and mitigation measures that would be implemented to address potential biodiversity impacts of the proposal are listed in Table 8-46.

Table 8-46: Biodiversity management and mitigation measures

| No. | Impact | Environmental management and mitigation measures |
|---|---|---|
| **B1** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, the limits of the work zone, areas for parking and turning of vehicles and plant equipment would be clearly and accurately marked out. These areas would be located so that vegetation disturbance is minimised as much as possible and the drip-line of trees avoided. |
| **B2** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, exclusion zones would be identified and established around all vegetation to be retained, such as the environmental protection area in the west of the proposal site. Periodic monitoring would be undertaken to ensure all controls are in place and no inadvertent impacts are occurring. |
| **B3** | Potential impact to surrounding vegetation and threatened ecological communities | Materials, plant, equipment, work vehicles and stockpiles would be placed to avoid damage to surrounding vegetation and outside tree driplines. |
| **B4** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, personnel would be informed of the environmentally sensitive aspects of the proposal site, including plans for impacted and adjoining areas showing vegetation communities, important flora and fauna habitat areas, and locations where threatened species, populations or ecological communities have been recorded. Construction personnel would be made aware that any native fauna species encountered must be allowed to safely leave the proposal site where possible and a local wildlife rescue organisation or appropriately experienced ecologist must be called for assistance where necessary. |
| **B5** | Potential impact to surrounding vegetation and threatened ecological communities | Where possible, hollows would be cut out of hollow-bearing trees and re-established in large trees to the west of the proposal site to mitigate the loss of hollow habitat on fauna. |

| No. | Impact | Environmental management and mitigation measures |
|---|---|---|
| **B6** | Potential impacts to the Cumberland Plain Land Snail | Pre-clearing surveys for the Cumberland Plan Land Snail would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing to translocate any individuals that may be inhabiting areas that would be cleared or disturbed. This includes all areas of dumped rubbish across the proposal site. |
| **B7** | Potential impacts to the Cumberland Plain Land Snail | Prior to construction, exclusion zones would be established around Cumberland Plain Land Snails habitat in the environmental protection area. All personnel would be inducted to understand the exclusion zone to limit the potential of trampling snails. |
| **B8** | Potential impacts to the Cumberland Plain Land Snail | Large woody debris cleared within the proposal site would be relocated into habitat to the west of the proposal site. |
| **B9** | Potential impacts to the Green and Golden Bell Frog | Pre-clearing surveys for the Green and Golden Bell Frog would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing and dewatering of potential habitat to ensure that individuals have not inhabited the site. A suitably qualified ecologist would also be present during the dewatering of the habitat. A stop work in the immediate vicinity would be implemented if this species is identified on the proposal site, and then further consideration of approach to management of individuals on proposal site through consultation with a Green and Golden Bell Frog expert. |
| **B10** | Potential impacts to the Green and Golden Bell Frog | Any work in and around the suitable habitat during clearing would follow the Hygiene Protocol for the Control of Disease in Frogs (Department of Environment and Climate Change, 2008b) to reduce the potential for introduction and spread of Chytrid fungus. |
| **B11** | Potential impacts from introduction and spread of weeds | Weed control would be undertaken by suitably qualified and/or experienced personnel. This may include:<br>• Manual weed removal in preference to herbicides<br>• Replacing non-target species removed/killed as a result of weed control activities<br>• Protecting non-target species from spray drift<br>• Using only herbicides registered for use within or near waterways for the specific target weed<br>• Applying herbicides during drier times when the waterway level is below the high-water mark<br>• Not applying herbicide if it is raining or if rain is expected<br>• Mixing and loading herbicides, and cleaning equipment away from waterways and drains. |
| **B12** | Potential impacts from introduction and spread of weeds | During construction, weed management would be undertaken in areas affected by construction prior to any clearing works in accordance with the *Biosecurity Act 2015* to ensure they are not spread to the surrounding environment; including during transport disposal off-site to a licenced waste disposal facility. |
| **B13** | Potential impacts from introduction and spread of weeds | All weeds, propagules, other plant parts and/or excavated topsoil material that is likely to be infested with weed propagules that are likely to regenerate would be treated on site or bagged, removed from site and disposed of at a licensed waste disposal facility. |
| **B14** | Potential impacts from introduction and spread of plant pathogens | During construction, all vehicles driving to and from the proposal site would follow a protocol to prevent the spread or introduction of phytophthora, namely vehicles would be clean, including the tyres and any equipment. |

## 8.12 Resource use and waste management

This section assesses the potential resource use and waste management impacts of the proposal.

### 8.12.1 Methodology

The resource use and waste management assessment involved:

- Identifying resource use and management during construction and operation
- Identifying likely waste generating activities and likely waste types
- Identifying mitigation measures to manage potential impacts associated with resource use and waste management.

The waste management hierarchy principles established under the *Waste Avoidance and Resource Recovery Act 2001* of avoid/reduce/reuse/recycle/dispose would be applied to the construction and operation of the proposal.

### 8.12.2 Potential impacts

**Construction**

The type and quantities of resources and materials needed to construct the proposal are relatively minor and readily available within the Greater Sydney region. The main resources likely to be required during construction would be fill, concrete, asphalt, aggregate, sand and water.

Final specifications and quantities would be defined during detailed design and confirmed by the relevant construction contractor(s).

The volume of waste anticipated to be generated during construction would be relatively minor. Existing metropolitan waste management facilities would have capacity to receive the anticipated waste streams generated by the proposal. General construction wastes and wastes from site offices would be collected for off-site recycling wherever practicable.

Potential waste types that would be generated during construction include:

- Concrete
- Asphalt
- Green waste (from removing and pruning trees and vegetation)
- Surplus building material
- Spoil, such as excavated natural material, general solid waste, special waste, restricted solid waste, and/or hazardous waste
- Sediments
- General office waste (including sewage and grey water)
- Domestic waste from personnel (including food scraps, glass and plastic bottles, paper and plastic containers).

Potential temporary impacts associated with waste management during construction could include:

- Waste being unnecessarily directed to landfill due to inadequate collection, classification and disposal of waste
- Excess spoil being unnecessarily directed to landfill due to poor characterisation, insufficient planning, incorrect handling and/or incorrect classification
- A potential increase in vermin from the incorrect storage, handling and disposal of putrescible waste from the proposal
- Excessive amounts of materials being ordered, resulting in a large amount of left-over, unused resources
- Lack of identification of feasible options for recycling or reuse of resources.

Wastes that contain hazardous, special or otherwise contaminated materials which are unsuitable to be retained on the proposal site would be treated and/or disposed of off-site at a licensed facility in accordance with the relevant guidelines. The management of contaminated soils is discussed in Section 8.10 (Contamination).

Recyclables such as containers (plastics, glass, cans, etc.), paper and cardboard would be collected by an authorised contractor for off-site recycling. There are a number of material recovery facilities near the proposal site. The recycling facility would be determined by the contractor engaged to collect the material.

Wastewater would also be generated by the use of staff amenities at the proposal site. Sewage and grey water from these amenities would be disposed to sewer or transported to an appropriately licenced liquid waste treatment facility.

Sediment basins or tanks would be installed onsite. Sediments would be recovered from the basins/tanks and removed from the proposal site for appropriate disposal.

#### Operation

The key materials required for the operation of the proposal include aggregate, sand, cement and water. Additional production materials include:

- Supplementary cementitious materials (e.g. fly ash)
- Air-entraining admixture
- Steel fibre
- Poly fibre.

The amount of input materials required would vary based on demand and resultant production rates. For the purposes of this assessment, peak production rates have been assumed at 730 tonnes of concrete per day. Refer to Chapter 5 (Proposal description) for the volume of input materials required to support this production rate.

The volumes of waste generated during operations, maintenance and repairs are anticipated to be minimal and would be readily managed through the implementation of standard mitigation measures.

Operation of the proposal would generate waste streams, including:

- Concrete from faulty precast segments (anticipated to be about two to three per cent of total production based on experience from precast segment production from Sydney Metro City & Southwest)
- Oil, grease and other liquid wastes from the maintenance of plant and equipment
- Production materials such as aggregates, sand, cement, fly ash, steel fibre and poly fibre
- General office waste (including sewerage and grey water)
- Domestic waste from personnel (including food scraps, glass and plastic bottles, paper and plastic containers).

Water management infrastructure would include onsite detention and a water recycling facility included as part of the batching plant. Water would be recycled onsite wherever possible.

Potential operation waste impacts would be similar to those mentioned above for construction. The impacts are expected to be minor and would be managed through the mitigation measures identified in Section 8.12.3. After the completion of operations and decommissioning of the precast facilities, the assets would be deconstructed and the materials removed from the proposal site. Where possible, salvaged materials would be recycled and reused. Any residual material would be disposed of at a licensed waste management facility.

### 8.12.3 Management and mitigation measures

Waste would be managed in accordance with Sydney Metro's Construction Environmental Management Framework.

Relevant initiatives in the Sydney Metro West Sustainability Plan would be applied to the proposal as outlined in Section 8.15 (Sustainability, climate change and greenhouse gases).

The Construction Environmental Management Framework also provides the basis for the development and implementation of a design and/or construction sustainability management plan. The framework provides minimum requirements for the plan which includes waste management and recycling.

The management and mitigation measures that would be implemented to manage waste and resources use are listed in Table 8-47.

Table 8-47: Waste and resource mitigation measures

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **WR1** | Compliance with legislative and policy requirements | All waste would be assessed, classified, managed, transported and disposed of in accordance with the *Waste Classification Guidelines and the Protection of the Environment Operations (Waste) Regulation 2014*. |
| **WR2** | Waste minimisation | Waste would be minimised by accurately calculating materials brought to the proposal site and limiting materials packaging. |
| **WR3** | Waste management | 100 per cent of usable spoil from construction would be reused, in accordance with the Sydney Metro spoil management hierarchy. |
| **WR4** | Reuse and recycling | Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities. |
| **WR5** | Waste tracking | A materials tracking system would be implemented for material transferred to offsite locations such as licensed waste management facilities. |
| **WR6** | Reuse and recycling | At least 95 per cent of inert and non-hazardous construction waste, excluding spoil, and at least 50 per cent of office waste would be recycled or alternatively beneficially reused. |

Mitigation measures in other chapters that are relevant to the management of potential impacts include:

- Section 8.10 (Contamination), specifically measures which address the disturbance of contaminated land and measures to minimise the likelihood and potential impact of accidental spills or leaks.

## 8.13 Air quality

This section assesses the potential air quality impacts of the proposal.

### 8.13.1 Methodology

The air quality assessment involved:

- Establishing prevailing climate and meteorological conditions around the proposal site using publicly available data from the Bureau of Meteorology (BoM) monitoring station at Horsley Park
- Establishing prevailing ambient air quality conditions around the proposal using publicly available data over the last five complete calendar years (2015 to 2019) from air quality monitoring stations at St Marys and Prospect, operated by the Environment, Energy and Science Group of DPIE
- Identifying air quality sensitive receivers with the potential to be adversely affected by the proposal
- Undertaking a desktop review of Commonwealth Department of Agriculture, Water and the Environment National Pollutant Inventory data to identify any projects or facilities that may be contributing to local air quality conditions
- Identifying key potential air quality-related risks arising from the proposal. Environmental features, such as local climate and meteorology, background air quality conditions, and terrain, were analysed to identify the sensitivity of the receiving environment to potential air quality-related impacts
- Assessing potential air quality impacts during construction and operation of the proposal. Potential impacts of the proposal were qualitatively estimated using metrics developed based on guidance from the Australian and New Zealand standard AS/NZS ISO 31000: 2018 Risk Management – Principles and Guidelines
- Identifying mitigation measures to address or manage potential air quality impacts.

Based on guidance from AS/NZS ISO 31000:2018, magnitude and likelihood definitions are outlined in Table 8-48 and Table 8-49 respectively. The air quality risk assessment matrix is presented in Table 8-50.

Table 8-48: Magnitude definitions for air quality assessment

| Magnitude of potential impact | Definition |
|---|---|
| **Catastrophic** | • Long-term (greater than 12 months) and irreversible large-scale environmental impacts. Would cause exceedances at a larger number of receivers<br>• Extended substantial disruptions and impacts to receivers |
| **Severe** | • Long-term (6 to 12 months), environmental impacts to neighbouring receivers<br>• Severe disruptions or long-term impacts to receivers |
| **Major** | • Medium-term (between 3 and 6 months) impacts. Would likely cause exceedances at a small number of sensitive receivers under most circumstances<br>• Major disruptions or long-term impacts to receivers |
| **Moderate** | • Medium-term (between 1 and 3 months), short-term and/or well-contained environmental impacts. Has the potential to result in exceedances of air quality criteria under some circumstances<br>• Moderate impacts or disruptions to receivers |
| **Minor** | • Short-term impacts (less than 1 month). Of a magnitude that would not be expected to result in exceedances of air quality criteria under almost all circumstances<br>• Minor or short-term impacts to receivers |
| **Insignificant** | • No noticeable changes to the environment and/or highly localised event. Not of a magnitude that would be expected to result in exceedances of air quality criteria under any circumstances<br>• Negligible impact to receivers. |

Table 8-49: Likelihood definitions for air quality assessment

| Likelihood of potential impacts | Definition | Probability |
|---|---|---|
| **Almost certain** | Expected to occur frequently during time of activity or project (10 or more times every year) | >90% |
| **Very likely** | Expected to occur occasionally during time of activity or project (1 to 10 times every year) | 75% to 90% |
| **Likely** | More likely to occur than not occur during time of activity or project (once each year) | 50% to 75% |
| **Unlikely** | More likely not to occur than occur during time of activity or project (once every 1 to 10 years) | 25% to 50% |
| **Very Unlikely** | Not expected to occur during the time of activity or project (once every 10 to 100 years) | 10% to 25% |
| **Almost unprecedented** | Not expected to ever occur during time of activity or project (less than once every 100 years) | <10% |

Table 8-50: Air quality risk assessment matrix

| Likelihood | Definition | | | | | |
|---|---|---|---|---|---|---|
| | **Insignificant** | **Minor** | **Moderate** | **Major** | **Severe** | **Catastrophic** |
| **Almost certain** | Medium | High | High | Very high | Very high | Very high |
| **Very likely** | Medium | Medium | High | High | Very high | Very high |
| **Likely** | Low | Medium | Medium | High | High | Very high |
| **Unlikely** | Low | Low | Medium | Medium | Medium | High |
| **Very unlikely** | Low | Low | Low | Medium | Medium | High |
| **Almost unprecedented** | Low | Low | Low | Low | Medium | Medium |

### 8.13.2 Existing environment

#### Climate and meteorology

Meteorological conditions are important for determining the direction and rate at which air pollution would disperse. Dust generation is the main air quality risk during construction, and long-term climate data is useful for identifying periods throughout the year when conditions conducive to dust generation are most likely (such as warm and/or dry periods). The closest BoM monitoring station to the proposal site is located about six kilometres to the south-west at Horsley Park (Station ID: 067119). Meteorological data collected over the five most recent calendar years (2015 to 2019) at the Horsley Park BoM station were reviewed to identify local meteorological trends.

Temperature and rainfall data indicates that the setting around the proposal site experiences warm and wet summers (December to February) with average daily maximum temperatures between 28 and 30 degrees Celsius. The average daily maximum temperatures in winter (June to August) are between 17 to 19 degrees Celsius. Winter is the driest season. The driest period of the year is between July and September when the average monthly rainfall is around 36 millimetres per month. The average annual rainfall is 748 millimetres over an average of 74 rain days per year.

Winds blowing from the south-west were most common around the proposal site, occurring approximately eight to twelve per cent of the year. Importantly, winds from the east (e.g. winds blowing from east to west in the direction of the nearest residential receivers at Erskine Park) were only measured as occurring around four per cent of the year.

### Terrain

Terrain can affect the speed and direction of winds across a landscape and may alter the path that a pollutant may take between the emission source and the point of impact.

Elevations within 10 kilometres of the proposal site range from zero to 125 metres above sea level. Elevations at the proposal site range between approximately 50 and 60 metres; about the same elevation as the nearest sensitive receivers to the west. Therefore, topography within the proposal site is relatively even compared to its surrounds and does not significantly affect the speed and direction of winds across the proposal site.

### Ambient air quality

The Environment, Energy and Science Group uses a standardised measurement known as the air quality index to characterise air quality and acceptability of air quality at a location and compare it in relative terms with other locations throughout NSW. Average daily air quality index values for the two monitored stations between 2016 and 2020 were:

- St Marys – ranging from 50 to 75
- Prospect – ranging from 47 to 82.

These values correspond with an air quality index outcome of 'fair', indicating that air quality around these stations is generally of an acceptable quality. Worse air quality index values can occur as a result of a combination of natural and human phenomena including dust storms and bushfires. The recent bushfire events in 2019/2020 resulted in the air quality index exceeding 200 (being the hazardous level), indicating the effect that bushfires can have on air quality.

### Background air quality

Air quality data sourced from monitoring stations at St Marys (about five kilometres to the north-west) and at Prospect (about nine kilometres to the east) are summarised in Table 8-51, which also provides the air quality impact assessment criterion for each pollutant specified in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (Environment Protection Authority, 2016).

Local daily particulate matter ($PM_{10}$ and $PM_{2.5}$) concentrations were occasionally measured above the relevant criterion. Concentrations and the frequency of exceedances were higher in 2019 compared with previous years, generally as a result of the 2019/20 Australian bushfires. Annually averaged $PM_{10}$ concentrations were measured below the Environmental Protection Authority's 25 $\mu g/m^3$ criterion at St Marys for all five years. At Prospect, the criterion was exceeded in 2019 with a key contributing factor also being the 2019/20 Australian bushfires. Annually averaged $PM_{2.5}$ concentrations were recorded above eight $\mu g/m^3$ (the specified criterion) at Prospect in 2015, 2016, 2018 and 2019, and at St Marys in 2019.

Nitrogen dioxide ($NO_2$), carbon monoxide (CO) and sulfur dioxide ($SO_2$) concentrations were measured well below the relevant criteria for all years reviewed at both stations.

Collectively, this data indicates that elevated background particulate matter concentrations represent the highest air quality risk at the setting around the proposal site.

Table 8-51: Background air quality data

| Pollutant | Averaging period | Criteria | St Marys | | | | | Prospect | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 |
| **$PM_{10}$ ($\mu g/m^3$)** | Maximum 24-hour | 50 $\mu g/m^3$ | **53**[1] | **100** | 50 | **101** | **160** | **69** | **110** | **61** | **113** | **183** |
| | 24-hour | Exceeded 50 $\mu g/m^3$ [2] | **1** | **3** | 0 | **2** | **25** | **1** | **4** | **2** | **8** | **24** |
| | Annual | 25 $\mu g/m^3$ | 15 | 16 | 16 | 19 | 24 | 18 | 19 | 19 | 22 | **26** |

| Pollutant | Averaging period | Criteria | St Marys | | | | | Prospect | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 |
| **$PM_{2.5}$ ($\mu g/m^3$)** | Maximum 24-hour | 25 $\mu g/m^3$ | - | 14 | 13 | 13 | **29** | **30** | **85** | **30** | **48** | **134** |
| | 24-hour | Exceeded 25 $\mu g/m^3$ [2] | - | **5** | **3** | **4** | **23** | **1** | **5** | **3** | **4** | **24** |
| | Annual | 8 $\mu g/m^3$ | - | 7.8 | 7 | 7.8 | **9.6** | **8.2** | **8.7** | 7.7 | 8.5 | **112** |
| **CO ($mg/m^3$)** | Maximum 1-hour | 30 $\mu g/m^3$ | - | - | - | - | - | 2 | 2 | 2 | 2 | 6 |
| | | 10 $\mu g/m^3$ | - | - | - | - | - | <1 | 2 | 1 | 1 | 3 |
| **$NO_2$ ($\mu g/m^3$)** | Maximum 1-hour | 246 $\mu g/m^3$ | 60 | 79 | 70 | 70 | 62 | 100 | 100 | 113 | 96 | 92 |
| | Annual | 62 $\mu g/m^3$ | 8 | 7 | 8 | 9 | 7 | 20 | 19 | 19 | 17 | 17 |
| **$SO_2$ ($\mu g/m^3$)** | Maximum 1-hour | 570 $\mu g/m^3$ | - | - | - | - | - | 71 | 55 | 60 | 66 | 55 |
| | Maximum 24-hour | 228 $\mu g/m^3$ | - | - | - | - | - | 8 | 10 | 26 | 13 | 11 |
| | Annual | 60 $\mu g/m^3$ | - | - | - | - | - | 3 | 3 | 3 | 3 | 3 |

*1 Exceedances of the relevant air quality impact assessment criteria are shown in bold.*
*2 Figures presented are the number of times the measurements have exceeded the 24-hour criteria*

A search of the National Pollutant Inventory (July 2020) identified the Wallgrove Asphalt Plant located about one kilometre north-east of the proposal site at Honeycomb Drive. The main activity of this facility relates to hot mix asphalt manufacturing. Key pollutants emitted by this facility include CO, $NO_2$, $SO_2$, $PM_{10}$, and $PM_{2.5}$, which contribute to the air quality conditions in the locality.

#### Sensitive receivers

Sensitive receivers are generally located some distance from the proposal site. Sensitive receivers considered relevant to the air quality assessment include the residential area of Erskine Park about 375 metres to the west and the commercial/industrial area of Eastern Creek about 800 metres to the south and east. The nearest receivers to the north are located more than 1.7 kilometres away in Minchinbury.

### 8.13.3 Potential impacts

#### Construction

Potential air quality impacts associated with construction of the proposal would be minor with the implementation of standard mitigation measures outlined in Section 8.13.4, which would include best-practice dust management, and measures to manage exhaust emissions and airborne hazardous materials.

Potential unmitigated air quality impacts arising from construction are summarised in Table 8-52.

Table 8-52: Potential air quality impacts during construction

| Potential impacts | Likelihood | Magnitude | Unmitigated risk rating |
|---|---|---|---|
| **Dust-related impacts** | Unlikely | Moderate | Medium |
| **Exhaust-related pollutants** | Very unlikely | Insignificant | Low |
| **Airborne hazardous materials** | Very unlikely | Major | Medium |

#### Dust-related impacts

Potential construction dust impacts would be temporary in nature and would be substantially reduced with the implementation of standard mitigation measures identified in Section 8.13.4.

Given the background air quality and relatively low occurrence of winds blowing in the direction of the nearest receivers at Erskine Park, dust-related impacts during construction would be 'unlikely'. Considering the intensity of activities and duration of works, the potential magnitude of dust emissions generated during construction would be 'moderate' without mitigation. Therefore, without mitigation, potential dust generated during construction would present a 'medium' risk, which would be reduced to 'low' with the implementation of mitigation measures outlined in Section 8.13.4.

Activities with the highest potential to result in the generation of dust during construction of the proposal would include clearing, earthworks, materials handling, storage and transport activities. The volume of dust generated during a typical work day would vary depending on the types of activities occurring at the proposal site, the prevailing weather conditions (e.g. dry windy conditions increase the potential for wind erosion) and controls that are implemented to reduce these emissions.

### Exhaust-related pollutants

Exhaust emissions generated during construction would be temporary and would not significantly contribute to emissions in the local area, given elevated background particulate matter concentrations in the locality. These emissions would be adequately managed by the implementation of mitigation measures outlined in Section 8.13.4. No long-term adverse impacts to air quality are anticipated.

Exhaust emissions would involve periodic localised emissions of pollutants such as particulate matter as $PM_{10}$ and $PM_{2.5}$, $NO_2$, CO and $SO_2$, from the combustion of diesel fuel and petrol.

Ambient air quality measurements for $NO_2$, CO and $SO_2$ are well below the Environmental Protection Authority criteria. Considering this, the distance to the nearest sensitive receivers and prevailing meteorological conditions outlined above, impacts in relation to these exhaust-related pollutants are 'very unlikely'. Considering the elevated background particulate matter concentrations in the locality and the magnitude of exhaust emissions from plant and equipment during construction, emissions from the proposal would be 'insignificant'. Therefore, exhaust emissions from construction plant and equipment represent an overall 'low' risk without mitigation.

### Airborne hazardous materials

The excavation and handling of potentially contaminated and/or hazardous material during construction can be managed to acceptable levels with the implementation of standard mitigation measures outlined in Section 8.13.4 and those in Section 8.10 (Contamination).

The likelihood of potential impacts associated with airborne hazardous materials from the excavation of contaminated and/or hazardous materials during construction would be 'very unlikely' due to the distance of the nearest receivers and the prevailing meteorological conditions. The magnitude of potential impacts associated with airborne hazardous materials from the excavation of contaminated and/or hazardous materials would be 'major' as they can result in medium-term impacts to receivers if not adequately managed. Airborne hazardous materials from the excavation of contaminated and/or hazardous materials therefore represents an overall 'medium' risk without mitigation, which would be reduced to 'low' with the implementation of mitigation measures outlined in Section 8.13.4.

## Operation

Potential air quality impacts associated with operation of the proposal would be low and manageable with the implementation of standard mitigation measures outlined in Section 8.13.4.

Potential air quality impacts from operation are summarised in Table 8-53. Airborne hazardous materials do not impose a risk during operation and therefore have not been considered as part of the operational assessment.

Table 8-53: Potential air quality impacts during operation

| Potential impacts | Likelihood | Magnitude | Unmitigated risk rating |
|---|---|---|---|
| **Dust-related impacts** | Unlikely | Minor | Low |
| **Exhaust-related pollutants** | Very unlikely | Insignificant | Low |

### Dust-related impacts

Potential dust impacts associated with operation would be readily manageable using standard mitigation measures. During operation, key dust generating processes such as concrete batching would be fully enclosed within the facility. Internal roads and most of the proposal site would be sealed.

Dust may still be generated from bulk materials stored on hardstand areas and tracked materials along sealed areas. Although these sources would be ongoing for the duration of operation, it is expected that they would generate emissions at a significantly lower intensity than activities during construction. Consequently, the potential magnitude of dust emissions generated during operations would be 'minor'.

Considering the likelihood of impacts is considered 'unlikely' (as established for construction), the potential dust-related impacts during operation would represent a 'low' risk without mitigation. This potential risk would be further reduced and adequately managed by the implementation of mitigation measures outlined in Section 8.13.4.

#### Exhaust-related pollutants

Similarly to the construction phase, the likelihood and consequence of exhaust-related pollutants would be 'very unlikely' and 'insignificant' respectively. Therefore, the potential risk without mitigation would be 'low' and would be adequately managed by the implementation of mitigation measures outlined in Section 8.13.4.

### 8.13.4 Management and mitigation measures

Potential air quality impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework. The framework includes the following air quality management objectives to:

- Minimise gaseous and particulate pollutant emissions from construction activities as far as feasible and reasonable
- Identify and control potential dust and air pollutant sources.

The management and mitigation measures that would be implemented to address the air quality risks determined during construction and operation of the proposal are listed in Table 8-54.

Table 8-54: Management and mitigation measures – air quality

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **AQ1** | Dust impacts during construction | The following best-practice dust management measures would be implemented during construction works:<br>• Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather<br>• Adjust the intensity of activities based on measures and observed dust levels and weather forecasts<br>• Minimise the amount of materials stockpiled and position stockpiles away from surrounding receivers<br>• Regularly inspect dust emissions and apply additional controls as required. |
| **AQ2** | Dust impacts during operation | The following best-practice dust management measures would be implemented during operation:<br>• Ensure that loads are covered and that haulage vehicles are cleaned to remove any loose debris before leaving the site<br>• Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather<br>• Position long-term stockpiles away from surrounding receivers<br>• Regularly inspect and where necessary clean sealed haulage roads to remove tracked materials. |
| **AQ3** | Exhaust emissions during construction and operation | Plant and equipment would be maintained in a proper and efficient manner. Visual inspections of emissions from plant would be carried out as part of pre-acceptance checks. |
| **AQ4** | Airborne hazardous materials uncovered during construction | The following best-practice measures would be implemented to manage airborne hazardous materials during construction:<br>• Temporary coverings or odour supressing agents would be applied to excavated areas where appropriate<br>• Removal and disposal of hazardous materials would be undertaken in accordance with the relevant requirements in the *Work Health and Safety Act 2011*, Work Health and Safety Regulation 2017 and any applicable guidelines. |

## 8.14 Bushfire

A bushfire risk assessment has been prepared for the proposal. This assessment is attached as Appendix J (Bushfire Risk Assessment) of this REF. The methodology and results of this assessment are summarised in this section.

### 8.14.1 Methodology

The bushfire risk assessment involved:

- Reviewing the existing environment within and surrounding the proposal site, including topography and vegetation
- Undertaking an external inspection from publicly accessible areas surrounding the proposal site on 4 May 2020
- Reviewing aerial mapping relevant for bushfire analysis
- Reviewing and applying the relevant legislative requirements, policies, and guidelines to assess potential bushfire risks and impacts of the proposal
- Identifying management and mitigation measures to be implemented as part of the proposal to reduce bushfire risk.

**Policy and guidelines**

#### Planning for Bush Fire Protection 2019

Planning for Bush Fire Protection 2019 (PFBP 2019) establishes the regulatory framework for development within bushfire prone land and relevant bushfire protection measures.

The proposal is considered as 'other development' under the PFBP 2019. 'Other development' includes industrial and infrastructure development, which must satisfy the aim and objectives of PFBP 2019.

PFBP 2019 identifies the methodology to determine and assess bushfire risks. This includes identification of the Bushfire Attack Level (BAL), which is a means of measuring the severity of a building or structure's potential exposure to ember attack, radiant heat and direct flame contact. Identification of BAL involves consideration of fire weather, vegetation and slope. Further details relating to the PFBP 2019 methodology are provided in Appendix J (Bushfire Risk Assessment).

#### Australian Standards for Construction of Buildings in Bushfire Prone Areas (AS3959)

Within the Australian Standards for Construction of Buildings in Bushfire Prone Areas (AS3959), BAL is applied in combination with bushfire attack mechanisms to establish the construction requirements to improve protection of building elements and to understand the radiant heat exposures for people outside in open areas.

The BAL determines the vulnerability of assets and mitigation strategies that can be utilised to reduce the bushfire threat. In this regard, PFBP 2019 requires a maximum BAL of 40 for any proposed industrial development, including appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings. BAL levels associated radiant heat flux and predicted bushfire attack mechanisms are outlined in Table 8-55.

Table 8-55: Bushfire attack levels (AS3959)

| Bushfire Attack Level (BAL) | Radiant Heat Flux exposure ($kWm^2$)[1] | Description of predicted bushfire attack and levels of exposure |
|---|---|---|
| **BAL – Low** | NA | There is insufficient risk to warrant specific construction requirements. |
| **BAL – 12.5** | <12.5$kWm^2$ | Ember attack. |
| **BAL – 19** | >12.5$kWm^2$ – <19$kWm^2$ | Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux. |
| **BAL – 29** | >19$kWm^2$ – <29$kWm^2$ | Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux. |
| **BAL – 40** | >29$kWm^2$ – <40$kWm^2$ | Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux with the increased likelihood of exposure to flames. |
| **BAL – Flame Zone** | >40$kWm^2$ | Direct exposure to flames from the fire front in addition to radiant heat flux and ember attack. |

*1 $kWm^2$ – Kilowatts per square metre*

### NSW Rural Fire Service Guideline for Bushfire Prone Land Mapping

The NSW Rural Fire Service (RFS) Guideline for Bushfire Prone Land Mapping (RFS, 2015) establishes the methodology for categorising bushfire prone land. Vegetation buffers are a requirement of the vegetation category provided (e.g. the higher the risk associated with the vegetation type, the larger the vegetation buffer). The vegetation categories and buffer requirements include:

- **Category 1 (High)** – Land considered to be at the highest risk for bushfire and surrounded by a 100-metre buffer
- **Category 2 (Low)** – Land considered to be a lower bush fire risk than Category 1 and Category 3 but higher than the excluded areas. It is surrounded by a 30-metre buffer
- **Category 3 (Medium)** – Land considered to be at a medium risk for bushfire and surrounded by a 30-metre buffer.

## 8.14.2 Existing environment

The north-western portion of the proposal site (about 1,157 square metres) is located within the 100 metre Category 1 vegetation buffer identified as bushfire prone land by Blacktown City Council and Penrith City Council. Other areas of the proposal site are not within areas designated as bushfire prone land. The bushfire prone land map for the proposal is shown in Figure 8-34. The land to the west of the proposal site is identified as bushfire prone land and comprises a mix of vegetation, with the majority being dry sclerophyll forest, woodland, and grassland. Vegetation surrounding the Ropes Creek corridor and the grasslands that extend beyond the proposal site are not managed (not maintained to limit the spread and impacts of bushfire) and fall into the designation of Category 3 land.

The Forest Fire Danger Index measures the degree of danger of fire in Australian vegetation. This index combines a record of dryness, based on rainfall and evaporation, with meteorological variables for wind speed, temperature, and humidity. The scale of Forest Fire Danger Index ranges between 0 and 100. Most of NSW is determined as 80, however a number of areas, including Greater Sydney, Greater Hunter, Illawarra, Far South Coast and Southern Ranges Fire Areas have a higher Forest Fire Danger Index which are set at 100 by PBP 2019. The Forest Fire Danger Index applicable to the Blacktown LGA (and therefore the proposal site) is 100, meaning that the danger of fire in vegetation is considered high.

The Cumberland Zone Bush Fire Risk Management Plan 2010 (Cumberland Zone Bushfire Management Committee, 2010) identifies the prevailing weather conditions associated with the bushfire season, and the main sources of ignition in the Cumberland Zone area in which the proposal site is located. The Cumberland Zone area has on average over 450 bush and grass fires per year, of which only a few are considered to be major fires. The Ropes Creek area (which is located to the west of the proposal site) has been identified as an area known for deliberately lit fires associated with areas of bushland around and within built up areas.

The topography (effective slope) combined with vegetation formation (bushfire fuels) may create bushfire threats within an area designated as bushfire prone. The topography to the west of the proposal site has a gentle downslope to Ropes Creek between 1.14 and 4.57 degrees. Similar gentle slopes have been identified to the north of the proposal site. Slopes to the east of the proposal site are steeper upslope and away from the proposal site, ranging from 3.43 – 5.7 degrees. Slopes within the proposal site are generally flat with some areas of gentle gradients. These areas would be developed as part of the proposal and therefore are not considered in the assessment of bushfire threat.

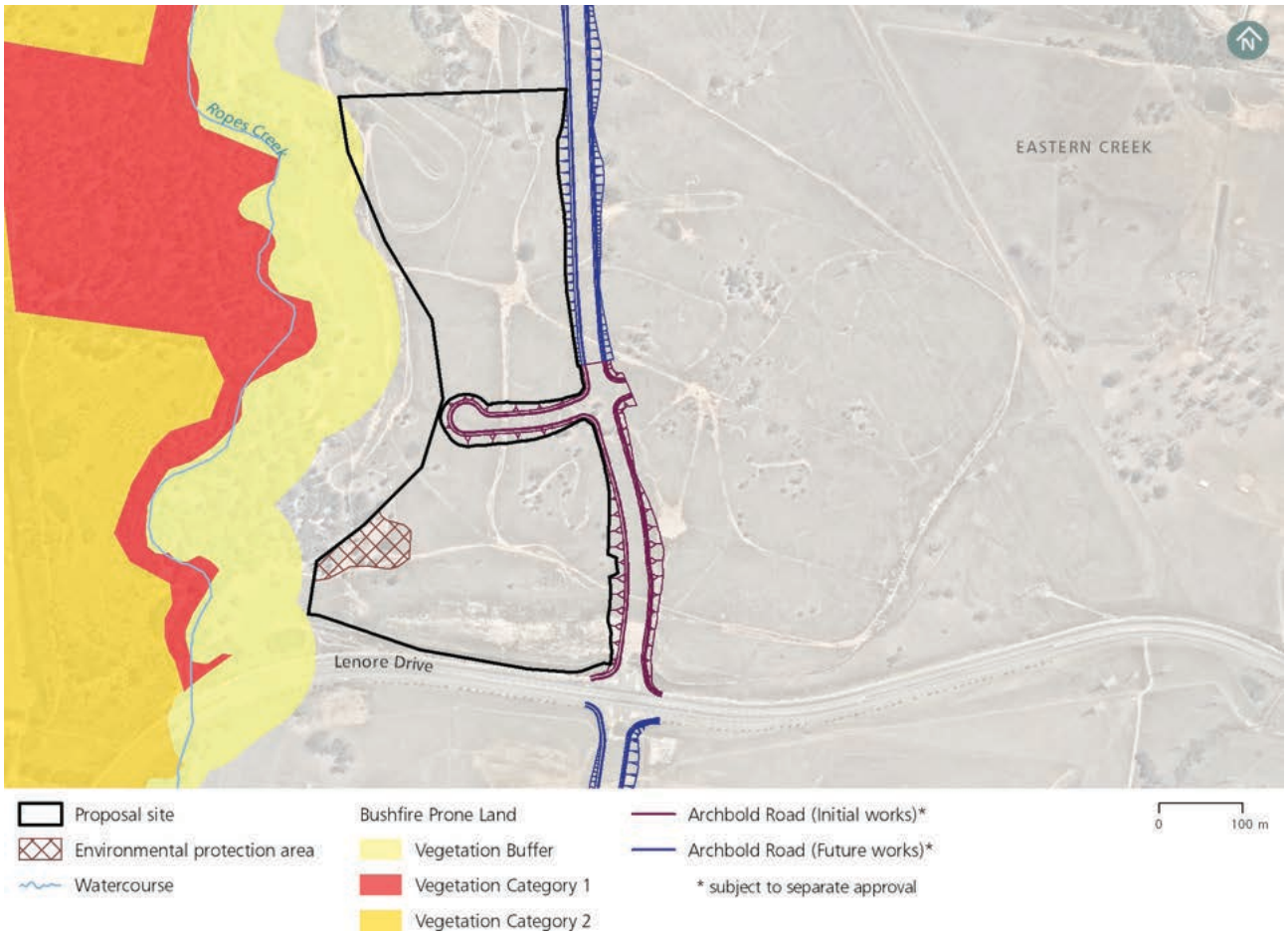


Figure 8-34: Bushfire prone land map

## 8.14.3 Potential impacts

### Bushfire attack levels

Bushfire risk to the proposal site would be appropriately managed through the implementation of management and mitigation measures (as described in Section 8.14.4). These include the establishment of Asset Protection Zones (APZs) around the proposal site, as well as measures to provide safe emergency access and egress, adequate water supply on the proposal site and emergency management and evacuation plans.

The BAL has been established based on the proposal site boundary, and takes into account that all vegetation within the proposal site would be cleared (with the exception of the environmental protection area in the south-west of the proposal site which would be retained). Key assets within the proposal site, such as the office buildings and parts of the sheds have been assessed as having a BAL of 12.5 (refer to Figure 8-35).

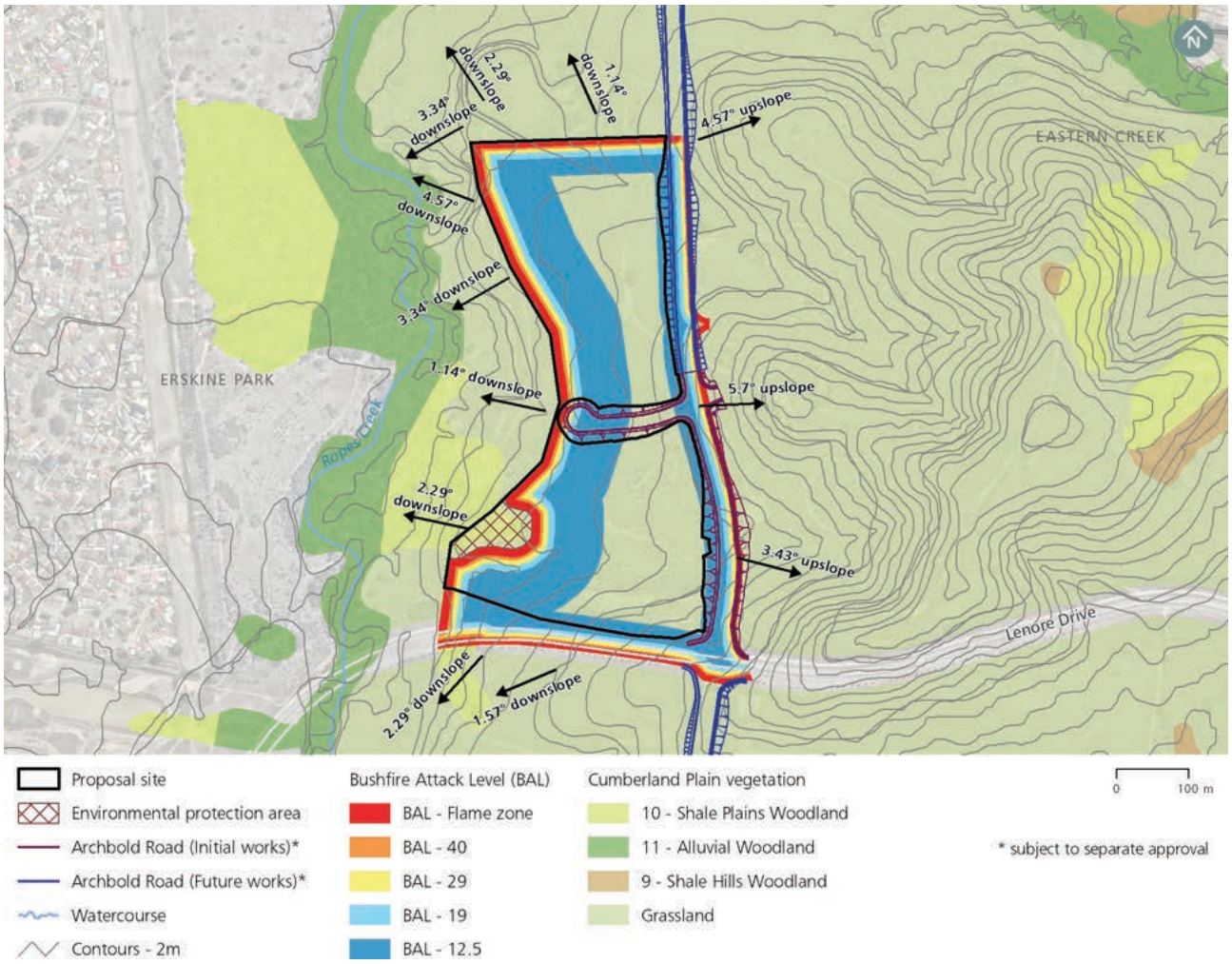


Figure 8-35: Bushfire attack levels for the proposal

### Asset protection zones

An APZ provides a fuel-reduced, physical separation between buildings and bushfire hazards. APZs comprise a key element in the suite of bushfire protection measures and dictate the type of construction required to mitigate the risk of bushfire.

To manage the bushfire risk of the proposal site, minimum APZs would be established to prevent the spread of a fire towards the proposal site (Figure 8-36). APZ widths for the proposal site have been determined in accordance with PBP 2019. In particular, access roads, carparks, hardstand areas and laydown areas are all non-combustible and would effectively operate as APZs, meeting the requirements established in the RFS document Standards for Asset Protection Zones (Standards for APZ).

APZs have been established based on potential bushfire hazards identified within the proposal site and surrounds. These APZs are in addition to the internal APZs established by the arrangement of the site infrastructure. The APZs provide maximum bushfire protection opportunities to the proposal.

As shown in Figure 8-36, APZs would be implemented based on the following:

- **APZ (10 metres)** – located outside the eastern boundary of the proposal site, adjacent to the planned Archbold Road upgrade and extension, where there is a lower risk for bushfire
- **APZ (12 metres)** – located adjacent to Lenore Drive (outside the south boundary of the proposal site), and the dam and grassland (north of the proposal site) where there is medium risk for bushfire
- **APZ (16 metres)** – located at the western boundary of the proposal site, adjacent to the riparian vegetation along Ropes Creek and the environmental protection area at the south-western portion of the proposal site where there is a higher risk for bushfire. However, hardstand and laydown areas in the western boundary of the proposal site would effectively operate as APZs to the Ropes Creek vegetation as these are non-combustible.

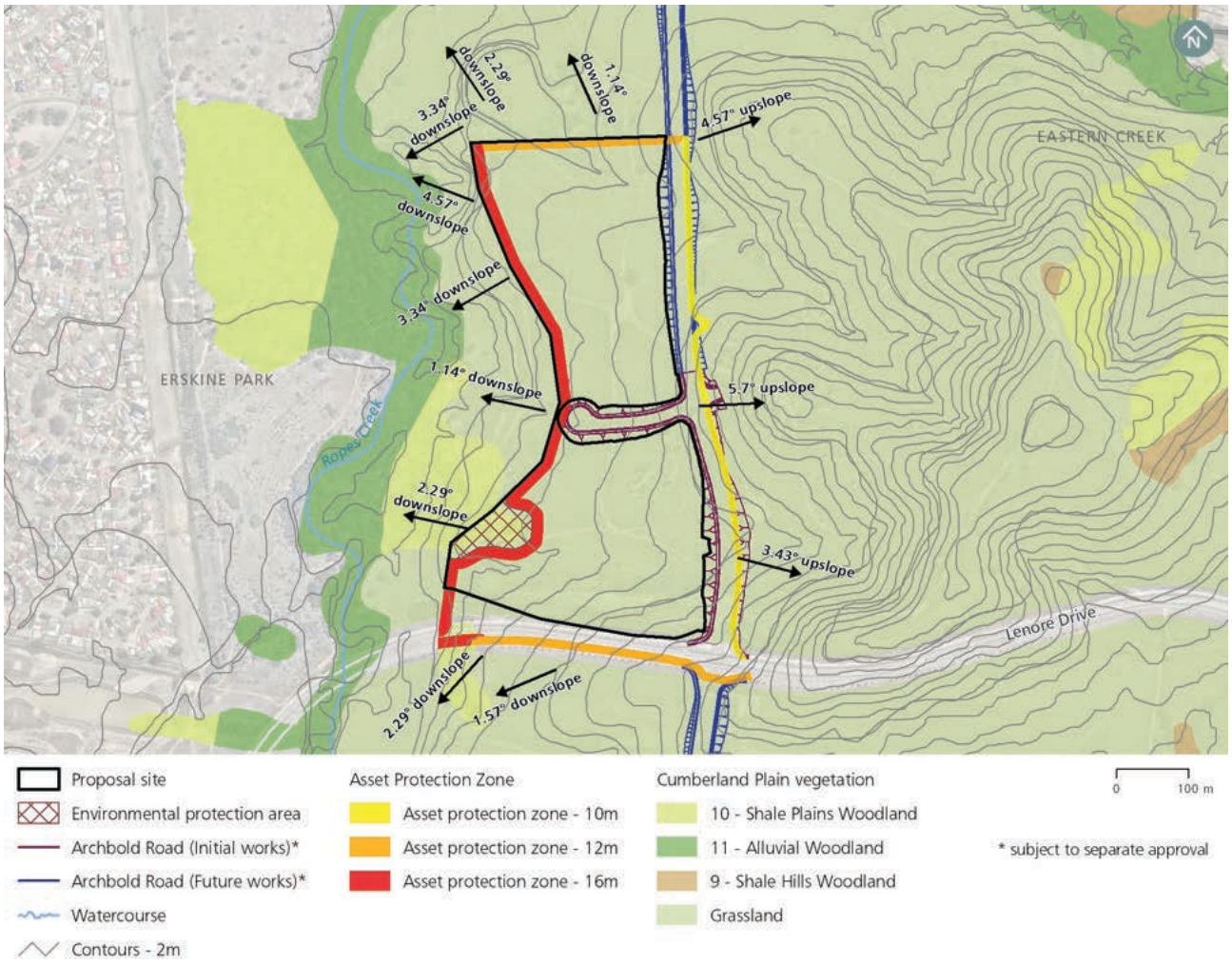


Figure 8-36: Asset protection zones for the proposal

### 8.14.4 Management and mitigation measures

The management and mitigation measures that would be implemented to address potential bushfire impacts are listed in Table 8-56.

Table 8-56: Management and mitigation measures – bushfire

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **BF1** | Bushfire protection measures | The proposal site would be managed as an Asset Protection Zone (APZ). The entire proposal site would be managed as an APZ as outlined within Appendix 4 of 'Planning for Bush Fire Protection 2019' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. The APZ would not extend into the environmental protection area in the south-west of the site. |
| **BF2** | Bushfire protection measures | Vulnerable buildings and/or critical assets would be constructed to appropriate BAL in accordance with the Australian Standard for the Construction of Buildings in Bushfire Prone Areas (AS3959). |
| **BF3** | Bushfire protection measures | The following measures would be implemented for access roads within the proposal site:<br>• Access roads would be two-wheel drive, all-weather roads<br>• Minimum 5.5 metre carriageway width kerb to kerb<br>• Maximum grades for sealed roads would not exceed 15 degrees and an average grade of not more than 10 degrees, or other gradient specified by road design standards, whichever is the lesser gradient<br>• Curves of roads would have a minimum inner radius of 6 metres<br>• Dead end roads would incorporate a minimum 12 metre outer radius turning circle, and would be clearly sign posted as a dead end<br>• A minimum vertical clearance of 4 metres would be provided to any overhanging obstructions, including tree branches. |
| **BF4** | Bushfire protection measures | The following water supply and utilities would be installed during construction and maintained during operation of the proposal:<br>• A minimum static water supply of 20,000 litres for firefighting purposes. The firefighting water can be available in a single tank or a number of tanks around the proposal site<br>• A hardened ground surface for truck access up to and within 4 metres of the water source<br>• A 65 millimetre metal Storz outlet with a gate or ball valve would be provided as an outlet on each of the tanks<br>• If the water tank is located above ground it would be of a non-combustible material<br>• If the water tank is located underground, it would have an access hole of 200 millimetres to allow tankers to refill direct from the tank.<br>• All associated fittings to the tank would be non-combustible. |
| **BF5** | Bushfire protection measures | Bushfire Emergency Management and Evacuation Plans would be developed for the construction and operation of the proposal. The bushfire evacuation procedures would be completed in accordance with NSW Rural Fire Service Guide to Developing A Bushfire Emergency Management Plan and meet the requirements of Australian Standard AS 3745-2010 – Planning for Emergencies in facilities. |
| **BF6** | Bushfire protection measures | Activities that generate sparks or excessive heat would be minimised when a total fire ban is declared by Rural Fire Service. |

## 8.15 Sustainability, climate change and greenhouse gases

### 8.15.1 Sustainability overview

The National Strategy for Ecologically Sustainable Development (Department of Environment and Heritage, 1992) defines Ecologically Sustainable Development (ESD) as "using, conserving and enhancing the community's resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased". The concept of ESD gives formal recognition to environmental and social considerations in decision-making to ensure that current and future generations enjoy an environment that functions as well as, or better than, the environment they inherit. Consideration of the proposal against the principles of ESD are detailed in Chapter 10 (Justification and conclusion).

An overview of the key documents which set the approach to sustainability for the proposal is provided below.

#### Sydney Metro West Sustainability Plan

A Sydney Metro West Sustainability Plan is being developed to set out the sustainability principles, objectives and initiatives including performance targets and outcomes which would be adopted from planning, procurement, design, construction and operations to end-of-life. This encompasses all three aspects of sustainability – environmental, social and economic.

Six principles have been developed to govern environmental and socio-economic outcomes and performance for Sydney Metro West. The principles are set out in Figure 8-37.


Figure 8-37: Sustainability principles and objectives

Targets and initiatives have been developed to support the sustainability principles for Sydney Metro West. The following initiatives would be of particular relevance to the proposal:

- Set and implement targets for the use of non-potable water in concrete
- Identify and implement opportunities for treatment and reuse on the proposal, including water from concrete batching and casting facilities
- Minimise the embodied impacts of concrete through the adoption of project-wide supplementary cementitious materials use target
- Minimise the embodied impacts of steel through maximising the use of recycled steel and steel produced using energy-reducing processes.

### 8.15.2 Climate change and greenhouse gases

The proposal's contribution to NSW's greenhouse gas emissions and the known effects of climate change has been considered in the following sections.

Consistent with the principle of 'tackle climate change' in the Sydney Metro West Sustainability Plan, the following initiatives are applicable to the proposal and would be implemented accordingly:

- Identify opportunities to reduce energy use and carbon emissions
- Reduce embodied carbon and increase use of recycled materials
- Establish energy efficiency and renewable energy/offset targets.

#### Greenhouse gas emissions

The volume of greenhouse gas emissions generated during construction of the proposal would be relatively minor. While it would not be possible to completely mitigate the generation of greenhouse gas emissions during construction (due to the need to consume energy and resources), the amount of emissions would be minimised through the implementation of the Sydney Metro West Sustainability Plan.

Potential greenhouse gas emissions would result from the following activities:

- Construction traffic and equipment emissions
- Emissions generated in producing construction materials (embodied energy)
- Electricity-generated emissions in response to the power requirements to service the proposal
- Upstream and downstream lifecycle emissions (e.g. fuel extraction, processing, production, transport, disposal) including emissions at the construction compounds/ laydown areas
- Emissions resulting from the decomposition of cleared vegetation.

Operational greenhouse gas emissions associated with the proposal would predominantly be attributed to vehicular movements, electrical consumption to power equipment and machinery, and embodied energy in materials.

#### Climate change risks

Climate change could have potential direct and indirect impacts in Greater Sydney and more specifically to the proposal. The types of potential climate change risks during construction and operation of the proposal would be associated with severe weather events, such as the increased frequency and severity of rainfall events placing increased pressure on erosion and sediment control measures and/or resulting in the flooding of the proposal site and surrounds. Potential climate change risks can be appropriately managed through the implementation of mitigation measures including erosion and sediment controls (refer to Section 8.8 (Soils and surface water quality)) and flooding measures (refer to Section 8.7 (Flooding)).

### 8.15.3 Management and mitigation measures

The proposal would be delivered under Sydney Metro's Construction Environmental Management Framework and the Sydney Metro West Sustainability Plan (given that the proposal would support the construction of Sydney Metro West) reflecting the scope and potential impacts as appropriate.

The Construction Environmental Management Framework provides the basis for the development and implementation of a design and/or construction sustainability measures. The framework provides minimum requirements for matters such as carbon and energy management, and waste management and recycling.

The management and mitigation measures that would be implemented to manage climate change and reduce greenhouse gas emissions are listed in Table 8-57.

Table 8-57: Climate change and greenhouse gases safeguards and management measures

| No. | Impact | Environmental management and mitigation measures |
|---|---|---|
| **SCC1** | Sustainability implementation | Sustainability initiatives would be incorporated into the detailed design and construction to support the achievement of the Sydney Metro West sustainability objectives. |
| **SCC2** | Sustainability implementation | Best practice level of performance would be achieved using market leading sustainability rating tools during construction and operation. |
| **SCC3** | Greenhouse gas emissions | 25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction and operation of the proposal would be offset. |
| **SCC4** | Greenhouse gas emissions | An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a baseline inventory calculated at the detailed design stage. |
| **SCC5** | Climate change risks | Climate change risk treatments would be confirmed and incorporated into the detailed design. |

## 8.16 Cumulative impacts

This section provides an assessment of the cumulative impacts associated with the proposal.

Cumulative impacts can occur when impacts from a project interact or overlap with impacts from other projects, and can potentially result in a larger overall effect on the environment, businesses or local communities. Cumulative impacts may occur when projects are constructed or operated concurrently or consecutively. Projects constructed consecutively (or sequentially) can have construction activities occurring over extended periods of time with little or no break in construction activities. This has the potential for increased impacts and construction fatigue for local communities.

### 8.16.1 Methodology

The assessment methodology for the cumulative impact assessment for the project involved:

- Developing screening criteria that would be used to determine whether a project should be assessed for cumulative impacts
- Identifying projects that could potentially result in cumulative impacts during construction and operation of the proposal
- Applying the screening criteria to determine which projects should be taken forward to the cumulative impact assessment
- Identifying potential impacts of the above projects, where known
- Assessing whether the impacts of the proposal would combine with the impacts of these projects to create a cumulative effect
- Assessing whether management and mitigation measures considered in this REF would be sufficient to manage impacts, or need modifying or supplementing.

**Screening criteria**

Screening criteria were developed as shown in Table 8-58 and applied to determine whether a project or local strategic plan should be included in the cumulative impact assessment.

Table 8-58: Cumulative impact assessment criteria

| Criteria | Triggers |
|---|---|
| **Location**<br>**A project was considered relevant for consideration where the project met one of the triggers** | Direct overlap: construction footprints intersect with the proposal |
| | In the area: within one kilometre of the proposal construction footprint |
| **Timeframe**<br>**A project was considered relevant where the project met one of the triggers** | Concurrent construction programs |
| | Consecutive construction programs (less than 18 months between the proposal and the projects construction programs) |
| **Status**<br>**A project was considered relevant where the project was at one of the following stages of the statutory assessment and approval process** | Approved projects (statutory approvals received), including approved projects that have not started construction, projects currently under construction, and recently completed projects |
| | Proposed projects (currently under statutory environmental impact assessment which includes where an application has been lodged) |
| | Local strategic plans (made public by the relevant government agency) |
| **Scale of potential impact**<br>**A project was considered relevant where the project involved substantial impacts to one or more of the following** | • Noise and vibration<br>• Traffic and transport<br>• Heritage<br>• Flooding<br>• Surface water<br>• Soils, geology and contamination<br>• Biodiversity. |

#### Identification of projects

Projects that satisfied at least one of the triggers in each of the screening criteria (location, timeframe, status and scale of potential impact) in Table 8-57 were included in the cumulative impact assessment.

The projects assessed as part of the consideration of cumulative impacts of the proposal are provided in Section 8.16.2.

#### Approach to potential cumulative impact assessment

Potential cumulative impacts have been considered for assessment based on the likely interactions of the proposal with other existing development and other reasonably foreseeable future development that was identified. The assessment of cumulative impacts has considered potential environmental impacts identified in Chapter 8 (Environmental impact assessment) of this REF. Based on analysis of the timing and aspects of the projects, the potential environmental impacts were identified. Only those impacts which are relevant to the interaction of the proposal and the identified projects were assessed.

### 8.16.2 Potential impacts

Projects considered as part of the cumulative impact assessment are provided in Table 8-59 and depicted in Figure 8-38.

Table 8-59: Projects assessed as part of the cumulative impact assessment

| Project name, proponent, status and expected construction period | Description |
|---|---|
| **Projects** | |
| **Archbold Road Upgrade and Extension (Transport for NSW)**<br>***Determined***<br>**Stage 1: Early-2021 to mid-2022** | REF for the upgrade and extension of Archbold Road between the Great Western Highway, Minchinbury and Old Wallgrove Road, Eastern Creek. Once complete, Archbold Road would be a key north-south route providing access to the WSEA.<br>The first stage of the planned Archbold Road upgrade and extension would provide access to the proposal site from Lenore Drive, via a new section of Archbold Road and the Western Access Road. As part of these works an Archbold Road Upgrade and Extension Addendum REF has been prepared to assess design changes to this section of road and include construction of a Western Access Road between the northern and southern precast sites. Further extensions of Archbold Road would be completed at a later stage.<br>The project is located next to the proposal site. It is expected that the first stage of the planned Archbold Road upgrade and extension would involve consecutive and concurrent construction with construction of the proposal. |
| **Eastern Creek Resource Recovery Facility (Hanson Construction Materials Pty Ltd) (SSD-9774)**<br>***Proposed***<br>**No construction program** | Construction and operation of a resource recovery facility comprising:<br>• A concrete recycling plant with a processing capacity of 100,000 tonnes per year<br>• A material storage depot with a capacity of 36,000 tonnes per year.<br>The project is located on Honeycomb Drive, about one kilometre east of the proposal site. There is no proposed construction program. In the event that an overlap of these projects did occur there may be some cumulative traffic impacts. Given that the proposal is anticipated to have a negligible impact on the operation of the surrounding road network, any potential cumulative traffic impacts would be relatively minor. Cumulative amenity related impacts such as noise and air quality would be unlikely as the proposal would have negligible impacts to receivers to the east which could be impacted by the resource recovery facility.<br>As there is no information readily available for the project it has not been considered further. |

| Project name, proponent, status and expected construction period | Description |
|---|---|
| **Extension of Honeycomb Drive (Archbold Road connection) (IRM Property Group (No 2) Pty Ltd)**<br>***Proposed***<br>**No construction program** | Development Application (DA-19-01184) for the construction of a new precinct road (the extension of Honeycomb Drive in the east to connect to Archbold Road extension in the west). Includes the subdivision of lot 1 and 2 of DP 1145808 to create 4 industrial Torrens title lots and associated works.<br>The project is located on Honeycomb Drive, within one kilometre of the proposal site. There is no proposed construction program. In the event that an overlap of these projects did occur there may be some cumulative amenity related impacts such as traffic, noise and air quality. These are anticipated to be relatively minor considering the minor nature of impacts from the proposal.<br>As there is no information readily available for the project it has not been considered further. |
| **Local strategies and plans** | |
| **Ropes Creek Precinct Draft Development Control Plan DCP**<br>***Proposed*** | A Draft DCP is currently being finalised for the Ropes Creek Precinct. The aim of this Draft DCP is to ensure the orderly and efficient development of the Ropes Creek Precinct as envisaged by the WSEA SEPP.<br>The Draft DCP includes the following development controls relevant to the proposal:<br>• Built form and streetscape amenity<br>• Subdivision requirements<br>• Landscape design<br>• Traffic, parking and access<br>• Infrastructure services<br>• Environmental management.<br>The DCP has been considered in the cumulative impact assessment as the proposal is located within land included in this DCP. Development controls relevant to the proposal are discussed in Chapter 4 (Statutory and planning considerations). |
| **Blacktown Local Strategic Planning Statement 2020**<br>**20-year land use vision for Blacktown City** | The Blacktown LSPS provides a 20-year land use vision for Blacktown City, and directs how future growth and change will be managed. The Blacktown LSPS supports growing targeted industry sectors and maximising opportunities to attract advanced manufacturing in industrial land. The proposal would utilise land for industrial services while providing employment opportunities. The proposal is located within the 'Mount Druitt' Precinct identified in the LSPS.<br>Planning priorities and actions relevant to the proposal are discussed in Chapter 2 (Need for the proposal). While the proposal is consistent with the LSPS, the strategy is a high level document and therefore is not relevant to consider further in the cumulative impact assessment. |

There is potential for cumulative environmental impacts between the proposal and projects listed in Table 8-58, particularly in relation to noise, traffic, heritage, flooding and biodiversity impacts. No cumulative impacts are anticipated from other environmental aspects including landscape and visual amenity, land-use, property and socio-economic, soils and surface water, groundwater, contamination, waste, air quality, bushfire, climate change and greenhouse gases. Whilst not all environmental impacts associated with these projects are known at this stage, likely cumulative impacts have been assessed below. Further detailed construction planning and co-ordination with stakeholders would be undertaken to manage potential cumulative impacts.

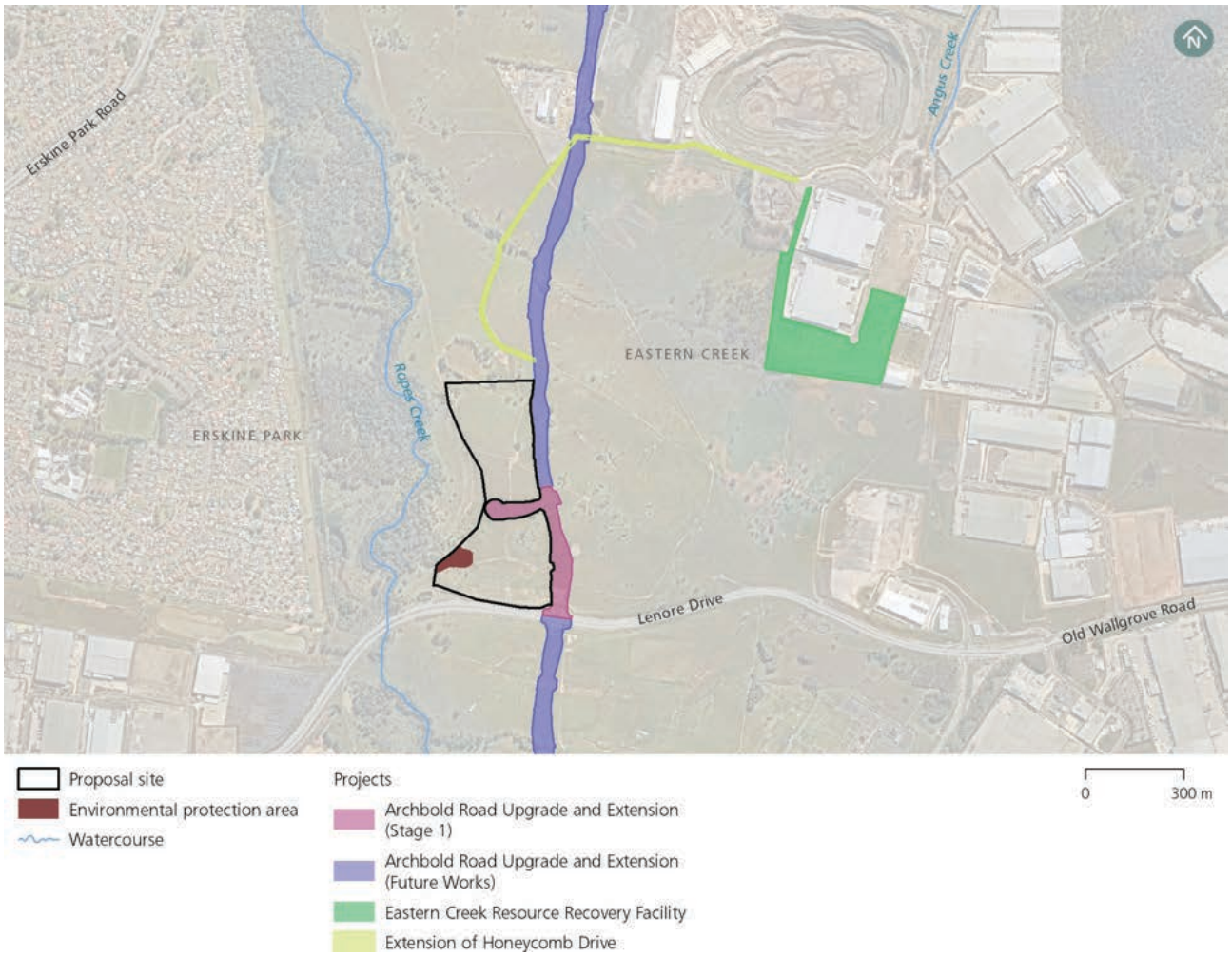


Figure 8-38: Nearby projects

### Noise and vibration

The proposal and the planned Archbold Road upgrade and extension are not expected to generate significant cumulative noise and vibration impacts.

The first stage of the planned Archbold Road upgrade and extension would be under construction at the same time as the construction of the proposal, which could lead to concurrent noise impacts. The Archbold Road Upgrade - Operational traffic noise and construction noise and vibration assessment (WSP Parsons Brinckerhoff, 2017a) identified that residents in Erskine Park would be affected for short periods during certain noise intensive construction activities. No operational noise exceedances are predicted for residents in Erskine Park.

As discussed in Chapter 8.1 (Noise and vibration), the predicted construction noise levels for the proposal would only result in 'minor' worst-case daytime impacts at receivers potentially affected by both the Archbold Road upgrade and extension and the proposal (residents in Erskine Park). These potential impacts would only occur for a relatively short duration of the proposed construction works (less than three months), typically at the start of site clearing works. At other times, noise levels are predicted to be compliant at all receivers.

The likelihood of worst-case construction noise levels being generated by both projects at the same time is, however, considered low. Rather than increasing construction noise levels, the expected impact of concurrent works in this area would generally be an increase in the duration and potential annoyance of noise impacts at the nearest receivers. To manage this risk, co-ordination and consultation with Transport for NSW would occur where required to manage the interface of these projects (refer to Section 8.16.3).

Compliance with noise criteria is predicted at all receivers during the operation of the proposal. As such, cumulative operational noise impacts from concurrent traffic generated from the planned Archbold Road upgrade and extension and the proposal would be negligible.

### Traffic and transport

The first stage of the planned Archbold Road upgrade and extension would be under construction at the same time as the construction of the proposal, however construction traffic impacts for both the proposal and the planned Archbold Road upgrade and extension are anticipated to be minimal. As such, cumulative construction traffic impacts are expected to be minor. Other projects are not expected to be under construction or would not significantly overlap with the proposal in the assessed peak construction year (2022).

Modelling results for the proposal indicate that the operation of the proposal, in isolation when compared to existing conditions, would have a negligible impact on intersection performance. As such, cumulative operational traffic impacts due to other projects are expected to be minor. Furthermore, as the operational life of the proposal would be about four to five years, any cumulative operational traffic impacts would be limited.

### Aboriginal heritage

A cumulative impact to Aboriginal heritage takes into consideration incremental impacts to Aboriginal cultural heritage values resulting from past, present and foreseeable future actions in a particular area or region.

An ACHAR has been undertaken by Kelleher Nightingale (2017) for the planned Archbold Road upgrade and extension. The Aboriginal heritage study area for Archbold Road is outlined in Figure 8-39 and shows an overlap with the eastern portion with the Aboriginal heritage study area for the proposal.

The targeted site investigations undertaken as part of the ACHAR found that the planned Archbold Road upgrade and extension would directly impact on ten Aboriginal heritage sites (one of which overlaps with the proposal site). Six of these Aboriginal heritage sites were covered by existing/pending AHIPs at the time of the assessment (2017), allowing for their recording and removal. The four remaining Aboriginal heritage sites would result in partial or total loss as a result of the development, which include one isolated artefact and three artefact scatter sites.

As discussed in Section 8.5 (Aboriginal heritage), construction of the proposal would result in the partial or total loss of ten identified Aboriginal sites. One Aboriginal site (AIF-06 (AHIMS ID 45-5-4599)) is located within the boundary of both the proposal site and the planned Archbold Road upgrade and extension boundary. It is assumed the Aboriginal site would be directly impacted by the planned Archbold Road upgrade and extension.

Sydney Metro would work with Transport for NSW to ensure impacts to Aboriginal heritage are managed and minimised where possible. Construction on the proposal site and the planned Archbold Road upgrade and extension footprint would impact on fifteen identified Aboriginal heritage sites in total, reducing the Aboriginal archaeological potential and values of the region. Archaeological test excavation (and salvage when required) would be undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW (2010). Once test excavation is completed, an application for an area based AHIP would be submitted to the NSW DPC for those portions of the study area with Aboriginal sites and PADs subject to impacts. Given the overlapping study areas and impacts to Aboriginal sites, Sydney Metro and other relevant parts of Transport for NSW would coordinate any future ACHAR(s) and AHIP application(s).

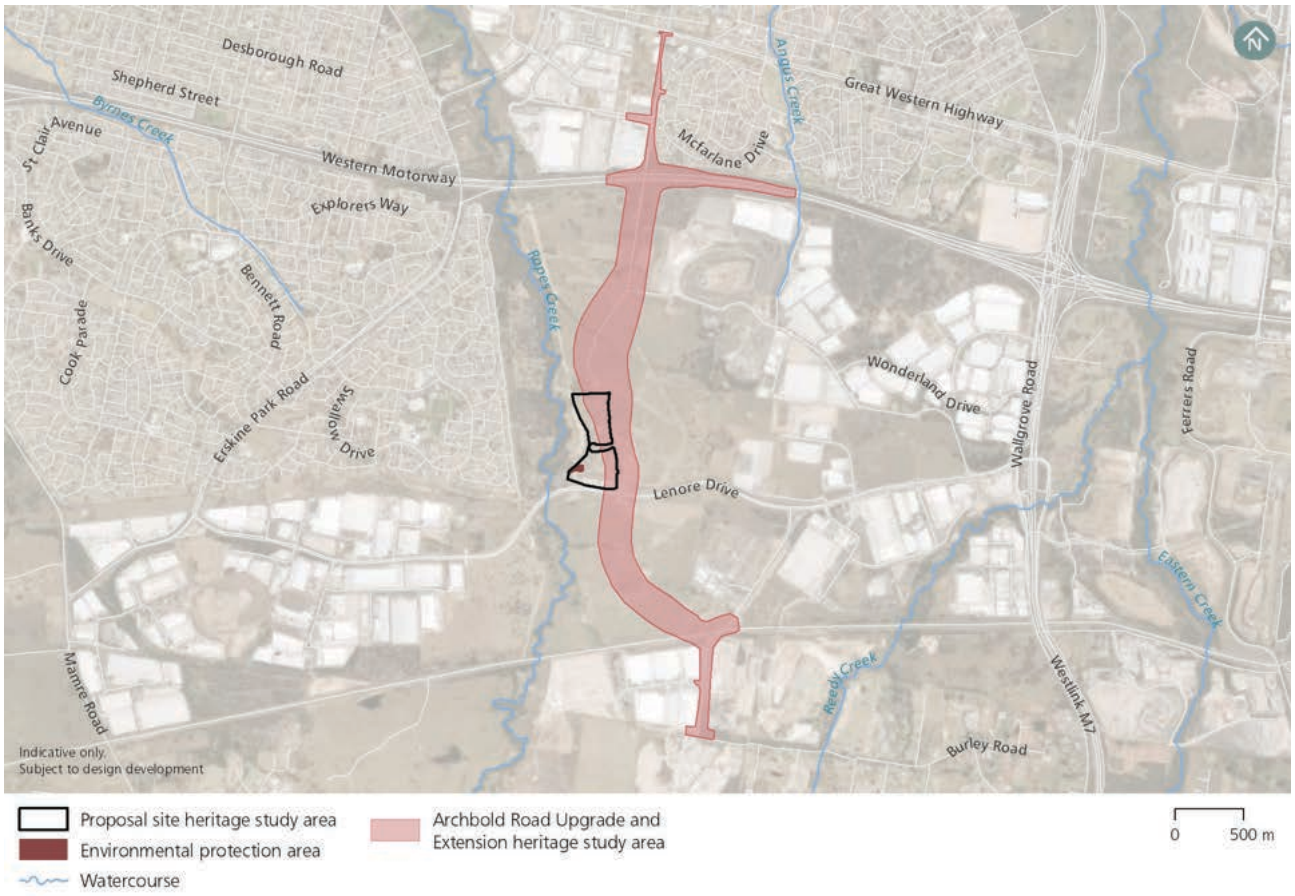


Figure 8-39: Aboriginal heritage study area for Archbold Road upgrade and extension and the proposal (Source of Archbold Road upgrade and extension Aboriginal study area: Artefact, 2017)

### Non-Aboriginal heritage

A Statement of Heritage Impact has been undertaken by Artefact for the Archbold Road upgrade and extension (Artefact, 2016). The heritage study area for Archbold Road directly overlaps with the heritage study area for the proposal. It has been determined that the planned Archbold Road upgrade and extension would result in at least partial direct impact on the shed and yard complex site (an area of archaeological potential) as seen in Figure 8-40. Works such as bulk earthworks and excavations would result in the complete removal of the sandstone yard and associated features such as the surrounding timber fence line.

As outlined in Chapter 8.4 (Non-Aboriginal heritage), the proposal overlaps with the paddocks associated with the shed and yard complex, however these potential archaeological remains are not expected to reach the threshold for local significance. As the proposal is not anticipated to have any archaeological impacts to items of non-Aboriginal heritage significance, non-Aboriginal cumulative impacts are not anticipated to occur.

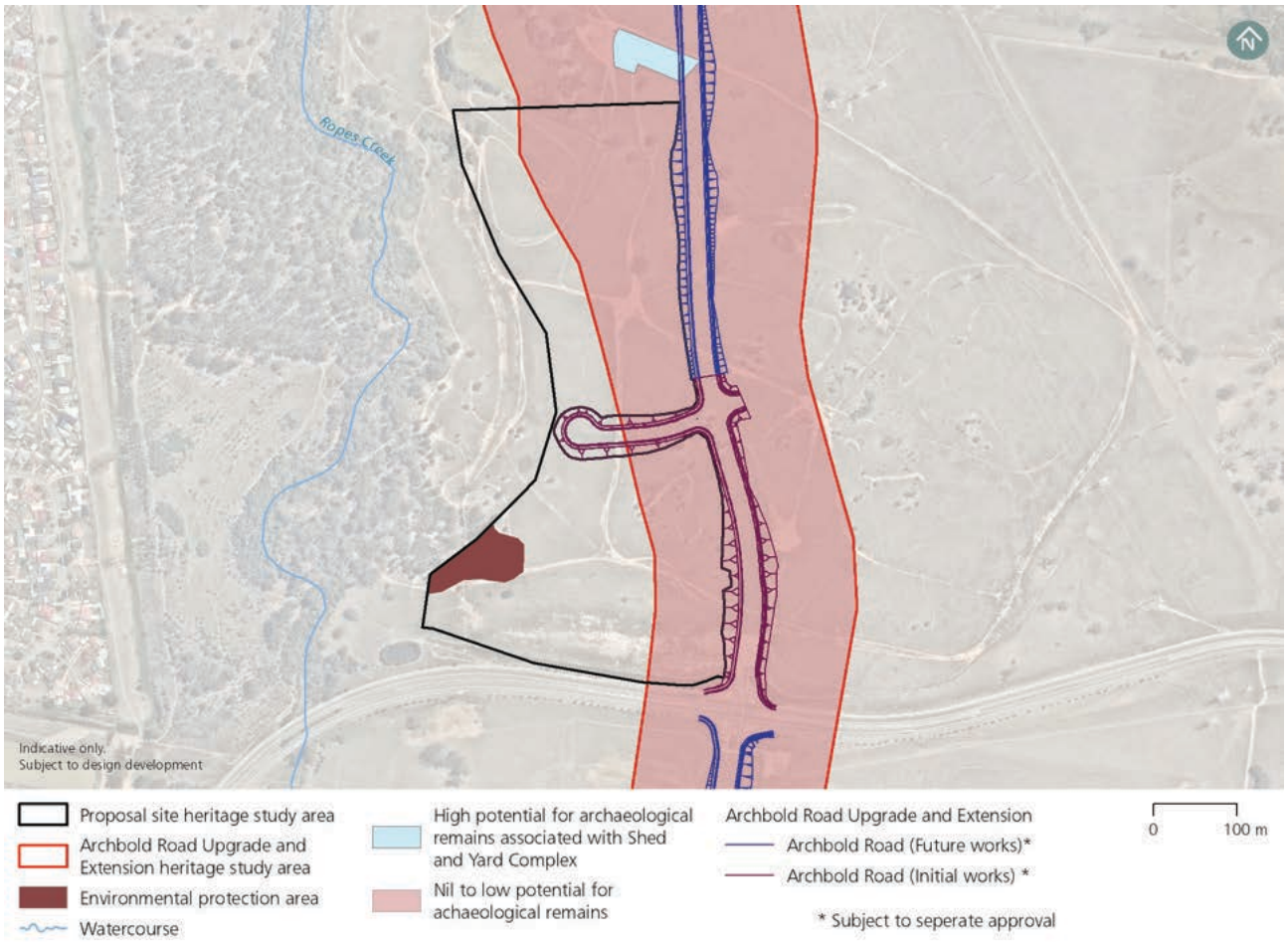


Figure 8-40: Detailed view of shed and yard complex (Artefact, 2017)

### Flooding

The detailed design of the proposal and the first stage of the planned Archbold Road upgrade and extension would be coordinated to appropriately manage stormwater drainage and any potential flooding impacts.

As noted in Chapter 8.7 (Flooding), the proposal would have no flood impacts in events up to and including the one per cent AEP event as the entire site is above the one per cent AEP flood level and any filled embankments would be outside of the flood extent. The proposal would also include the provision of appropriate flow diversion channels or culverts for management of external flows, as well as appropriate on-site stormwater detention/flood detention facilities. As such, the potential impacts of the proposal on hydrology and flooding would be minor.

The Archbold Road Upgrade and Extension REF identifies that the proposal would include an appropriate stormwater drainage system such that there would be no change in flood levels for the area immediately north of Lenore Drive in the 20-year storm event. It also identifies that the potential flood risk in both the short and long term would be minor. As a result of the minor potential impacts and the coordination of the design, the potential for cumulative flood impacts from the proposal and the planned Archbold Road upgrade and extension would be negligible.

It is anticipated that future individual developments on adjacent land would include necessary flood mitigation measures to minimise the potential for cumulative flood impacts in the locality. Therefore, the proposal, which would include flood mitigation, would not contribute to cumulative flood impacts.

### Biodiversity

When the impacts of the proposal are considered together with the planned Archbold Road upgrade and extension project, the contribution of the proposal to cumulative biodiversity impacts in the Cumberland Plain region is relatively low. While there would be some limited biodiversity impacts from the proposal, in the context of other projects, impacts are anticipated to be adequately managed through the implementation of mitigation measures.

Available information on the planned Archbold Road upgrade and extension project identifies that the project would require the removal of approximately 9.81 hectares of vegetation, of which 7.60 hectares is native vegetation (Cumberland shale plains woodland and Cumberland River-flat Forest) and is consistent with a threatened ecological community, and provides habitat for 19 threatened species (WSP Parsons Brinckerhoff, 2017b).

## 8.16.3 Management and mitigation measures

The mitigation measures that would be implemented to address potential cumulative impacts are listed in Table 8-60.

Table 8-60: Management and mitigation measures – Cumulative impacts

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **CI1** | Cumulative impacts | Co-ordination and consultation with the following stakeholders would occur where required to manage the interface of projects under construction at the same time:<br>• Other parts of Transport for NSW<br>• Department of Planning, Industry and Environment<br>• Utility providers<br>• Construction contractors.<br>Co-ordination and consultation with these stakeholders would include:<br>• Provision of regular updates to the detailed construction program, construction sites and haul routes<br>• Identification of key potential conflict points with other construction projects<br>• Developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve:<br>  • Adjustments to the Sydney Metro construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of other construction projects<br>  • Co-ordination of traffic management arrangements between projects. |

Mitigation measures in other chapters would contribute to reducing the overall environmental impact of the proposal. Mitigation measures in other chapters that involve coordination with other projects include:

- Section 8.5 (Aboriginal heritage), specifically a measure which involves coordination with Transport for NSW to manage the overlapping impacts to Aboriginal site AIF-06 (AHIMS ID45-5-4599)
- Section 8.7 (Flooding), specifically a measure to integrate detailed design of the proposal with proposed Archbold Road cross drainage and road drainage outlets.

# 9 Environmental management

This chapter identifies how the environmental impacts of the proposal would be managed through Environmental Management Plans and mitigation measures. Section 8.3 lists the proposed mitigation measures for the proposal to minimise the impacts of the proposal identified in Chapter 7 (Environmental impact assessment).

## 9.1 Environmental management systems

The Sydney Metro environmental management system would be used to manage the construction and operation of the proposal. The management system would provide the framework for implementing the environmental management measures documented in this REF, and any conditions of other approvals, licences or permits.

## 9.2 Environmental Management Plans

Sydney Metro has developed and successfully implemented a range of documents to set out the management approach during construction of its projects. These documents are outlined below and would be applied, as relevant, to the construction of the precast facilities.

Although these documents are typically applied to the construction phase of projects, it is proposed to also adopt these management documents for the operational phase of the precast facilities considering their role in supporting construction of Sydney Metro West and their use by the tunnelling contractors.

### 9.2.1 Construction Environmental Management Framework

The Sydney Metro Construction Environmental Management Framework details the approach to environmental management and monitoring during construction, which will be applied to this proposal. The framework is a linking document between planning approval documentation (including commitments made within this REF) and construction environmental management documentation, which would be developed by the construction contractors.

The Construction Environmental Management Framework details the environmental, stakeholder and community management systems and processes for the construction of the proposal.

### 9.2.2 Construction Noise and Vibration Standard

Noise and vibration impacts of the proposal would be managed in accordance with the Sydney Metro Construction Noise and Vibration Standard, which aims to manage noise and vibration levels where feasible and reasonable using a variety of mitigation measures. The Construction Noise and Vibration Standard provides guidance for managing construction noise and vibration impacts to provide a consistent approach to management and mitigation across all Sydney Metro projects.

The Standard also provides:

- A list of standard mitigation measures that would be implemented where feasible and reasonable
- Trigger levels (based on exceedances of airborne NMLs) for the implementation of additional mitigation measures.

### 9.2.3 Construction Traffic Management Framework

Traffic impacts associated with the proposal would be managed in accordance with the Sydney Metro Construction Traffic Management Framework. This framework provides an overall strategy and approach for construction traffic management, and an outline of the traffic management requirements and processes that would be applied. It establishes the traffic management processes and acceptable criteria to be considered and followed in managing impacts to the road network.

## 9.3 Management and mitigation measures

Environmental management measures to be implemented during the construction and operation of the proposal are listed in Table 9-1.

Table 9-1: Environmental management measures (compiled from Section 7 mitigation measures)

| Ref | Impact/issue | Safeguard/management measure |
|---|---|---|
| **Noise and vibration** | | |
| **NV1** | Construction noise and vibration | During construction, receivers that would potentially be affected by noise and/or vibration from the works would be appropriately notified before the relevant works start. |
| **NV2** | Construction airborne noise | Noise monitoring at the most affected receiver(s) would be undertaken at the start of construction works to check the levels are as predicted and to confirm that the standard mitigation measures are adequate. If the standard mitigation measures are not found to be adequate, further mitigation measures would be considered and implemented where feasible and reasonable. |
| **Traffic and transport** | | |
| **T1** | Traffic incidents | In the event of a traffic-related incident, coordination would be carried out with Transport Coordination and/or other parts of Transport for NSW. |
| **T2** | Emergency vehicles access | Access to properties for emergency vehicles would be provided at all times. |
| **T3** | Road safety | All trucks would enter and exit the proposal site in a forward direction, where feasible and reasonable. |
| **T4** | Staff parking | All staff parking would be provided on-site and not on surrounding local streets. |
| **T5** | Road safety | The driver induction process would include safety awareness in relation to all road users, particularly pedestrians and cyclists at the proposal site access point at Archbold Road / Lenore Drive during construction. |
| **Landscape and visual character** | | |
| **LV1** | Visual impacts – construction | Where feasible and reasonable, the elements within the construction site would be located to minimise visual impacts (for example storing materials and machinery behind fencing). |
| **LV2** | Landscape and visual impact – operation | Sheds would be finished in a colour which aims to minimise visual impacts, if visible from areas external to the site. |
| **LV3** | Lighting impacts during operation | Lighting of the sites would be orientated to minimise glare and light spill impacts on adjacent receivers in accordance with AS4282:2019. |
| **Aboriginal heritage** | | |
| **AH1** | Test excavation | Archaeological test excavation would be limited to the proposal site and undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010a) to confirm the geographic extent of RCIF 2 (AHIMS ID 45-5-3159), Blacktown Southwest 11 (AHIMS ID 45-5-0559) and the area of PAD identified within Ropes Creek Artefact Scatter 09 (AHIMS ID 45-5-5355).<br>Test excavation would be limited to areas subject to potential impacts by the proposal, and outside the area already salvaged and subject to impacts by the St Mary's Wastewater System Augmentation project. Archaeological test excavation would be undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010a). |
| **AH2** | Consultation | As part of the preparation of the test excavation methodology and ACHAR, comprehensive Aboriginal stakeholder consultation would be carried out in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010b) and the National Parks and Wildlife Regulation 2019. |

| Ref | Impact/issue | Safeguard/management measure |
|---|---|---|
| **AH3** | Aboriginal heritage | An AHIP would be submitted to the NSW DPC for those portions of the proposal site subject to impacts once test excavation is completed. The AHIP application would be supported by an ACHAR and test excavation report. |
| **AH4** | Overlapping impact | Sydney Metro would liaise with Transport for NSW regarding overlapping impacts to Aboriginal site AIF-06 (AHIMS ID 45-5-4599) and coordinating further assessment and management. |
| **AH5** | Unexpected finds | In the event that suspected Aboriginal ancestral remains are exposed during construction, the requirements of Section 3.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010) would be implemented. |
| **Non-Aboriginal heritage** | | |
| **NAH1** | Unexpected finds | An Unexpected Finds Procedure, to be implemented in the event that potential non-Aboriginal heritage objects are exposed during construction, would be prepared that complies with the *Heritage Act 1977*. |
| **Flooding** | | |
| **F1** | Potential increase in mainstream peak flood flows | Detailed design of the proposal site would include provision of appropriate on-site stormwater detention/flood detention facilities to cater for events up to and including the 1% AEP event. |
| **F2** | Potential geomorphic impacts due to changed flow regime in low flows and frequent flood events | Detailed design of the proposal site would include the provision of appropriate on-site stormwater detention/flood detention facilities. Outlet sizing would be designed to satisfactorily mitigate potential increases in peak flows in frequent events. |
| **F3** | Potential impacts on overland flooding and drainage conditions | Detailed design of the proposal site would include the provision of appropriate flow diversion channels or culverts for management of external flows. |
| **F4** | Potential impacts on overland flooding and drainage conditions | Detailed design would integrate with the planned Archbold Road upgrade and extension cross drainage and road drainage outlets. |
| **F5** | Potential impacts on overland flooding and drainage conditions | Detailed design would provide appropriate scour protection works at channel/culvert discharge points to Ropes Creek. |
| **F6** | Potential impacts on the proposal resulting from flooding | Detailed design would provide filling to a height of at least 0.5m above Ropes Creek 1% AEP flood level. |
| **Soils and surface water** | | |
| **SW1** | Soil salinity | Prior to ground disturbance in high probability salinity areas, testing would be carried out to determine the presence of saline soils. If salinity is encountered, excavated soils would not be reused or it would be managed in accordance with Book 4 Dryland Salinity: Productive Use of Saline Land and Water (NSW DECC, 2008). Erosion controls would be implemented in accordance with Blue Book (Landcom, 2004). |

| Ref | Impact/issue | Safeguard/management measure |
|---|---|---|
| **SW2** | Potential erosion and sedimentation | Erosion and sediment measures would be implemented in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004) and Volume 2D (NSW DECCW, 2008), commonly referred to as the 'Blue Book'. Additionally, any water collected from the proposal site would be appropriately treated and discharged to avoid any potential contamination or local stormwater impacts.<br>Temporary sediment basins would be designed in accordance with Managing Urban Stormwater: Soils and Construction and Managing Urban Stormwater, Volume 2D: Main Road Construction (DECC, 2008). |
| **SW3** | Wastewater discharge | Prior to discharge, wastewater would be treated to a level that is compliant with the ANZECC/ARMCANZ (2000) and ANZG (2018) default guidelines for 95 per cent species protection.<br>For the purposes of this management measure, during operation wastewater is defined as process water from operation of the precast facility and does not include surface runoff or stormwater. |
| **Contamination** | | |
| **C1** | Management of low risk contamination | For areas that have been identified as having moderate contamination impact potential, a further review of data would be performed.<br>Should the additional data review confirm that contamination is likely to have a very low or low impact potential, the areas would then be managed in accordance with the Soil and Water Management Plan for the proposal. This would typically occur where there is minor, isolated contamination that can be readily remediated through standard construction practices such as excavation and off-site disposal. |
| **C2** | Detailed Site Investigation | Where data from the additional data review (mitigation measure C1) is insufficient to understand the impact of contamination, a Detailed Site Investigation would be carried out in accordance with the NEPM (2013) and other guidelines made or endorsed by the NSW EPA.<br>The areas requiring Detailed Site Investigation would be confirmed following the additional data review (C1), however on the basis of the PSCI, it is anticipated that a Detailed Site Investigation would be required to characterise fill materials, and sediment from dam / retention pond for on-site reuse and/or off-site disposal. Fly tipped wastes and deposited wastes (from former land use) would need to be characterised for off-site disposal. |
| **C3** | Remediation | Where data from additional data review (mitigation measure C1) or the Detailed Site Investigation (mitigation measure C2) confirms that contamination would have a moderate to very high risk, a Remedial Action Plan (RAP) would be developed for the area of the construction footprint.<br>The RAP would detail the remediation works required to mitigate impacts from contamination throughout and following completion of construction. The RAP would be prepared in accordance with relevant NSW EPA guidelines and where applicable, detail remediation methodologies in accordance with Australian Standards and other relevant government guidelines and codes of practice.<br>Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land.<br>The requirements for a RAP and remediation would be confirmed following the additional data review (mitigation measure C1) and Detailed Site Investigation (mitigation measure C2). |

| Ref | Impact/issue | Safeguard/management measure |
|---|---|---|
| **C4** | Site Audit Statement | Where contamination is highly complex, such as significant groundwater contamination; contamination associated with vapour; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction, an accredited Site Auditor would review and approve the RAP and would develop a Site Audit Statement and Site Audit Report upon completion of remediation.<br>The requirement for a Site Audit Statement would be confirmed following preparation of the RAP (mitigation measure C3). |
| **C5** | Residual contamination following construction | Ongoing management and monitoring measures would be documented in an appropriate form and implemented for any areas where minor, residual contamination remains following construction. |
| **C6** | Accidental leaks or spills – operation | The operational environmental management plan (OEMP) for the proposal would include an Emergency Response Plan (or equivalent) which would specify the procedure to be followed in the event of a spill, including the notification requirements and use of absorbent material to contain the spill. |
| **C7** | Contaminated soil – operation | Where contaminated soils are to remain on-site, an appropriate OEMP would be prepared and implemented. The OEMP would include relevant ongoing management requirements developed in accordance with the NEPM (2013) and relevant guidelines made or approved by the NSW EPA. Measures may include but are not limited to, including procedures for excavation works, inspections and audits. |
| **C8** | Contaminated groundwater | Potential impacts from existing groundwater contamination (if present) during operation of the proposal would be managed through management and mitigation measures such as:<br>• Emplacement of appropriate topographic / drainage controls to minimise seepage and ponding of water across the site<br>• Drainage from sealed areas would be directed to stormwater drains (e.g. pipes, swales) via gross pollutant traps and sediment basins (if necessary) to mitigate potential impacts from sediments or wastes on receiving environments. |
| **Biodiversity** | | |
| **B1** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, the limits of the work zone, areas for parking and turning of vehicles and plant equipment would be clearly and accurately marked out. These areas would be located so that vegetation disturbance is minimised as much as possible and the drip-line of trees avoided. |
| **B2** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, exclusion zones would be identified and established around all vegetation to be retained, such as the environmental protection area in the west of the proposal site. Periodic monitoring would be undertaken to ensure all controls are in place and no inadvertent impacts are occurring. |
| **B3** | Potential impact to surrounding vegetation and threatened ecological communities | Materials, plant, equipment, work vehicles and stockpiles would be placed to avoid damage to surrounding vegetation and outside tree driplines. |

| Ref | Impact/issue | Safeguard/management measure |
|---|---|---|
| **B4** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, personnel would be informed of the environmentally sensitive aspects of the proposal site, including plans for impacted and adjoining areas showing vegetation communities, important flora and fauna habitat areas, and locations where threatened species, populations or ecological communities have been recorded. Construction personnel would be made aware that any native fauna species encountered must be allowed to safely leave the proposal site where possible and a local wildlife rescue organisation or appropriately experienced ecologist must be called for assistance where necessary. |
| **B5** | Potential impact to surrounding vegetation and threatened ecological communities | Where possible, hollows would be cut out of hollow-bearing trees and re-established in large trees to the west of the proposal site to mitigate the loss of hollow habitat on fauna. |
| **B6** | Potential impacts to the Cumberland Plain Land Snail | Pre-clearing surveys for the Cumberland Plan Land Snail would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing to translocate any individuals that may be inhabiting areas that would be cleared or disturbed. This includes all areas of dumped rubbish across the proposal site. |
| **B7** | Potential impacts to the Cumberland Plain Land Snail | Prior to construction, exclusion zones would be established around Cumberland Plain Land Snails habitat in the environmental protection area. All personnel would be inducted to understand the exclusion zone to limit the potential of trampling snails. |
| **B8** | Potential impacts to the Cumberland Plain Land Snail | Large woody debris cleared within the proposal site would be relocated into habitat to the west of the proposal site. |
| **B9** | Potential impacts to the Green and Golden Bell Frog | Pre-clearing surveys for the Green and Golden Bell Frog would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing and dewatering of potential habitat to ensure that individuals have not inhabited the site. A suitably qualified ecologist would also be present during the dewatering of the habitat. A stop work in the immediate vicinity would be implemented if this species is identified on the proposal site, and then further consideration of approach to management of individuals on proposal site through consultation with a Green and Golden Bell Frog expert. |
| **B10** | Potential impacts to the Green and Golden Bell Frog | Any work in and around the suitable habitat during clearing would follow the Hygiene Protocol for the Control of Disease in Frogs (Department of Environment and Climate Change 2008b) to reduce the potential for introduction and spread of Chytrid fungus. |
| **B11** | Potential impacts from introduction and spread of weeds | Weed control would be undertaken by suitably qualified and/or experienced personnel. This may include:<br>• Manual weed removal in preference to herbicides<br>• Replacing non-target species removed/killed as a result of weed control activities<br>• Protecting non-target species from spray drift<br>• Using only herbicides registered for use within or near waterways for the specific target weed<br>• Applying herbicides during drier times when the waterway level is below the high-water mark<br>• Not applying herbicide if it is raining or if rain is expected<br>• Mixing and loading herbicides, and cleaning equipment away from waterways and drains. |

| Ref | Impact/issue | Safeguard/management measure |
|---|---|---|
| **B12** | Potential impacts from introduction and spread of weeds | During construction, weed management would be undertaken in areas affected by construction prior to any clearing works in accordance with the *Biosecurity Act 2015* to ensure they are not spread to the surrounding environment; including during transport disposal off-site to a licenced waste disposal facility. |
| **B13** | Potential impacts from introduction and spread of weeds | All weeds, propagules, other plant parts and/or excavated topsoil material that is likely to be infested with weed propagules that are likely to regenerate would be treated on site or bagged, removed from site and disposed of at a licensed waste disposal facility. |
| **B14** | Potential impacts from introduction and spread of plant pathogens | During construction, all vehicles driving to and from the proposal site would follow a protocol to prevent the spread or introduction of phytophthora, namely vehicles would be clean, including the tyres and any equipment. |
| **Resource use and waste management** | | |
| **WR1** | Compliance with legislative and policy requirements | All waste would be assessed, classified, managed, transported and disposed of in accordance with the *Waste Classification Guidelines and the Protection of the Environment Operations (Waste) Regulation 2014*. |
| **WR2** | Waste minimisation | Waste would be minimised by accurately calculating materials brought to the proposal site and limiting materials packaging. |
| **WR3** | Waste management | 100 per cent of usable spoil from construction would be reused, in accordance with the Sydney Metro spoil management hierarchy. |
| **WR4** | Reuse and recycling | Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities. |
| **WR5** | Waste tracking | A materials tracking system would be implemented for material transferred to offsite locations such as licensed waste management facilities. |
| **WR6** | Reuse and recycling | At least 95 per cent of inert and non-hazardous construction waste, excluding spoil, and at least 50 per cent of office waste would be recycled or alternatively beneficially reused. |
| **Air quality** | | |
| **AQ1** | Dust impacts during construction | The following best-practice dust management measures would be implemented during construction works:<br>• Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather<br>• Adjust the intensity of activities based on measures and observed dust levels and weather forecasts<br>• Minimise the amount of materials stockpiled and position stockpiles away from surrounding receivers<br>• Regularly inspect dust emissions and apply additional controls as required. |
| **AQ2** | Dust impacts during operation | The following best-practice dust management measures would be implemented during operation:<br>• Ensure that loads are covered and that haulage vehicles are cleaned to remove any loose debris before leaving the site<br>• Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather<br>• Position long-term stockpiles away from surrounding receivers<br>• Regularly inspect and where necessary clean sealed haulage roads to remove tracked materials. |
| **AQ3** | Exhaust emissions during construction and operation | Plant and equipment would be maintained in a proper and efficient manner. Visual inspections of emissions from plant would be carried out as part of pre-acceptance checks. |

| Ref | Impact/issue | Safeguard/management measure |
|---|---|---|
| **AQ4** | Airborne hazardous materials uncovered during construction | The following best-practice measures would be implemented to manage airborne hazardous materials during construction:<br>• Temporary coverings or odour suppressing agents would be applied to excavated areas where appropriate<br>• Removal and disposal of hazardous materials would be undertaken in accordance with the relevant requirements in the *Work Health and Safety Act 2011*, Work Health and Safety Regulation 2017 and any applicable guidelines. |
| **Bushfire** | | |
| **BF1** | Bushfire protection measures | The proposal site would be managed as an Asset Protection Zone (APZ). The entire proposal site would be managed as an APZ as outlined within Appendix 4 of 'Planning for Bush Fire Protection 2019' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. The APZ would not extend into the environmental protection area in the south-west of the site. |
| **BF2** | Bushfire protection measures | Vulnerable buildings and/or critical assets would be constructed to appropriate BAL in accordance with the Australian Standard for the Construction of Buildings in Bushfire Prone Areas (AS3959). |
| **BF3** | Bushfire protection measures | The following measures would be implemented for access roads within the proposal site:<br>• Access roads would be two-wheel drive, all-weather roads<br>• Minimum 5.5 metre carriageway width kerb to kerb<br>• Maximum grades for sealed roads would not exceed 15 degrees and an average grade of not more than 10 degrees, or other gradient specified by road design standards, whichever is the lesser gradient<br>• Curves of roads would have a minimum inner radius of 6 metres<br>• Dead end roads would incorporate a minimum 12 metre outer radius turning circle, and would be clearly sign posted as a dead end<br>• A minimum vertical clearance of 4 metres would be provided to any overhanging obstructions, including tree branches. |
| **BF4** | Bushfire protection measures | The following water supply and utilities would be installed during construction and maintained during operation of the proposal:<br>• A minimum static water supply of 20,000 litres for firefighting purposes. The firefighting water can be available in a single tank or a number of tanks around the proposal site<br>• A hardened ground surface for truck access up to and within 4 metres of the water source<br>• A 65 millimetre metal Storz outlet with a gate or ball valve would be provided as an outlet on each of the tanks<br>• If the water tank is located above ground it would be of a non-combustible material<br>• If the water tank is located underground, it would have an access hole of 200 millimetres to allow tankers to refill direct from the tank.<br>• All associated fittings to the tank would be non-combustible. |
| **BF5** | Bushfire protection measures | Bushfire Emergency Management and Evacuation Plans would be developed for the construction and operation of the proposal. The bushfire evacuation procedures would be completed in accordance with NSW Rural Fire Service Guide to Developing A Bushfire Emergency Management Plan and meet the requirements of Australian Standard AS 3745-2010 – Planning for Emergencies in facilities. |
| **BF6** | Bushfire protection measures | Activities that generate sparks or excessive heat would be minimised when a total fire ban is declared by Rural Fire Service. |

| Ref | Impact/issue | Safeguard/management measure |
|---|---|---|
| **Sustainability, climate change and greenhouse gas** | | |
| **SCC1** | Sustainability implementation | Sustainability initiatives would be incorporated into the detailed design and construction to support the achievement of the Sydney Metro West sustainability objectives. |
| **SCC2** | Sustainability implementation | Best practice level of performance would be achieved using market leading sustainability rating tools during construction and operation. |
| **SCC3** | Greenhouse gas emissions | 25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction and operation of the proposal would be offset. |
| **SCC4** | Greenhouse gas emissions | An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a baseline inventory calculated at the detailed design stage. |
| **SCC5** | Climate change risks | Climate change risk treatments would be confirmed and incorporated into the detailed design. |
| **Cumulative impacts** | | |
| **CI1** | Cumulative impacts | Co-ordination and consultation with the following stakeholders would occur where required to manage the interface of projects under construction at the same time:<br>• Other parts of Transport for NSW<br>• Department of Planning, Industry and Environment<br>• Utility providers<br>• Construction contractors.<br>Co-ordination and consultation with these stakeholders would include:<br>• Provision of regular updates to the detailed construction program, construction sites and haul routes<br>• Identification of key potential conflict points with other construction projects<br>• Developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve:<br>  • Adjustments to the Sydney Metro construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of other construction projects<br>  • Co-ordination of traffic management arrangements between projects. |

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# 10 Justification and conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the proposal site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the NSW EP&A Act, including the principles of ESD as defined in Schedule 2 of the NSW EP&A Regulation.

This REF seeks to assess the environmental impacts resulting from construction and operation of the proposed two precast facilities in Eastern Creek.

## 10.1 Justification

### 10.1.1 Need for the proposal

Sydney Metro West would involve the construction and operation of a metro rail line between Westmead and Sydney CBD, including about 24 kilometres of underground twin tunnels. These tunnels would be lined with precast concrete segments which are erected by tunnel boring machines as they move forward. The need for Sydney Metro West is detailed in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement (Sydney Metro, 2020a).

Stage 1 of the works for Sydney Metro West includes the tunnel and station excavation works from Westmead to The Bays. Future stage(s), including tunnel excavation between The Bays and Sydney CBD, would be subject to future Environmental Impact Statement(s). While the design of major civil elements between Westmead and The Bays is well progressed, further planning is underway on elements such as tunnel alignment east of The Bays and through the complex Sydney CBD, and the overall delivery strategy for Sydney Metro West.

It has been identified through detailed construction planning that additional precast facilities would be required to enable the efficient delivery of Sydney Metro West (including the section from The Bays to the Sydney CBD).

Due to the scale of Sydney Metro West, the tunnelling and station excavation works have been separated into geographically-specific contract packages between Westmead and the Sydney CBD. Based on the delivery strategy for Sydney Metro West, multiple tunnelling packages would be in delivery at the same time and separate precast facilities would be required for each tunnelling contractor.

The precast facility at the Clyde stabling and maintenance facility construction site proposed as part of Stage 1 of the works for Sydney Metro West would not provide sufficient space or be able to meet the productivity requirements to support the Sydney Metro West delivery strategy. Furthermore, while tunnelling works are still underway, the precast facility at Clyde would need to be decommissioned for the land to support future construction activities, including fit out of the tunnels.

Additional precast capacity would provide the ability to align the production of precast segments with the delivery strategy, while supporting multiple tunnelling contractors concurrently. Precast facilities separate from the Clyde site would also be able to be used over the entire duration of Sydney Metro West tunnelling works, as they would not be required to be decommissioned to allow future construction activities to commence.

### 10.1.2 Benefits and impacts of the proposal

The proposal would support the delivery of the proposed Sydney Metro West. It would also deliver social and economic benefits by providing employment opportunities during construction and operation of the proposal. The proposal would be designed and managed to provide operational efficiencies and to appropriately mitigate impacts on the surrounding environment and local community.

Due to the location of the proposal and its distance from the nearest receivers, the potential amenity related impacts (such as noise and air quality) associated with the construction and operation of the proposal would be negligible to minor.

Management and mitigation measures would be implemented to minimise the potential impacts of the proposal. The potential key impacts of the proposal include:

- The preparation of an AHIP, supported by test excavation and comprehensive Aboriginal stakeholder consultation, would be completed to manage potential impacts to Aboriginal heritage. The proposal would result in the partial to total loss of value of 10 Aboriginal sites. The overall archaeological significance of seven of these sites has been assessed as low. One site, RCAS 09 (AHIMS ID 45-5-5355) has been assessed as having moderate overall significance and two sites (AHIMS ID 45-3-3159 and AHIMS ID 45-5-0559) having high overall significance. One of the sites, AIF-06 (AHIMS ID 45-5-4599) is also within the boundary of the planned Archbold Road upgrade and extension. Sydney Metro and other relevant parts of Transport for NSW would coordinate any future Aboriginal Cultural Heritage Assessment Report(s) (ACHAR) and AHIP application(s)
- The proposal has sought to minimise impacts to biodiversity, including through the establishment of an environmental protection area to retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Construction of the proposal would require clearing of about 1.92 hectares of native vegetation, a subset of which is BC Act and EPBC Act listed as endangered and critically endangered community, respectively. This vegetation provides habitat for, or has the potential to support, other protected threatened species
- Potential temporary cumulative impacts with other projects, on noise and vibration, traffic and transport, Aboriginal heritage, non-Aboriginal heritage, flooding and biodiversity, may occur given the potential overlap with other projects including the planned Archbold upgrade and extension. Co-ordination and consultation with relevant stakeholders (including other parts of Transport for NSW) would occur where required to manage the interface of projects under construction at the same time. These potential impacts are considered manageable through the implementation of mitigation measures for these projects (and the proposal) as discussed in Section 8.16 (Cumulative impacts).

Other potential environmental impacts such as noise and vibration, traffic and transport, landscape and visual character, non-Aboriginal heritage, land-use and socio-economic, flooding, contamination, soils and surface water, groundwater, waste and resource management, air quality, bushfire and sustainability, climate change and greenhouse gas have also been assessed in this REF (refer to Chapter 8 (Environmental impact assessment)).

Environmental impacts have been avoided or would be minimised wherever possible through design and the site-specific mitigation measures summarised in Chapter 9 (Environmental management). The benefits of the proposal are considered to outweigh the potential impacts and the proposal is considered to be justified.

## 10.2 Objects of the EP&A Act

An assessment of the proposal against the objects of the EP&A Act is provided in Table 10-1.

Table 10-1: Assessment of the proposal against the objects of the EP&A Act

| Object | Comment |
|---|---|
| **1.3(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources** | The proposal would provide social and economic benefits by providing employment opportunities in the Western Sydney area during the construction and operation of the proposal.<br>The proposal would have no impact on the state's key natural and other resources; agricultural land, natural areas, forests or minerals. A range of safeguards and management measures are proposed to minimise potential environmental impacts associated with the proposal. |
| **1.3(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment** | Ecologically sustainable development is considered in Section 10.3. |
| **1.3(c) to promote the orderly and economic use and development of land** | The proposal would utilise land for industrial services, which aligns with planning for the area under the WSEA SEPP, while providing employment opportunities. |

| Object | Comment |
|---|---|
| **1.3(d) to promote the delivery and maintenance of affordable housing** | This objective is not directly relevant to the proposal. |
| **1.3(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats** | The proposal would retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within an environmental protection area in the south-west of the proposal site. Construction of the proposal would require the clearing of native vegetation that is BC Act and EPBC Act listed as endangered and critically endangered community, respectively. This vegetation provides habitat (or has the potential to support) other protected threatened species. The potential impacts on vegetation, threatened species, population and ecological communities' area are discussed in Section 8.11 (Biodiversity).<br>Due to the presence of the critically endangered ecological communities and threatened fauna habitat, exclusion zones would be established to delineate the works limit boundary to ensure no accidental impacts occur (including, but not limited to, the environmental protection area). |
| **1.3(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)** | The proposal would impact 10 Aboriginal heritage items. One of the sites, AIF-06 (AHIMS ID 45-5-4599) is also within the boundary of the planned Archbold Road upgrade and extension. Sydney Metro and other relevant parts of Transport for NSW would coordinate any future ACHAR and AHIP application(s). Test excavations would be undertaken to support an AHIP with objects of significance appropriately managed.<br>The proposal is not predicted to have any impacts on non-Aboriginal heritage.<br>Impacts to heritage and the approach to managing these impacts are discussed in Section 8.4 (Non-Aboriginal heritage) and Section 8.5 (Aboriginal heritage). |
| **1.3(g) to promote good design and amenity of the built environment** | Design of the proposal would generally be suited to the planned industrial context surrounding the proposal site. Landscape character and visual amenity impacts from the proposal would be negligible or minor adverse at some locations and would be managed in accordance with the Construction Environmental Management Framework, which specifies key environmental management procedures. Landscape and visual amenity impacts are discussed in Section 8.3 (Landscape and visual character). |
| **1.3(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants** | The construction of all buildings would be completed in a manner which is consistent with the applicable Australian and international safety standards. |
| **1.3(i) To promote the sharing of the responsibility for environmental planning between different levels of government in the State** | Sharing the responsibility of environmental planning is interpreted under two principal planning approval pathways in the EP&A Act. The EP&A Act also describes who is responsible for managing and coordinating these pathways. Part 5, Division 5.1 of the EP&A Act describes the responsibilities for public agencies undertaking development without consent.<br>These provisions are supported by the provisions of ISEPP. Collectively they describe the sharing responsibilities across all levels of Government in delivering public infrastructure. In delivering the proposal under the above pathway Sydney Metro has fulfilled its obligations in this regard under the EP&A Act. |

| Object | Comment |
|---|---|
| **1.3(j) To provide increased opportunity for public involvement and participation in environmental planning and assessment** | Chapter 6 (Stakeholder and community consultation) outlines the opportunity for public involvement in the proposal.<br>Consultation would be undertaken with the community and stakeholders as the detailed design is developed, as the pre-construction work takes place, while the proposal is being constructed, and once construction is complete.<br>The exhibition of the REF and the submissions response process will provide an opportunity for the public to raise concerns and comments about the proposal. Sydney Metro will respond to these submissions and undertake additional environmental assessment or design refinements if and where required. |

## 10.3 Ecologically sustainable development

Sydney Metro is committed to ensuring that its projects are implemented in a manner that is consistent with the principles of ecologically sustainable development (ESD). The principles of ESD are generally defined under the provisions of clause 7(4) of Schedule 2 to the EP&A Regulation as:

- **Precautionary principle** – Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for not implementing mitigation measures or strategies to avoid potential impacts
- **Inter-generational equity** – The present generation should ensure that the health, diversity and productivity of the environment are equal to or better for the future generations
- **Conservation of biological diversity and ecological integrity** – Preserving biological diversity and ecological integrity requires that ecosystems, species and genetic diversity within species are maintained
- **Improved valuation and pricing of environmental resources** – This principle establishes the need to determine economic values for services provided by the natural environment, such as the atmosphere's ability to receive gaseous emissions, cultural values and visual amenity.

The principles of ESD have been adopted by Sydney Metro throughout the development and assessment of the proposal and the proposal would be delivered within the environmental and sustainability framework established for the proposed Sydney Metro West. Table 10-2 provides an assessment of the proposal in relation to the principles of ESD.

Table 10-2: Adherence with the principles of ESD

| ESD principle | Comment |
|---|---|
| **Precautionary principle** | A precautionary approach has been applied throughout the development of the proposal.<br>The REF process has sought to minimise the environmental impact of the proposal. There are no threats of serious or irreversible damage posed by this development. All of the environmental risks have been carefully and thoughtfully considered through the preparation of the REF and would be mitigated through the implementation of Sydney Metro's Construction Environmental Management Framework for the proposal and the management and mitigation measures included in Chapter 9 (Environmental management). |
| **Inter-generational equity** | This proposal would serve to deliver innovation and attract the jobs of the future for Western Sydney and NSW, utilising land for industrial services while providing employment opportunities in Western Sydney. The proposal would also support the delivery of Sydney Metro West which would provide long-term transport and city-shaping benefits across Greater Sydney. |

| ESD principle | Comment |
|---|---|
| **Conservation of biological diversity and ecological integrity** | The proposal site layout has been designed to minimise impacts to biodiversity, including through the establishment of an environmental protection area to avoid vegetation clearing in the south-west of the proposal site.<br>The proposal would require the removal of about 1.92 hectares of vegetation including native plantings throughout the proposal site. The native vegetation to be removed provides habitat (or potential habitat) for 18 threatened animal species that were either identified in the ecological study area (i.e. Cumberland Plain Land Snail) or are considered at least moderately likely to occur based on the presence of suitable habitat (e.g. Green and Golden Bell Frog, Grey-headed Flying Fox).<br>Due to the presence of the critically endangered ecological communities and threatened fauna habitat, exclusion zones would be established to delineate the works limit boundary to ensure no accidental impacts occur (including, but not limited to, the environmental protection area). In addition to this, the proposal would retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest for the purposes of an environmental protection area. The adherence to the mitigation measures outlined in this REF would help to ensure that biological diversity and ecological integrity of receiving environments would be retained. |
| **Improved valuation and pricing of environmental resources** | Environmental and social issues were considered in the strategic planning and establishment of the need for the proposal, and in consideration of various proposal options. The value placed on environmental resources is evident in the extent of the planning, environmental investigations, design of proposal and proposed mitigation measures. Implementation of these mitigation measures would result in an economic cost to Sydney Metro. Mitigation measures relating to resource management include the avoidance, reuse, recycling and management of waste during construction and operation of the proposal. |

## 10.4 Conclusion

The proposal has been subject to assessment under Division 5.1 of Part 5 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. This has included consideration of other environmental planning instruments as well as other NSW and Commonwealth legislation.

The proposal as described in the REF best meets the proposal objectives, however would still result in some potential impacts including Aboriginal heritage and biodiversity. Management and mitigation measures as detailed in this REF would ameliorate or minimise these expected impacts.

Potential temporary cumulative impacts on noise and vibration, traffic and transport, and potential impacts to Aboriginal heritage, non-Aboriginal heritage, flooding and biodiversity, may occur given the potential overlap with other projects including the planned Archbold upgrade and extension.

The REF has considered and assessed these impacts in accordance with Clause 228 of the EP&A Regulation and the requirements of the EPBC Act (refer to Chapter 8 (Environmental impact assessment), Appendix A (Consideration of Environmental Factors and Matters of National Environmental Significance)). Based on the assessment contained in this REF, it is considered that the proposal is not likely to have a significant impact upon the environment or any threatened species, populations or communities. Accordingly, an EIS is not required, nor is the approval of the Minister for Planning and Public Spaces.

The proposal has also taken into account the principles of ecologically sustainable development and the objects of the EP&A Act. The proposal would be delivered to maximise the benefit for the community, be cost effective and minimise any adverse impacts on the environment. On balance, the proposal is considered justified and in the public interest.

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# 12 Glossary

| | Definitions |
|---|---|
| **ACHAR** | Aboriginal Cultural Heritage Assessment Report |
| **AEP** | Annual Exceedance Probability |
| **AHIMS** | Aboriginal Heritage Information Management System |
| **AHIP** | Aboriginal heritage impact permit |
| **Archbold Road Upgrade and Extension REF** | Review of Environmental Factors determined by Transport for NSW in 2017. The works subject to the REF would include a future upgrade and extension of Archbold Road between the Great Western Highway, Minchinbury and Old Wallgrove Road, Eastern Creek |
| **APZ** | asset protection zone |
| **ANZECC/ ARMCANZ** | Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand (2000) |
| **ANZG** | Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018) |
| **BAL** | Bushfire Attack Levels |
| **BC Act** | (NSW) *Biodiversity Conservation Act 2016* |
| **Blacktown LEP** | *Blacktown Local Environmental Plan 2015* |
| **Blacktown LSPS** | Blacktown Local Strategic Planning Statement 2020 |
| **BoM** | Bureau of Meteorology |
| **BTEX** | benzene, ethylbenzene, toluene and three isomers of xylene |
| **CBD** | central business district |
| **CLM Act** | Contaminated Land Management Act 1997 |
| **Clyde facility** | A temporary precast concrete segment production facility included within the Clyde stabling and maintenance facility construction site as part of Stage 1 of the works for Sydney Metro West |
| **CO** | carbon monoxide |
| **$CO_2$** | carbon dioxide |
| **dB(A)** | decibel |
| **DCP** | Development Control Plan |
| **DECCW** | NSW Department of Environment, Climate Change and Water |
| **DPC** | NSW Department of Premier and Cabinet |
| **DPI** | NSW Department of Primary Industries |
| **DPIE** | NSW Department of Planning, Industry and Environment Cluster |
| **EP&A Act** | (NSW) *Environmental Planning and Assessment Act 1979* |
| **EP&A Regulation** | (NSW) *Environmental Planning and Assessment Regulation 2000* |
| **EPA** | (NSW) Environment Protection Authority |
| **EPBC Act** | (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* |
| **EPL** | environment protection licence |
| **ESD** | ecologically sustainable development |
| **GDEs** | groundwater dependent ecosystems |

| | Definitions |
|---|---|
| **ha** | hectare |
| **Heritage Act** | (NSW) *Heritage Act 1977* |
| **ICNG** | Interim Construction Noise Guideline |
| **IN1** | Zoning General Industrial under the WSEA SEPP |
| **ISEPP** | State Environmental Planning Policy (Infrastructure) 2007 |
| **$L_{Aeq(15minute)}$** | The 'energy average noise level' considered over a 15-minute period. This parameter is used to assess potential construction noise impacts |
| **LA90** | The 'background noise level' in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively |
| **$L_{AFmax}$** | The maximum noise level measured during a monitoring period, using 'fast' weighting |
| **LEP** | Local Environmental Plan |
| **LGA** | local government area |
| **m/s** | metres per second |
| **NEPM** | National Environment Protection (Assessment of Site Contamination) Measure (2013) |
| **NHMRC** | National Health and Medical Research Council |
| **NCA** | noise catchment areas |
| **NML** | noise management level |
| **$NO_2$** | nitrogen dioxide |
| **Northern precast site** | Site of the proposed precast facility at the north of the proposal site with an approximate area of 8 ha |
| **NPfI** | Noise Policy for Industry |
| **NSW** | New South Wales |
| **OEMP** | operational environmental management plan |
| **PAH** | Polycyclic aromatic hydrocarbons |
| **PCTs** | plant community types |
| **PCB** | polychlorinated biphenyls |
| **PFBP 2019** | Planning for Bush Fire Protection 2019 |
| **Planned Archbold Road upgrade and extension** | The first stage of the planned Archbold Road upgrade and extension would provide access to the proposal site from Lenore Drive, via a new section of Archbold Road and the Western Access Road. Further extensions of Archbold Road would be completed at a later stage. Works would be undertaken by other parts of Transport for NSW. |
| **$PM_{2.5}$** | particles with a diameter of 2.5 micrometres or less |
| **$PM_{10}$** | particles with a diameter of 10 micrometres or less |
| **PMF** | probable maximum flood level |
| **POEO Act** | (NSW) *Protection of the Environment Operations Act 1997* |
| **PFAS** | polyfluoroalkyl substances |
| **proponent (the)** | Sydney Metro |
| **proposal (the)** | The construction and operation of two separate, adjacent precast facilities, the northern and southern precast facilities, including boiler, aggregate bins and consumables, hardstand/ laydown areas, offices, parking, pre-cast carousel including batch plant, and sheds. |

| | Definitions |
|---|---|
| **proposal site (the)** | Site located at Lenore Drive opposite Old Wallgrove Road, Eastern Creek |
| **RAP** | Remedial Action Plan |
| **RBL** | rating background level |
| **REF** | Review of Environmental Factors |
| **RFS** | NSW Rural Fire Service |
| **RNP** | NSW Road Noise Policy |
| **SEPP** | State Environmental Planning Policy |
| **SEPP 33** | State Environmental Planning Policy – 33 Hazardous and Offensive Development |
| **SEPP 55 – Remediation of Land** | State Environmental Planning Policy No 55 – Remediation of Land |
| **$SO_2$** | sulfur dioxide |
| **Southern precast site** | Site of the proposed precast facility at the south of the proposal site with an approximate area of 8 ha |
| **SVOCs** | semi-volatile organic compounds |
| **TECs** | threated ecological communities |
| **Transport for NSW** | Transport for New South Wales |
| **TRH** | Total recoverable hydrocarbons |
| **VOCs** | volatile organic compounds |
| **WSEA** | Western Sydney Employment Area |
| **WSEA SEPP** | State Environmental Planning Policy (Western Sydney Employment Area) 2009 |

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# Appendix A

## Consideration of Environmental Factors and Matters of National Environmental Significance

# Appendix A

## Consideration of Environmental Factors and Matters of National Environmental Significance

### Consideration of clause 228(2) factors and matters of national environmental significance

In addition to the requirements of the Is an EIS required? guideline (Department of Urban Affairs and Planning, 1999) as detailed in the REF, the following factors, listed in Clause 228(2) of the EP&A Regulation have also been considered in Table A1-1 to assess the likely impacts of the proposal on the natural and built environment.

Table A1-1: Review of clause 228(2) environmental factors

| Clause 228 considerations | Impact |
|---|---|
| **a. Any environmental impact on a community.** | |
| Construction of the proposal would result in short-term negative impacts related to noise and vibration, visual amenity, air quality. The proposal would require clearing of about 1.92 hectares (ha) of native vegetation, a subset of which includes the following TECs:<br>• 1.74 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered)<br>• 0.07 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)<br>• <0.001 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 ha of the associated BC Act listed Cumberland Plain Woodland community.<br>The proposal would also result in the partial to total loss of value of 10 Aboriginal sites. One Aboriginal site is located within the boundary of both the proposal site and the planned Archbold Road upgrade and extension boundary. The proposal also has the potential to temporarily impact on identified sensitive receivers and community as described in Section 8.1 (Noise and vibration), Section 8.3 (Landscape and visual character), Section 8.5 (Aboriginal heritage), Section 8.10 (Contamination) and Section 8.11 (Biodiversity). Other potential environmental impacts are negligible and therefore have not been described in further detail. These impacts would be managed according to the mitigation measures outlined in Chapter 9 (Environmental management).<br>The proposal would support the construction and delivery of Sydney Metro West. It would also provide social and economic benefits by providing employment opportunities during construction and operation of the proposal in the Western Sydney area. | Minor adverse |

| Clause 228 considerations | Impact |
|---|---|
| **b. Any transformation of a locality.** | |
| The proposal site is located within an established and future industrial area. During construction, the proposal would result in impacts on the existing locality, which would be predominantly through minor adverse visual amenity impacts associated with the presence of construction vehicles, plant and equipment within the proposal site. However public access to the proposal site is restricted and, based upon the location, topography and existing vegetation these construction activities would not be viewed by concentrations of users with the exception of three viewpoints: two in close proximity from Lenore Drive and one from Sennar Road, Erskine Park. In these views the proposal would be seen in the context of industrial land uses and existing energy infrastructure, increasing the capacity of these views to absorb the proposal.<br>During operation, the proposal would modify the landscape character from undeveloped land however the proposal would be consistent with the general industrial uses identified for the future development of the proposal site under the WSEA SEPP. | Minor adverse |
| **c. Any environmental impact on the ecosystems of the locality.** | |
| The proposal has sought to minimise impacts to biodiversity, including through establishing an environmental protection area to retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Construction of the proposal would require clearing of about 1.92 ha of native vegetation, a subset of which includes the following TECs:<br>• 1.74 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered)<br>• 0.07 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)<br>• <0.001 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 ha of the associated BC Act listed Cumberland Plain Woodland community.<br>This vegetation provides habitat (or has the potential to support) other protected threatened species. | Minor adverse |
| **d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality.** | |
| The proposal is located on unused land owned by Sydney Metro that is not publicly accessible.<br>The proposal site is located within an established and future industrial area. The construction and operation of the proposal would result in temporary visual impacts associated with the presence of construction vehicles, plant and equipment within the proposal site.<br>Construction and operation of the proposal would be consistent with the general industrial uses identified for the future development of the proposal site under the WSEA SEPP.<br>The generally isolated vegetation within the proposal site is typically of poor quality. Construction of the proposal would also result in some loss of the area's environmental and scientific quality through habitat and vegetation loss. The proposal has sought to minimise impacts to biodiversity, including through establishing an environmental protection area to retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. | Minor adverse |
| **e. Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations.** | |
| Construction of the proposal would also result in the partial to total loss of value of 10 Aboriginal sites. One Aboriginal site is located within the boundary of both the proposal site and the Archbold Road upgrade and extension boundary. | Moderate adverse |

| Clause 228 considerations | Impact |
|---|---|
| **f. Any impact on the habitat of protected fauna (within the meaning of the *National Parks & Wildlife Act 1974*).** | |
| The native vegetation to be removed for the proposal site provides habitat (or potential habitat) of 18 threatened fauna species (three listed as endangered and 15 as vulnerable under the BC Act). An assessment of significance under the BC Act has been conducted for threatened species that have been identified within the ecological study area or that are considered to have a moderate or high likelihood of occurring in the proposal site due to the presence of suitable habitat. The conclusions of the assessments indicate that a significant impact is considered unlikely on any threatened species or threatened ecological communities listed under the BC Act | Minor adverse |
| **g. Any endangering of any species of animal, plant or other form of life, whether living on land, water or air.** | |
| The proposal would require clearing of about 1.92 ha of native vegetation, a subset of which includes the following TECs:<br>• 1.74 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered)<br>• 0.07 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)<br>• <0.001 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 ha of the associated BC Act listed Cumberland Plain Woodland community.<br>This vegetation provides habitat (or has the potential to support) other protected threatened species. The proposal has sought to minimise impacts to biodiversity, including through establishing an environmental protection area to retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. | Minor adverse |
| **h. Any long-term effects on the environment.** | |
| As described above, the proposal would have the following long-term impacts:<br>• Clearing of about 1.92 ha of native vegetation, a subset of which includes the following TECs:<br>  • 1.74 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered)<br>  • 0.07 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)<br>  • <0.001 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 ha of the associated BC Act listed Cumberland Plain Woodland community.<br>• This vegetation provides habitat (or has the potential to support) other protected threatened species<br>• Partial to total loss of value of 10 Aboriginal sites. One Aboriginal site is located within the boundary of both the proposal site and the Archbold Road upgrade and extension boundary. | Moderate adverse |

| Clause 228 considerations | Impact |
|---|---|
| **i. Any degradation of the quality of the environment.** | |
| Construction of the proposal would result in short-term negative impacts on noise and vibration, visual amenity, and air quality. The proposal would require clearing of about 1.92 ha of native vegetation, a subset of which includes the following TECs:<br>• 1.74 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered)<br>• 0.07 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)<br>• <0.001 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 ha of the associated BC Act listed Cumberland Plain Woodland community.<br>The proposal would also result in the partial to total loss of value of 10 Aboriginal sites. One additional Aboriginal site is located within the boundary of both the proposal site and the planned Archbold Road upgrade and extension boundary. The above issues could impact on identified sensitive receivers and community as described in Section 8.1 (Noise and vibration), Section 8.3 (Landscape and visual character), Section 8.5 (Aboriginal heritage), Section 8.10 (Contamination) and Section 8.11 (Biodiversity). Other potential environmental impacts are negligible and therefore have not been described in further detail. These impacts would be managed according to the mitigation measures outlined in Chapter 9 (Environmental management). | Moderate adverse |
| **j. Any risk to the safety of the environment.** | |
| The mitigation measures included in Chapter 9 (Environmental management) would be introduced to manage potential environmental safety risks including contamination and bushfire. Providing these measures are implemented, managed, monitored and maintained, there would be minor impact. | Minor adverse |
| **k. Any reduction in the range of beneficial uses of the environment.** | |
| The proposal is located on unused land owned by Sydney Metro that is not publicly accessible.<br>Overall, the proposal would generally develop unused or underutilised land consistent with the general industrial uses identified for the future development of the proposal site and adjoining areas under the WSEA SEPP. The proposal would also assist in realising the overall benefits of the Sydney Metro West project as set out in the Sydney Metro West Westmead to The Bays and Sydney CBD – Environmental Impact Statement. | Nil |
| **l. Any pollution of the environment.** | |
| During construction, the proposal has the potential to result in minor short-term noise impacts during high noise intensity construction activities. The proposal also has the potential to result in temporary air pollution from vehicle and machinery emissions, and there is a low risk of accidental spills and leaks. There is also a low risk of water pollution from turbid stormwater following ground disturbance. These impacts would be managed in accordance with the mitigation measures outlined in Chapter 9 (Environmental management). | Minor adverse |

| Clause 228 considerations | Impact |
|---|---|
| **m. Any environmental problems associated with the disposal of waste.** | |
| Sampling and testing of soils in areas of potential contamination concern would be conducted if required to characterise the soils (with respect to contamination) and determine the appropriate waste classification (which may include hazardous wastes or special wastes). Soils would be managed in accordance with the waste classification and disposed of off-site.<br>Illegal dumping has historically taken place across parts of the proposal site. Therefore, there is some risk and potential for encountering controlled waste. Providing the safeguards included in Chapter 9 (Environmental management) are implemented to manage waste, the proposal is unlikely to result in any environmental problems associated with waste. | Nil |
| **n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply.** | |
| The proposal would require limited quantities of common construction materials including concrete, gravel and water. The proposal would not create a substantial demand on these resources. | Nil |
| **o. Any cumulative environmental effect with other existing or likely future activities.** | |
| Cumulative construction traffic associated with the planned Archbold Road upgrade and extension could lead to cumulative impacts on the surrounding road network however construction traffic impacts for both the proposal and the planned Archbold Road upgrade and extension are anticipated to be minimal. As such, cumulative construction traffic impacts are expected to be minor.<br>Cumulative construction noise impacts may occur if construction of the planned Archbold Road upgrade and extension is carried out at the same time as the proposal. However, construction noise levels predicted to be generated by the proposal are generally 'minor' and high noise intensity construction works are of short duration.<br>Cumulative heritage impacts would occur as construction of the proposal and the planned Archbold Road upgrade and expansion footprint would impact on fifteen identified Aboriginal heritage sites in total, reducing the archaeological potential of the region. Sydney Metro would work with Transport for NSW so that impacts to Aboriginal Heritage are managed and minimised where possible.<br>Cumulative biodiversity impacts would occur when the impacts of the proposal are considered together with the planned Archbold Road upgrade and extension project. However, the contribution of the proposal, in relation to this project, to cumulative biodiversity impacts in the Cumberland Plain region is relatively low. | Minor adverse |
| **p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions.** | |
| The proposal would not result in any impact on coastal processes and coastal hazards including those under projected climate change conditions. | Nil |

## Consideration of Matters of National Environmental Significance

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government's Department of Agriculture, Water and the Environment. These issues are considered in Table A1-2. It has been determined the proposal would not have a significant impact on a critically endangered or endangered community or species and would not need to be referred to the Australian Government's Department of Agriculture, Water and the Environment.

Table A1-2: Checklist of EPBC Act matters

| Matters of national environmental significance | Impact |
|---|---|
| **a. World heritage properties.** | |
| There are no items within the proposal site listed on the World Heritage List. | Nil |
| **b. National heritage places.** | |
| There are no items within the proposal site listed on the National Heritage List. | Nil |
| **c. Wetlands of international importance.** | |
| There are no wetlands of international importance in the proposal site or likely to be affected by the proposal. | Nil |
| **d. Nationally threatened species and ecological communities.** | |
| The proposal would establish an environmental protection area to retain an area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, a threatened ecological community as listed under the EPBC Act. Construction of the proposal would require clearing <0.001 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered). An assessment of significance was undertaken for the proposal which concluded that the impact of the proposal on the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community is predicted to be minor.<br>Three threatened animal species listed under the EPBC Act are considered moderately likely to use the habitats in the ecological study area for foraging: the Green and Golden Bell Frog (listed as endangered), the Swift Parrot (listed as critically endangered) and the Grey-headed Flying-fox (listed as vulnerable). However, assessments of significance concluded it is unlikely the proposal would result in a significant impact to these species.<br>In consideration of the above, the proposal would not need to be referred to the Australian Government's Department of Agriculture, Water and the Environment. | Minor adverse |
| **e. Migratory species.** | |
| The proposal would have no impact on a listed migratory species. | Nil |
| **f. Commonwealth marine areas.** | |
| The proposal would have no impact on a Commonwealth marine area. | Nil |
| **g. The Great Barrier Reef Marine Park.** | |
| The proposal would have no impact on The Great Barrier Reef Marine Park. | Nil |
| **h. Protection of water resources from coal seam gas development and large coal mining development.** | |
| The proposal would have no impact on water resources from coal seam gas development and large coal mining development. | Nil |
| **i. Nuclear actions (including uranium mining).** | |
| The proposal does not involve a nuclear action. | Nil |
| **j. Any impact (direct or indirect) on Commonwealth land?** | |
| The proposal would have no impact (direct or indirect) on Commonwealth land. | Nil |

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# Sydney Metro West
# Eastern Creek Precast Facilities

## Review of Environmental Factors

### Volume 2 Technical Appendices B - F

November 2020

Cover: A precast facility used on the Sydney Metro City & Southwest project.

# Appendix B

## Preliminary Contaminated Site Investigation

# Sydney Metro West Eastern Creek Precast Facilities

## Preliminary contaminated site investigation

Rev C | Final

23 October 2020

**Sydney Metro**

IA199800

# Sydney Metro West Eastern Creek Precast Facilities

| | |
|---|---|
| Project No: | IA199800 |
| Document Title: | Preliminary contaminated site investigation |
| Revision: | C |
| Document Status: | Final |
| Date: | 23 October 2020 |
| Client Name: | Sydney Metro |
| Client No: | Client Reference |
| Project Manager: | Westley Owers |
| Author: | David Harris and Michael Stacey |
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Jacobs Australia Pty Limited

Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.jacobs.com



## Document history and status

| Revision | Date | Description | Author | Checked | Reviewed | Approved |
|---|---|---|---|---|---|---|
| A | 08/05/2020 | Draft PCSI | DH/MS | MS | MS | |
| B | 10/07/2020 | Revised PCSI | MS | | | |
| C | 23/10/2020 | Revised PCSI | MS | | | |
| | | | | | | |
| | | | | | | |

## Contents

# Executive Summary

Jacobs has undertaken a preliminary contaminated site investigation (PCSI) of the proposed precast facility sites located at Lenore Drive, Eastern Creek NSW (the proposal site) as part of key deliverables and scope to inform a Review of Environmental Factors (REF).

The PCSI has included a review of desktop information, a site walkover inspection, an assessment of potential areas and sources of on-site and off-site contamination, an assessment of the potential impacts to human health and the environment from exposure to contamination during construction / operation of the proposal site, potential mitigation / management measures, and recommendations for further works where necessary.

The findings of the PCSI have identified a moderate potential for on-site contamination (soil) as a result of historic filling activities, the former use of the proposal site (agricultural land use), potential for contaminated sediments within farm dams and the presence of fly tipped wastes.

On-site soil and groundwater contamination if exposed during construction activities and operation of the proposal site could impact upon human health and environmental receptors if appropriate management / remediation measures are not adopted in response to contamination risks.

To quantify the potential contamination impacts identified, the following is mitigation measures would be implemented:

- For areas that have been identified as having moderate contamination impact potential, a further review of data would be performed
- Where data from the additional data review is insufficient to understand the impact of contamination, a Detailed Site Investigation would be carried out in accordance with the NEPM (2013) and other guidelines made or endorsed by the NSW EPA.

# 1. Introduction

## 1.1 Sydney Metro West Eastern Creek Precast Facilities

Sydney Metro propose to establish two precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. A Review of Environmental Factors (REF) has been prepared for the proposal seeking approval under Part 5 of the Environmental Planning and Assessment 1979 (EP&A Act).

The proposal would comprise the following key features and activities:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
  - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
  - Boiler, aggregate bins and consumables
  - Office facilities
  - On-site parking for up to 60 light vehicles
- Internal roads with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The northern and southern precast facilities would operate concurrently, 24 hours a day, seven days a week for the majority of the lifespan of the project.

The proposed layout of the proposal is provided in Figure 1-1.

The future use of the site beyond the operation of the proposal would be determined by Sydney Metro and would be subject to separate approvals, as required. If no future use of the site is proposed at that time, the site would be placed into care and maintenance.

The proposal does not include the construction of the surrounding road network (upgrade and extension of Archbold Road), which would be undertaken by Transport for NSW under separate approval.

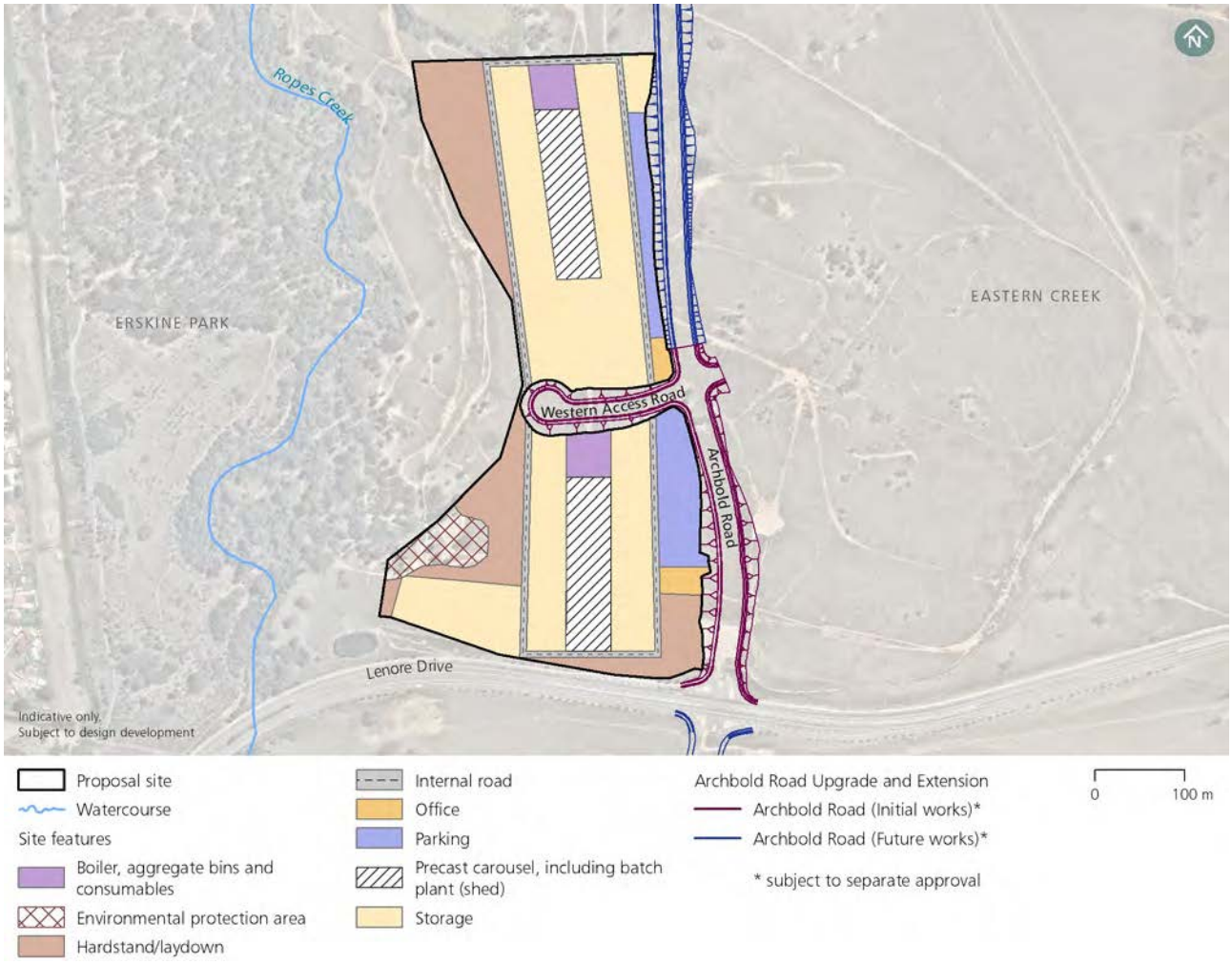



Figure 1-1 The proposal

## 1.2 Purpose and scope of this report

This technical paper is one of several technical papers that form part of a Review of Environmental Factors (REF). The purpose of this technical paper is to provide a Preliminary contaminated site investigation (PCSI) to assess the potential contamination impacts to construction and operation of the proposal associated with historical and current contaminating activities and/or operations undertaken and environmental receptors on or adjacent to the contamination study area (i.e. the proposal site and surrounding areas) for inclusion into the REF. The report presents factual information derived through desktop review of available information relevant to potential contamination issues, and the observations from a site walkover inspection.

## 1.3 Structure of this report

The remainder of this report is structured as follows:

- Chapter 2 provides the legislative and policy context relating to contamination
- Chapter 3 explains the assessment methodology including a method for assessing the potential contamination impacts to construction and operation of the proposal
- Chapter 4 details the existing environment
- Chapter 5 documents the contamination study area site history
- Chapter 6 describes the information reviewed for the contamination assessment
- Chapter 7 documents details of the observations made during the site inspection
- Chapter 8 identifies any potential contamination sources within the contamination study area
- Chapter 9 provides an assessment of the potential contamination impacts of the proposal during construction and operations
- Chapter 10 identifies mitigation and management measures.

# 2. Legislative and policy context

This section outlines the state and local strategies relevant to contamination assessment of the contamination study area.

## 2.1 Relevant contamination guidelines

In preparing this PCSI, the following guidelines were considered (where relevant):

- Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land (Department of Urban Affairs and Planning and Environment Protection Authority (EPA), 1998)
- Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA, 2020)
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (as revised 2013)
- PFAS National Environmental Management Plan ver. 2.0 (HEPA, January 2020).

Should further investigations, remediation work and validation be carried out, these activities would be carried out in accordance with the following guidelines or other appropriate/endorsed guidelines available at that time:

- Guidelines made or approved under section 105 of the *Contaminated Land Management 1997*, including
  - Contaminated Sites: Sampling Design Guidelines (EPA, 1995)
  - Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition) (EPA, 2017)
  - Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination (DEC, 2007)
  - Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 Environment Protection Authority, 2015
- Australian Standard (AS 4482.1-2005) Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds
- Australian Standard (AS 4482.2-1999) Guide to the sampling and investigation of potentially contaminated soils – Volatile substances
- Managing asbestos in or on soil (WorkCover NSW, 2014). [Online] Available at: http://www.safework.nsw.gov.au/__data/assets/pdf_file/0005/329171/Managing-asbestos-in-soil-guide.pdf
- Technical Note: Light Non-Aqueous Phase Liquid Assessment and Remediation (EPA, 2015)
- Information for the assessment of former gasworks sites (DEC, 2005)
- Vapour Intrusion: Technical Practice Note (DECW, 2010)
- Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (EPA, 2012)
- Best Practice Note: Landfarming (EPA, 2014)
- Waste Classification Guidelines (EPA, 2014)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2018).

# 3. Methodology

This section provides an overview of the contamination study area and methodology for this PCSI.

## 3.1 Contamination Study Area

To account for potential soil, groundwater and vapour contamination that may be present as a result of historical and / or current activities carried out on and / or adjacent to the proposal site, the contamination study area for this investigation is defined as the construction/operational footprint (referred to herein after as the proposal site), and surrounding land within approximately one kilometre of the proposal site area Figure 3-1.

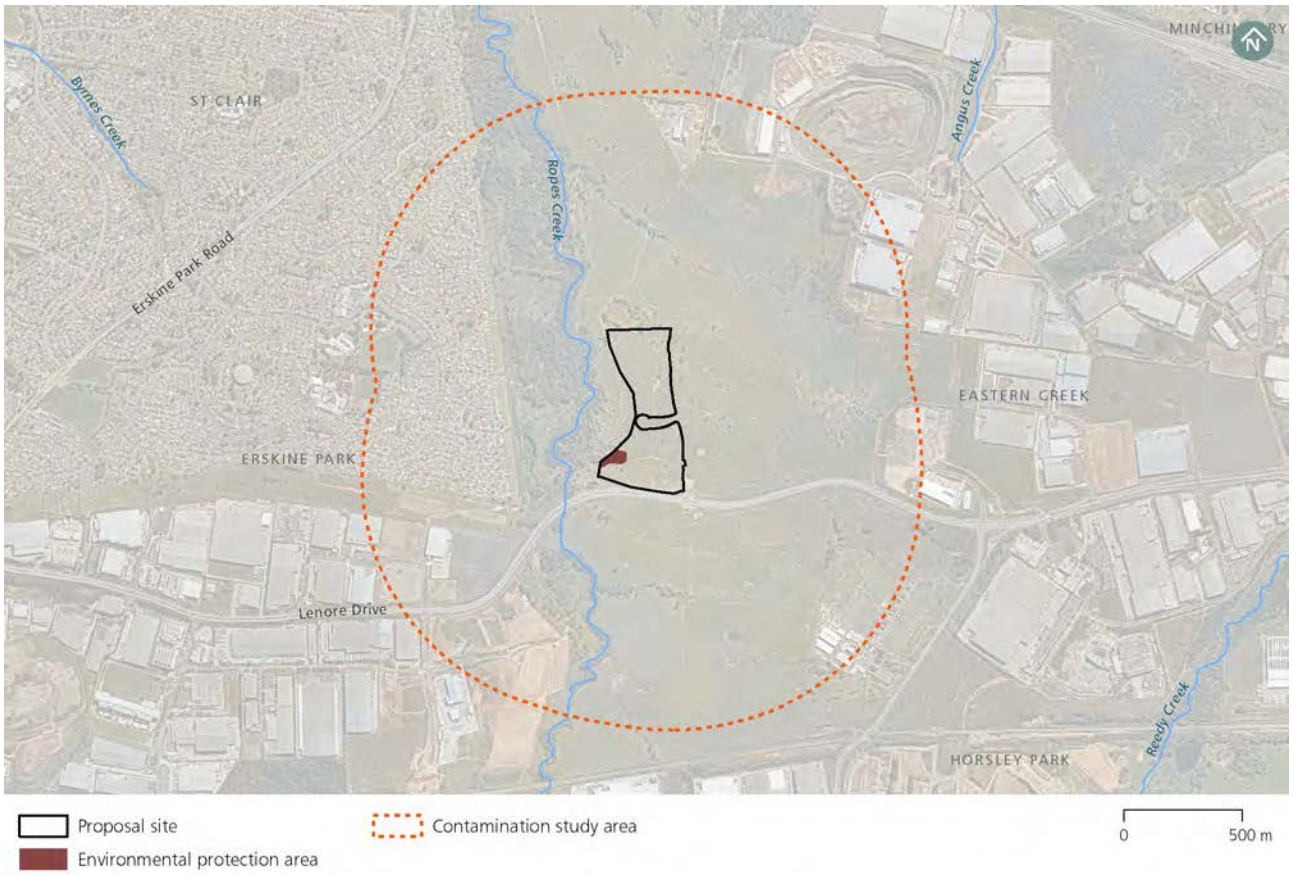



Figure 3-1 Contamination study area

## 3.2 Study methodology

The scope of works undertaken for the PCSI was as follows:

- A review of available information relating to the physical environment within the contamination study area, including topography, geology, hydrogeology, soils and surface waters.
- A review of historical aerial photography and maps.
- A review of publicly available information including (but not limited to) NSW Environment Protection Authority (NSW EPA) databases and Department of Primary Industries, Office of Water licensed groundwater bore database.
- A review of recent and historic reports relevant to contamination and / or intrusive ground investigations undertaken within the contamination study area.
- Site walkover inspection

- Identification and description of Areas of Environmental Interest (AEI's)
- Conclusions and recommendations.

## 3.3 Desktop assessment

The desktop assessment involved a review of available information relevant to the contamination study area as detailed in the Lotsearch report LS011866 EP, Lenore Drive Eastern Creek dated 3 April 2020 (Appendix A) and other publicly available information sources to understand the existing environment and the potential for contamination sources to be present within the contamination study area. The review of information included:

- Review of existing land uses within the contamination study area and information on topography, drainage, geology, soils, hydrogeology and receiving environments
- Review of historical aerial photographs and maps as contained within the Lotsearch (April 2020) report
- Review of publicly available information as contained within the Lotsearch (April 2020) report
- Publicly available information available via general internet searches for the key words (contamination, remediation and site investigation) for suburbs and major projects within the contamination study area
- Review of information provided by Sydney Metro, including relevant design plans.

## 3.4 Site inspection

A site walkover inspection was conducted on 8 April 2020 by an environmental scientist.

## 3.5 High-level prioritisation exercise

A high-level prioritisation exercise was carried out to assist in assessing the potential impact from construction and operation to expose contamination to human and/or ecological receptors. The exercise considered source-pathway-receptor relationships consistent with a conceptual site model as defined by the National Environment Protection (Assessment of Site Contamination) Measure 1999, as revised 2013 (NEPM, 2013). The prioritisation exercise considered the following:

*Contamination severity and extent*

- Known or potential sources of contamination and likely potential contaminants of concern
- The type of potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air)
- Approximate spatial distribution of potential contamination, and proximity to the proposal site.

The nature of construction and operational activities proposed as part of the proposal (e.g. surface disturbance, cut-and-fill areas) and whether such activities would expose known or potential areas of contamination.

*Pathways and receptors*

- Assessment of potential pathways from a contamination source to a receptor without mitigation measures. Pathways were considered to include dust generation, vapour/gas emissions, excavation and disposal or reuse of soils, extraction and disposal or reuse of groundwater from dewatering or drainage, migration of groundwater via preferential pathways and surface water erosion. It was assumed that where construction or operational activities would expose known or potential areas of contamination, the exposure pathways to construction workers could be complete. Where construction or operational activities are located within and/or adjacent to sensitive environmental receptors, pathways could exist as a result of uncontrolled site discharges during construction
- Potential human and ecological receptors (including location, and potential for primary or secondary contact with contamination). Potential receptors were considered to comprise project construction workers and visitors, operational site users, the general public and nearby residents and commercial workers in the surrounding land use, intrusive maintenance workers, receiving water bodies and ecological receptors.

Exposure pathways to these receptors were considered to include direct dermal contact (der), ingestion (ing) or inhalation (inh) by human receptors and uptake by aquatic flora and intake by aquatic fauna.

Based on this prioritisation exercise, areas of environmental interest (AEI) were categorised into five categories of contamination potential (very low, low, moderate, high and very high) representing potential impacts during construction and operation without management and mitigation measures. The matrix used for categorising potential impacts from construction and operation is provided in Table 3-1.

The categories of potential contamination impact to construction or operational activities represent a qualitative assessment. Although not definitive, examples of the contamination status represented by the categories is provided below:

- *Very low to low impact* could represent smaller volumes of contaminated materials, likely to be limited to surface soils, with pathways readily managed with typical soil and water controls and personnel protective equipment (PPE), and readily remediated by standard construction methods and management measures
- *Moderate impact* could represent larger volumes of contaminated materials, with pathways readily managed with typical soil and water controls and PPE and readily remediated by standard construction methods or smaller volumes of more complex contamination which may require specialised remediation methods and specialised management measures for pathways and/or administrative controls during operation
- *High to very high impact* could represent more significant exposure risks, contaminated groundwater and gas/vapours, increased quantum of contaminated materials and wider contamination extent requiring remediation and specialised remediation methods. Pathways may require specialised management measures for example, positive pressure tents, odour control and/or engineering controls during operation.

Table 3-1: Contamination impact potential matrix

| | | Contamination severity and extent | | | | |
|---|---|---|---|---|---|---|
| | | **SE1** Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent | **SE2** Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent | **SE3** Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread | **SE4** Known contamination present in the media of concern at concentrations above the relevant assessment criteria and limited in extent | **SE5** Known contamination present in the media of concern at concentrations above the relevant assessment criteria and widespread |
| **Pathways and receptors** | **PR1** Media of concern is unlikely to coincide with or otherwise impact on the project *AND/OR* No or unlikely exposure pathway for human or ecological receptor's during construction and/or operation | Very low | Low | Low | Moderate | Moderate |
| | **PR2** Media of concern may intersect the project *AND* Exposure pathway for human or ecological receptors could be present and complete during construction and/or operation | Low | Moderate | Moderate | High | High |
| | **PR3** Media of concern would intersect the project *AND* Exposure pathway for human or ecological receptors could be present and complete during construction and/or operation | Moderate | Moderate | High | High | Very high |

# 4. Existing environment

This section includes a description of the existing environment, zoning, and land use characteristics and features across the contamination study area (i.e. proposal site and surrounding areas) for the purpose of informing conditions relevant to contamination assessment.

## 4.1 Site identification

The proposal site is irregular in shape and is located between Lenore Drive and the M4 Motorway in Erskine Park. The particulars of the contamination study area are identified in Table 4-1.

Table 4-1 Site details

| Particulars | Description |
|---|---|
| Address | Lenore Drive, Erskine Park |
| Legal description | Part of Lot 10, deposited plan (DP) 1157491 |
| Local government area | City of Blacktown |
| Site dimensions | Area: About 16 ha |

## 4.2 Zoning and land use

At the time of preparing this PSCI, the proposal site was adjacent to a combination of land uses including:

- North: Open space (cleared grazing land)
- East: Open space (cleared grazing land)
- South: Lenore Drive, open space (cleared grazing land) and substation (Sydney West Substation)
- West: Ropes Creek and Erskine Park residential area (west of the creek).

A review of the Lotsearch (April 2020) report indicated that a number of environmental planning instruments (EPI) apply to the proposal site including:

- State Environmental Planning Policy (Western Sydney Employment Area) 2009 (WSEA SEPP)
- Blacktown Local Environment Plan Amendment (Western Sydney Employment Area) 2013
- Blacktown Local Environment Plan 2015 (BLEP 2015).

Based on the WSEA SEPP, the proposal site is wholly within IN1 – General industrial zoning.

## 4.3 Geology

Reference to the Penrith 1:100,000 surface geology mapping sheet indicates that the majority of the proposal site is underlain by Bringelly Shale of the Wianamatta Group. Areas adjacent to the western boundary of the proposal site are underlain by Quaternary alluvium (adjacent to Ropes Creek).

Descriptions of the surface geological units are summarised in Table 4-2.

Table 4-2 Summary of surface geology across the proposal site

| Unit | Descriptions |
|---|---|
| Quaternary Alluvium | The surface geology comprises Quaternary alluvium consisting of fine-grained sand, silt and clay from Quaternary fluvial deposition. |
| Bringelly Shale | The Bringelly Shale is a complex formation composed of a variety of lithologies with highly ceramic properties. Its plasticity is variable but generally higher than that of the Ashfield Shale because of the generally lower siderite content. Lithologies which comprise the Bringelly shale are in order of decreasing volumetric significance: claystone and siltstone, laminate, sandstone, coal and highly carbonaceous claystone, and tuff (Cobbity Claystone Bed). Claystone and siltstone are dominant while thin laminate horizons occur throughout. Sandstone is minor and sporadic, forming prominent "benches" in outcrop. The lower 30 m of the Bringelly Shale is usually distinctive being relatively thinly bedded and containing the most carbonaceous sediments within the Wianamatta Group. Above this lower zone, claystone, siltstone and sandstone units are more thickly bedded. |

## 4.4 Soils

A review of the Penrith 1:100,000 soil landscape mapping sheet indicates that the majority of the proposal site is underlain by the Blacktown Soil Landscape. Areas adjacent to the western boundary of the proposal site is underlain by the South Creek Soil Landscape (adjacent to Ropes Creek).

Descriptions of the soil landscape units are summarised in Table 4-3.

Table 4-3 Summary of soil landscapes across proposal site

| Unit | Description |
|---|---|
| Blacktown | Are typically located on the flat to gently undulating terrain between creek channels and are described as shallow to moderately deep (<100cm) clays and silty clays derived from Bringelly Shale.<br>The soil landscape typically comprises hard setting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines. Limitations associated with this soil landscape include high erodibility, shrink-swell potential, salinity, low fertility and localised areas of permanently high water tables or seasonal waterlogging. |
| South Creek | Described as Quaternary alluvium derived from Wianamatta Group shales that comprise deep sandy, sandy clay and clay soils.<br>The soil landscape often consists of very deep layered sediments over bedrock or relic soils and is typically a dynamic soil landscape with many areas of erosion and deposition.<br>Limitations associated with this soil landscape include high erodibility, shrink-swell potential, salinity, low fertility and localised areas of permanently high-water tables or seasonal waterlogging. |

## 4.5 Topography and drainage

Topography data presented by Lotsearch (April 2020) indicated that the proposal site generally slopes from east to west towards Ropes Creek. The steepest and most elevated topography is located along the eastern boundary of the proposal site. The elevation of the site varies between 44 m Australian Height Datum (AHD) adjacent to the western boundary in proximity to Ropes Creek to approximately 60m AHD along the eastern boundary of the proposal site.

The majority of the proposal site is unsealed and is covered by grassed and exposed earth.

Rainfall falling onto the proposal site is likely to infiltrate directly into the sub-soils within the site with run-off likely to occur as overland flows which would discharge directly into Ropes Creek and minor drainage lines / features present on proposal site.

Overall, site drainage is likely to be to the west towards Ropes Creek.

## 4.6 Groundwater bore database

The Lotsearch (April 2020) report search of the NSW Department of Primary Industries (DPI) – Office of Water registered groundwater bore database and the Bureau of Meteorology National Groundwater Information System indicated that there were no registered groundwater bores within 500 metres of the proposal site. This is considered to be an adequate buffer where proposed construction works are unlikely to impact upon the use of groundwater bores. No registered groundwater bores were identified to be located within the proposal site. The groundwater assessment (refer to Section 8.9 of the REF) states that changes to groundwater levels associated with the construction and operation of the proposal are likely to be minor, with potential changes unlikely to cause adverse environmental impacts or drawdown at existing licensed bores.

A full list of all registered bores identified within a two kilometre buffer of the proposal site is provided in the Lotsearch (April 2020) report.

## 4.7 Sensitive receptors

A number of sensitive receiving environments have been identified on and/or adjacent to the proposal site through the desktop assessment, including:

- Remnants of Cumberland Plain vegetation including Shale Plains Woodland, Alluvial Woodland, Shale Hills Woodland and Shale/Gravel Transition Forest – located on proposal site and within the contamination study area
- Ropes Creek – located approximately 150 metres to the west of the proposal site and within the contamination study area
- Terrestrial groundwater dependent ecosystems (high potential) – adjacent to the south western proposal site boundary (outside of the proposal site) and in the vicinity of Ropes Creek. Based on information from the Biodiversity Assessment Report (Jacobs, 2020), a small area of ponded water in an offshoot of Ropes Creek within the north-west of the ecological study area (outside of the proposal site) may qualify as a GDE, however these wetlands are man-made and exist due to damming of a small catchment of rain and ponding of stormwater next to Lenore Drive. No other GDEs have been identified in or around the proposal site however the biodiversity study area has only assessed a 50m buffer area.
- Terrestrial groundwater dependent ecosystems (moderate to low potential) – approximately 500 metres east of the proposal site
- Terrestrial inflow dependent ecosystems - adjacent to the south western site boundary and approximately 500 metres east of the proposal site.

# 5. Site History

## 5.1 Historical Aerial Imagery

Aerial imagery was reviewed for the years 1956, 1961, 1965, 1970, 1982, 1991, 2000, 2007, 2009, 2014 and 2019 to assess land use and changes in general conditions within and adjacent to the proposal site. The findings of the aerial imagery review are summarised in Table 5-1. Historical aerial imagery is presented in the Lotsearch (April 2020) report provided in Appendix A.

Table 5-1 Summary of historical aerial imagery

| Years | Proposal site | Surrounding Area |
|---|---|---|
| 1956 | The proposal site is largely open space (possible grazing land) with some scattered trees.<br>A large dam is present partially within the northern portion of the proposal site.<br>Drainage lines are visible within the northern and southern portions of the proposal site (southern drainage lines are less defined). | Areas surrounding the proposal site comprise open space (possible grazing land) with scattered trees.<br>Areas surrounding Ropes Creek are well vegetated.<br>There are a number of structures (nominal three) located to the north of the proposal site (possible residential dwellings and outbuildings).<br>A quarry is present to the north east of the proposal site.<br>Archbold Road is evident to the north east of the proposal site. |
| 1961 | The proposal site is generally unchanged from the 1956 imagery with the exception of a small dam possibly constructed within the southern drainage line. | Areas surrounding the proposal site are generally unchanged from the 1956 imagery with the exception of the following:<br>▪ an additional structure (possible shed) present to the north east of the proposal site<br>▪ a number of small dams have been constructed adjacent to drainage lines to the north and east of the proposal site<br>▪ vegetation clearing on a property to the west of the proposal site<br>▪ increased quarrying operations to the north east of the proposal site. |
| 1965 | The proposal site is generally unchanged from the 1961 imagery. | Areas surrounding the proposal site are generally unchanged from the 1961 imagery with the exception of the following:<br>▪ high voltage transmission towers (possible four sets of three towers) have been constructed to the east of the proposal site.<br>▪ increased quarrying operations including stockpiling to the north east of the proposal site. |
| 1970 | The proposal site is generally unchanged from the 1965 imagery. | Areas surrounding the site are generally unchanged from the 1965 imagery with the exception of the following:<br>▪ additional high voltage transmission towers (possible seven sets of two towers) have been constructed to the east of the proposal site.<br>▪ possible race track to the west of the proposal site |

| Years | Proposal site | Surrounding Area |
|---|---|---|
| | | ▪ substation has been constructed to the south east of the proposal site<br>▪ increased quarrying operations including stockpiling to the north east of the proposal site. |
| 1982 | The proposal site is generally unchanged from the 1970 imagery with the exception of darkened areas (possible grass fire) observed across the central portion of the proposal site. | Areas surrounding the proposal site are generally unchanged from the 1970 imagery with the exception of the following:<br>▪ darkened areas (possible grass fire) observed extending to the east of the proposal site<br>▪ increased quarrying operations including stockpiling to the north east of the proposal site. |
| 1991 | The proposal site is generally unchanged from the 1982 imagery. | Areas surrounding the proposal site are generally unchanged from the 1982 imagery with the exception of the following:<br>▪ a number of objects / structures (possible truck parking / sheds) are located to the north of the proposal site<br>▪ Erskine Park (to the west of the proposal site) has been developed for residential purposes<br>▪ increased quarrying operations including stockpiling to the north east of the proposal site. |
| 2000 | The proposal site is generally unchanged from the 1991 imagery. | Areas surrounding the proposal site are generally unchanged from the 1991 imagery with the exception of the following:<br>▪ increased quarrying operations including stockpiling to the north east of the proposal site. |
| 2007 | The proposal site is generally unchanged from the 2000 imagery with the exception of increased tracks evident throughout the northern portion of the proposal site. | Areas surrounding the proposal site are generally unchanged from the 2000 imagery with the exception of the following:<br>▪ a portion of the drainage line to the north east of the proposal site has been redirected and the drainage lined filled.<br>▪ increased quarrying operations including stockpiling to the north east of the proposal site. |
| 2014 | The proposal site is generally unchanged from the 2007 imagery with the exception of increased tracks evident throughout the proposal site. | Areas surrounding the site are generally unchanged from the 2007 imagery with the exception of the following:<br>▪ the majority of the structures (residential dwellings / sheds) previously present to the north of the proposal site have been demolished / removed<br>▪ Lenore Drive has been constructed<br>▪ increased quarrying operations including stockpiling to the north east of the proposal site. |

| Years | Proposal site | Surrounding Area |
|---|---|---|
| 2019 | The proposal site is generally unchanged from the 2014 imagery. | Areas surrounding the proposal site are generally unchanged from the 2014 imagery with the exception of the following:<br>▪ a number of commercial premises have been constructed to the east of the proposal site<br>▪ increased quarrying operations including stockpiling to the north east of the proposal site. |

## 5.2 Historical maps

Historical topographical maps were reviewed for the years 1929, 1942, 1975 and 2015 to assess land use and changes in general conditions within and adjacent to the proposal site. The findings of the historical map review are summarised in Table 5-2. Historical maps are presented in the Lotsearch (April 2020) report provided in Appendix A.

Table 5-2 Summary of historical topographic maps

| Years | Proposal site | Surrounding Area |
|---|---|---|
| 1929 | The proposal site is largely open space.<br>The map indicates that a structure may have been present on site on the western boundary of the proposal site. | Areas surrounding the proposal site generally comprise open space with scattered structures.<br>The Great Western Road is present to the north of the proposal site.<br>A vineyard is present to the north east of the proposal site.<br>A quarry is present to the east of the proposal site.<br>Ropes Creek is present to the west of the proposal site.<br>A drainage line is visible to the north of the proposal site.<br>Archbold Road is an unsealed road to the north east of the proposal site.<br>Increased development (more structures and roads) are present in areas to the north west of the proposal site. |
| 1942 | The proposal site is generally unchanged from the 1929 map with the exception of the single structure identified on the 1929 map appears to be located to the west of the proposal site boundary. | Areas surrounding the proposal site are generally unchanged from the 1929 map. |
| 1975 | The proposal site is generally unchanged from the 1942 map with the exception of a dam present partially within the northern portion of the proposal site. | Areas surrounding the proposal site are generally unchanged from the 1942 map with the exception of the following:<br>▪ transmission lines are present to the north, east, east and south of the proposal site<br>▪ the single structure to the west of the proposal area is not present<br>▪ structures are present to the north and north east of the proposal site<br>▪ the Great Western Highway is present to the north of the proposal site |

| Years | Proposal site | Surrounding Area |
|---|---|---|
| | | ▪ overburden is present to the north and east of the proposal site<br>▪ a substation is present to the south of the proposal site<br>▪ a dam and increased structures are present to the west of the proposal site. |
| 2015 | The proposal site is generally unchanged from the 1975 map with the exception of the following:<br>▪ a small water feature (possible dam) is present within the south western portion of the proposal site<br>▪ a drainage line is present within the north eastern portion of the proposal site. | Areas surrounding the proposal site are generally unchanged from the 1942 map with the exception of the following:<br>▪ a structure is present to the north east of the proposal site<br>▪ a drainage line is present to the north and north east of the proposal site<br>▪ the M4 Motorway is present to the north of the proposal site<br>▪ a number of dams are present to the east of the proposal site<br>▪ residential development to the west of the proposal site. |

Review of the historic aerial imagery and topographic maps has identified a number of potential sources of contamination and and/or adjacent to the proposal site, including:

- The degradation and potentially inappropriate demolition of structures within the contamination study area (including transmission towers) containing hazardous building materials – located to the north, east and south of proposal site.
- Sediments within on-site dams (potential contaminant sink) – northern portion of the proposal site. Based on topographical information, the dam located within the northern portion of the proposal site is likely to receive surface water flows from commercial/industrial areas to the east of the proposal site. The dam located within the southern portion of the site is likely to only receive localised surface water flows from undeveloped areas located to the east and south east of the proposal site.
- General agricultural use including localised contamination associated with chemical use / storage and waste disposal and more diffuse contamination associated with pesticide / herbicide use – within and adjacent to the proposal site.
- Substation operations including transformer oils and the use / storage of Aqueous Film Forming Foam (AFFF) – located to the south east of the proposal site.
- Potential use of overburden (material of unknown quality) – located to the north and east of the proposal site.

# 6. Information review

## 6.1 NSW EPA contaminated sites register

A search of the NSW EPA Contaminated Sites Record of Notices (under section 58 of the *Contaminated Land Management Act 1997*) and the list of contaminated sites notified to the NSW EPA (under section 60 of the *Contaminated Land Management Act 1997*) as detailed in the Lotsearch (April 2020) report indicated that there was one site registered with the NSW EPA within one kilometre of the proposal site that was either regulated, formerly regulated or had been notified. The site is summarised in Table 6-1.

Table 6-1: NSW EPA regulated / formerly regulated / notified sites within 1 km of the proposal site

| Site | Site address | Regulated / formerly regulated / notified | Site activity | Location relative to proposal site (approx.) | Contamination status |
|---|---|---|---|---|---|
| Fulton Hogan Industries (formerly Pioneer Road Services) | Honeycomb Drive, Eastern Creek | Notified | Other industry | 750 m (east) | Regulation under CLM Act not required |

Based on the review of the NSW EPA contaminated sites register, considering that the NSW EPA does not require contamination from the Fulton Hogan Industries site to be regulated, the potential for contamination from the Fulton Hogan Industries site to impact upon construction and/or operation of the proposal is likely to be low.

## 6.2 Environmental Protection Licences

A search of the NSW EPA Protection of the Environment Operations (POEO) Act public register (under section 308 of the *POEO Act 1997*) as detailed in the Lotsearch (April 2020) report indicated there were three sites (based on property addresses) within one kilometre of the proposal site that have current environmental protection licences (EPL). The sites are summarised in Table 6-2.

Table 6-2: Sites with current EPL within 1 km of the proposal site

| Organisation | Site address | Licence holder | Activity | Location relative to proposal site (approx.) |
|---|---|---|---|---|
| NSW Electricity Networks Operations Pty Ltd | 200 Old Wallgrove Road, Eastern Creek | Transgrid | Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste | 700 m (south east) |
| Dial-A-Dump Pty Ltd | Honeycomb Drive, Eastern Creek | Genesis Facility | Waste disposal by application to land | 1 km (north east) |
| Dial-A-Dump Pty Ltd | Honeycomb Drive, Eastern Creek | Genesis Facility | Waste storage - other types of waste | 1 km (north east) |
| Dial-A-Dump Pty Ltd | Honeycomb Drive, Eastern Creek | Genesis Recycling Facility | Composting | 1 km (north east) |
| Dial-A-Dump Pty Ltd | Honeycomb Drive, Eastern Creek | Genesis Recycling Facility | Recovery of general waste | 1 km (north east) |

| Organisation | Site address | Licence holder | Activity | Location relative to proposal site (approx.) |
|---|---|---|---|---|
| Dial-A-Dump Pty Ltd | Honeycomb Drive, Eastern Creek | Genesis Recycling Facility | Waste storage - other types of waste | 1 km (north east) |
| Fulton Hogan Industries Pty Ltd | Honeycomb Drive, Eastern Creek | Fulton Hogan Industries Pty Ltd | Recovery of general waste; Waste storage - other types of waste | 750 m (east) |

A search of the POEO Act public register (under section 308 of the *POEO Act 1997*) as detailed in the Lotsearch (April 2020) report indicated there were three sites (based on property addresses) within one kilometre of the proposal site that had EPLs no longer in force or that had been surrendered. The sites are summarised in Table 6-3.

Table 6-3: Sites with former EPL within 1 km of the proposal site

| Organisation | Site address | Issued date | Activity | Location relative to proposal site (approx.) |
|---|---|---|---|---|
| Luhrmann Environment Management Pty Ltd | Waterways throughout NSW | 6 September 2000 | Other Activities / Non Scheduled Activity - Application of Herbicides | On-site (northern portion of proposal site) and close proximity to western boundary |
| Robert Orchard | Various waterways throughout NSW | 7 September 2000 | Other Activities / Non Scheduled Activity - Application of Herbicides | On-site (northern portion of proposal site) and close proximity to western boundary |
| Sydney Weed and Pest Management Pty Ltd | Waterways throughout NSW | 9 November 2000 | Other Activities / Non Scheduled Activity - Application of Herbicides | On-site (northern portion of proposal site) and close proximity to western boundary |
| Hanson Construction Materials Pty Ltd | Wallgrove Road, Eastern Creek | 2 November 2000 | Concrete works | 750 m (east) |
| Hanson Construction Materials Pty Ltd | Wallgrove Road, Eastern Creek | 2 November 2000 | Crushing, grinding or separating | 750 m (east) |
| Hanson Construction Materials Pty Ltd | Wallgrove Road, Eastern Creek | 2 November 2000 | Land-based extractive activity | 750 m (east) |
| Hanson Construction Materials Pty Ltd | Wallgrove Road, Eastern Creek | 2 November 2000 | Recovery of general waste | 750 m (east) |
| Hanson Construction Materials Pty Ltd | Wallgrove Road, Eastern Creek | 2 November 2000 | Waste storage – other types of waste | 750 m (east) |

| Organisation | Site address | Issued date | Activity | Location relative to proposal site (approx.) |
|---|---|---|---|---|
| Nace Civil Engineering Pty Ltd | Erskine Park Link Road, Erskine Park | 11 March 2011 | Road construction | Adjacent to southern site boundary |

The EPLs issued (historic and current) to activities within one kilometre of the proposal site are associated with waste management, herbicide application to waterways, quarrying, cement related operations and road construction. EPLs generally detail requirements for the management of pollution risks associated with the licenced activities. As such, if activities are operating in accordance with their respective EPL, the risk of those activities causing contamination would be reduced. Potential contamination impacts to construction and / or operation would likely be associated with those licenced activities relating to waste management and which store/use chemicals which could cause groundwater contamination (bulk chemical storage/use and liquid waste management) and generate landfill gas and vapours adjacent to the proposal site.

## 6.3 Other NSW EPA information

### 6.3.1 EPA sites with other contamination issues

A search of NSW EPA sites with other contamination issues (i.e. James Hardie asbestos manufacturing and waste disposal sites, radiological investigation sites in Hunters Hill and Pasminco lead abatement strategy area) as detailed in the Lotsearch (April 2020) report indicated no records within the site, or within one kilometre of the proposal site.

### 6.3.2 Former gasworks

A search of former gasworks sites as detailed in the Lotsearch (April 2020) report indicated no records within the proposal site, or within one kilometre of the proposal site.

### 6.3.3 EPA PFAS investigation program

A search of EPA PFAS investigation program as detailed in the Lotsearch (April 2020) report indicated no records within the proposal site, or within one kilometre of the proposal site.

## 6.4 Waste management and liquid fuel facilities

A search of waste management and liquid fuel facilities sites as detailed in the Lotsearch (April 2020) report indicated one record listed on the National Waste Management Site Database within one kilometre of the proposal site. The proposal site is summarised in Table 6-4.

Table 6-4: Waste management and liquid fuel facilities within one kilometre of the proposal site

| Site | Site address | Facility type | Facility class | Location relative to proposal site (approx.) |
|---|---|---|---|---|
| Genesis Xero Waste – Landfilling and Recycling | Honeycomb Drive, Eastern Creek | Waste management | Reprocessing | 1 km (north east) |

Potential contamination issues associated with the recorded waste management facilities could include potential impacts to groundwater and/or surface water as a result of offsite migration of chemicals (via infiltration into underlying groundwater or surface water discharge) and generation of landfill gas. Contaminants of potential concern include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), organic contaminants, hydrocarbons, heavy metals, PFAS compounds and methane.

## 6.5 Department of Defence

A search of Defence sites subject to the PFAS investigation program, PFAS management program and/or three year regional contamination investigation program as detailed in the Lotsearch (April 2020) report indicated no records within the proposal site, or within one kilometre of the proposal site.

## 6.6 Airservices Australia

A search of Airservices Australia sites subject to the national PFAS management program as detailed in the Lotsearch (April 2020) report indicated no records within the proposal site, or within one kilometre of the proposal site.

## 6.7 Business directory search

A search of business directory listing between the years 1950 to 1991 as detailed in the Lotsearch (April 2020) was undertaken.

Businesses with potential contaminating activities are based on those industries detailed in the Australian Standard *Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1-2005).

- Agricultural / horticultural activities
- Airports
- Asbestos production and disposal
- Battery manufacture and recycling
- Breweries / distilleries
- Chemicals manufacture and use
- Defence works
- Drum reconditioning
- Dry cleaning
- Electrical
- Engine works
- Foundries
- Gas works
- Iron and steel works
- Landfill sites
- Marinas
- Metal treatments
- Mining and extractive industries
- Power stations
- Printing shops
- Railway yards
- Scrap yards
- Service stations and fuel storage facilities
- Sheep and cattle dips
- Smelting and refining
- Tanning and associated trades
- Water and sewerage treatment plant
- Wood preservation.

The business directory search indicated no records (including motor garages) within the proposal site, or within one kilometre of the proposal site.

## 6.8 Previous contamination site investigations

A search of internet resources was carried out for previous contamination investigations and/or general contamination information for sites which were located within and/or adjacent (within one kilometre of the proposal site) to the proposal site. The internet search used the key words “contamination”, “remediation” and “site investigation” in the suburbs of Eastern Creek, Erskine Park, Horsley Park and Minchinbury.

The following publicly available investigations and contamination information was reviewed:

- *Preliminary Site (Contamination) Investigation. Oakdale East Industrial Estate. 224-398 Burley Road, Horsley Park* (Douglas Partners, September 2018) (https://s3.ap-southeast-2.amazonaws.com/dpe-files-production/s3fs-public/dpp/303475/Attachment%20G_Contamination%20Report.PDF)
- *Land Capability, Salinity and Contamination Assessment, Ropes Creek, NSW (WSP / Parsons Brinkerhoff, October, 2016)* (*https://majorprojects.accelo.com/public/74094338fc944a2c8067876259f1ffec/Ropes%20Creek%20Land%20Capability,%20Salinity%20and%20Contamination%20Assessment.pdf*
- *Assessment of Soil and Water Impacts: Proposed Energy from Waste Facility, Eastern Creek* (Edson Environmental & Engineering, 12 April 2015) (https://www.planning.nsw.gov.au/Assess-and-Regulate/Projects/Eastern-Creek-Energy-from-Waste/~/media/814AEFB44BB74B32B3AD1B466ECF2873.ashx)
- *Phase 1 Preliminary Site Investigation. Honeycomb Drive, Eastern Creek NSW* (ADE Consulting Group, 13 June 2014) (https://www.tngnsw.com.au/media/1099/appendix-v1-phase-1-preliminary-site-investigation.pdf)

The following provides a summary of the information from the available investigations and contamination information in relation to the proposal site. Full copies of the available investigations and contamination information reviewed are available in the links above.

**Preliminary Site (Contamination) Investigation. Oakdale East Industrial Estate. 224-398 Burley Road, Horsley Park (Douglas Partners, September 2018)**

The location of the site subject of this report (the investigation site) is approximately one kilometre south of the proposal site.

Douglas Partners undertook a preliminary site investigation (PSI) as part of the Oakdale East Estate Development Control Plan (DCP) and to assist project planning. The historical data review completed as part of the PSI identified a number of potential contamination issues associated with historical operations and current conditions within the investigation site. These included the potential for hazardous building materials, chemical use and filling.

The potential for contamination (if present) identified in the Douglas Partners (September 2018) investigation to impact the proposal site is likely to be low, based on the following:

- Transport/migration of contamination to the proposal site is unlikely due to the lateral separation (investigation site located approximately one kilometre south of the proposal site)
- The regional topography surrounding the proposal site indicates that the investigation site is located down gradient.

**Land Capability, Salinity and Contamination Assessment – Ropes Creek, NSW (WSP / Parsons Brinkerhoff, October 2016)**

The location of the site subject of this report (the investigation site) includes the proposal site as well as a larger area to the east and north of the proposal site.

WSP Environmental Pty Ltd (WSP) was commissioned by the New South Wales Government, Department of Planning and Environment (DPE) to provide a Land Capability, Salinity and Contamination Assessment for the Ropes Creek proposed development area (i.e. the investigation site).

With respect to contamination, the following information was detailed in the report:

- Soil sampling undertaken did not identify elevated concentrations of contamination

- Historical and current agricultural activities could have contaminated the investigation site with pesticides and heavy metals (although these were not identified by the soil and groundwater sampling)
- Concentrations of some heavy metals (cadmium, copper, nickel and zinc) were reported to be present in groundwater and some surface waters exceeding the adopted investigation criteria. It was considered that, in the absence of elevated heavy metal concentrations in the soil above the investigation criteria and no obvious sources of heavy metals observed at the investigation site, the concentrations reported are likely to be indicative of natural slightly elevated metal concentrations in groundwater regionally and not directly attributed to historical and current activities on the subject site. Elevated heavy metals detected in surface water may have been attributable to the highly turbid nature of the surface water sampled.
- Based on the historical and current land uses and the limited analysis undertaken, widespread contamination across the investigation site was not evident.
- Prior to redevelopment of the investigation site, soil and surface remediation works will likely be limited to the removal of all infrastructure associated with the former agricultural land use activities and remediation of soils and deeper fill (if encountered). Illegally dumped wastes will require removal.

The potential for contamination (if present) identified in the WSP / Parsons Brinkerhoff (October 2016) investigation to impact the proposal site is possible based on the following:

- The proposal site is located wholly within the investigation site
- Potential contamination sources were identified including infrastructure associated with the former agricultural land use activities, fill materials (if encountered) and illegally dumped wastes.

**Assessment of Soil and Water Impacts: Proposed Energy from Waste Facility, Eastern Creek (Edson Environmental & Engineering, 12 April 2015)**

The location of the site subject of this report (the investigation site) is approximately one kilometre north east of the proposal site.

The report was commissioned to address the requirements listed by the Director General of Planning NSW with respect to potential soil and water impacts of the proposed project.

With respect to contamination, the following information was detailed in the report:

- The investigation site is an engineered landfill facility
- The presence of a deep quarry and associated dewatering for over 40 years followed by construction of an engineered landfill site and pumping of leachate from a basal drainage system has resulted in substantial depressurisation of the local groundwater systems and a hydraulic gradient into the quarry within the investigation site
- Stage 1 Environmental Site Assessments (ESAs) have been undertaken on broader parcels of land which encompassed the investigation site in 1995 and 2004, neither of which reported any indication of past industrial activity on the investigation site (i.e. low potential for contamination)
- A number of intrusive investigations have been undertaken on portions of the investigation site. The investigations involved the collection and laboratory analysis of soil, sediment, surface water and groundwater. The actual locations of all samples collected from the investigation site could not be ascertained based on the information provided. Contamination from the investigation site and adjoining sites were not reported in the information provided.

The potential for contamination (if present) identified in the Edson Environmental & Engineering (April 2015) assessment to impact the proposal site is likely to be low based on the following:

- Transport/migration of contamination to the proposal site is unlikely due to the lateral separation (investigation site located approximately one kilometre north east of the proposal site)
- Contamination has not been identified on the investigation site

- There is a reported hydraulic gradient towards the investigation site. This would reduce the potential for contaminated groundwater (if present) to migrate from the landfill located on the investigation site to the proposal site.

**Phase 1 Preliminary Site Investigation. Honeycomb Drive, Eastern Creek NSW (ADE Consulting Group, 13 June 2014)**

The location of the site subject of this report (the investigation site) is approximately 300 metres north east of the proposal site.

A. D. Envirotech Australia Pty Ltd (ADE) was engaged by Urbis on behalf of The Next Generation NSW Pty Ltd (TNG NSW) to undertake a Phase I Preliminary Site Contamination Investigation (PSI) to assess the potential for contamination on the investigation site located off Honeycomb Drive, Eastern Creek NSW.

With respect to contamination, the following information was detailed in the report:

- The investigation site has been utilised as grazing land as far back as records indicate
- An asphalt plant and associated waste water overflow dam has been present adjacent the investigation site since at least 1978
- Due to the proximity of the asphalt plant and the potential for overflow from adjacent waste water dam, contaminated fill and the deposition of airborne dust, there was the potential for contamination to be present on the investigation site.

The potential for contamination (if present) identified in the ADE Consulting Group (June 2014) investigation to impact the proposal site is possible based on the following:

- Overflows from the asphalt plant and waste water overflow could be discharged to the drainage lines within the northern portion of the proposal site.

# 7. Site inspection

A site inspection was undertaken by a Jacobs Environmental Scientist on 8 April 2020. Photographs taken during the inspection are provided in Appendix B.

The purpose of the site inspection was to make observations of the current site conditions and adjacent site land uses with respect to contamination.

For the purpose of this assessment the site has been sub-divided into two (2) areas representative of the proposal site including (refer to Figure 1-1):

- Area 1 – Southern precast site
- Area 2 – Northern precast site

Table 7-1 and Table 7-2 provides a summary of the observations made during the site inspection of Area 1 and Area 2.

Table 7-1: Summary of site features and observations – Area 1

| Feature | Observation | Reference Photo Plate |
|---|---|---|
| Site surfacing | Grass and unsealed tracks | 1-5,16,29 |
| Site structures | No on-site structures present | - |
| Site services | No above ground services were observed during site inspection, except for maintenance hole covers for sewer infrastructure. | 31 |
| Topography / gradient | Undulating hills of variable height and gradient, generally sloping to the west towards Ropes Creek. | 1,2,3,5 |
| Site drainage | Sheet flow and concentrated flows via land drains discharging into on-site retention ponds. Surplus drainage from concentrated flows and overland flows discharge to Ropes Creek. | 18,14 |
| Fill materials | Earthen embankment adjacent to Lenore Drive is grassed, but likely to comprise fill material due to artificial profile and gradient. | 7,8,9,11,12 |
| Waste(s) | Numerous waste materials observed adjacent to Lenore Drive along the southernmost portion of the southern precast site along proposed internal road, including:<br>▪ Small stockpiles of construction and demolition waste (bricks, cement, sand, asphalt, ceramic, metal, timber, PVC tubing)<br>▪ Uncontrolled waste from illegal dumping, including electrical appliances, computer parts, household furniture, vehicle parts, tyres, gypsum board, plastics, timber, mattresses, glass and potential asbestos containing materials.<br>Uncontrolled waste materials within proposed storage area in southernmost portion of the southern precast site, upgradient of on-site retention pond, including:<br>▪ Stockpiles of timber, plastic, fabric, occasional vehicle parts, metal and potential asbestos containing materials.<br>Uncontrolled waste materials within / adjacent to the environmental protection area east of the southern precast site, including:<br>▪ Household furniture, electrical goods, timber, plastic, metal, gypsum board, fabric, potential asbestos containing materials, asphalt, vehicle parts, containers of paint, motor oils, wood oils, lubricants, emulsifiers and flammable liquids. | 8-15,17,20-25 |

| Feature | Observation | Reference Photo Plate |
|---|---|---|
| Above ground / underground storage tanks | No above ground storage tanks observed during site inspection. No evidence of underground storage tanks observed during site inspection. | - |
| Asbestos | Potential asbestos containing materials were observed during site inspection, in several areas of the site, as detailed above. | 8-15,17,21 |
| Chemical and other hazard material storage | None observed during site inspection. | - |
| Phytotoxicity | None observed during site inspection. | - |
| Staining and odours | None observed during site inspection. | - |
| Incidents and complaints | None recorded during site inspection. | - |
| Evidence of previous investigations | None observed during site inspection. | - |
| Additional observations | Evidence of dispersive soils with high erosion risk observed during site inspection. Significant washout and gullying of access tracks and unsealed areas observed. | 16 |

Table 7-2: Summary of site features and observations – Area 2

| Feature | Observation | Reference Photo Plate |
|---|---|---|
| Site surfacing | Grass and unsealed tracks | 28 |
| Site structures | No on-site structures present | - |
| Site services | No above ground services were observed during site inspection, except for maintenance hole covers for sewer infrastructure. | 32 |
| Topography / gradient | Broadly flat, shallow gradient sloping to the west towards Ropes Creek. | 30 |
| Site drainage | Sheet flow and concentrated flows via land drains discharging into on-site retention ponds. Surplus drainage from concentrated flows and overland flows discharge to Ropes Creek. | 26, 28,29, |
| Fill materials | Fill materials possibly present forming bund of stormwater retention pond. | 26-29 |
| Waste(s) | An isolated area of waste materials observed during the archaeological assessment (Artefact, 2020) within the northern portion of the site. Waste materials observed included:<br>▪ Metal and brick debris, remains of a metal refrigerator, fence posts and star pickets. | - |
| Above ground / underground storage tanks | No above ground storage tanks observed during site inspection. No evidence of underground storage tanks observed during site inspection. | - |
| Asbestos | None observed during site inspection. | - |
| Chemical and other hazard material storage | None observed during site inspection. | - |
| Phytotoxicity | None observed during site inspection. | - |
| Staining and odours | None observed during site inspection. | - |
| Incidents and complaints | None recorded during site inspection. | - |
| Evidence of previous investigations | None observed during site inspection. | - |

| Feature | Observation | Reference Photo Plate |
|---|---|---|
| Additional observations | None observed during site inspection. | - |

Based on the observations made during the site inspection, there were a number of potential contamination sources identified on the proposal site. These included potential filling of the earthen embankment adjacent to Lenore Drive and the bund of the stormwater retention pond and isolated occurrences of fly tipped waste materials (mainly with the southern portion of the proposal site).

# 8. Areas of environmental interest

Based on the findings of the desktop review and observation from the site inspection, a number of potential contamination sources have been identified within and/or adjacent to the proposal site.

To understand the potential interaction of construction activities and operation of the proposal site with potential contamination, areas have been categorised into five categories of potential contamination impact (very low, low, moderate, high and very high) based on the impact prioritisation methodology in Section 3.5. The results of this exercise are presented in Table 8-1.

A number of areas have been identified as having a moderate potential for contamination to impact upon construction and operation of the proposal site (refer to Figure 8-1).

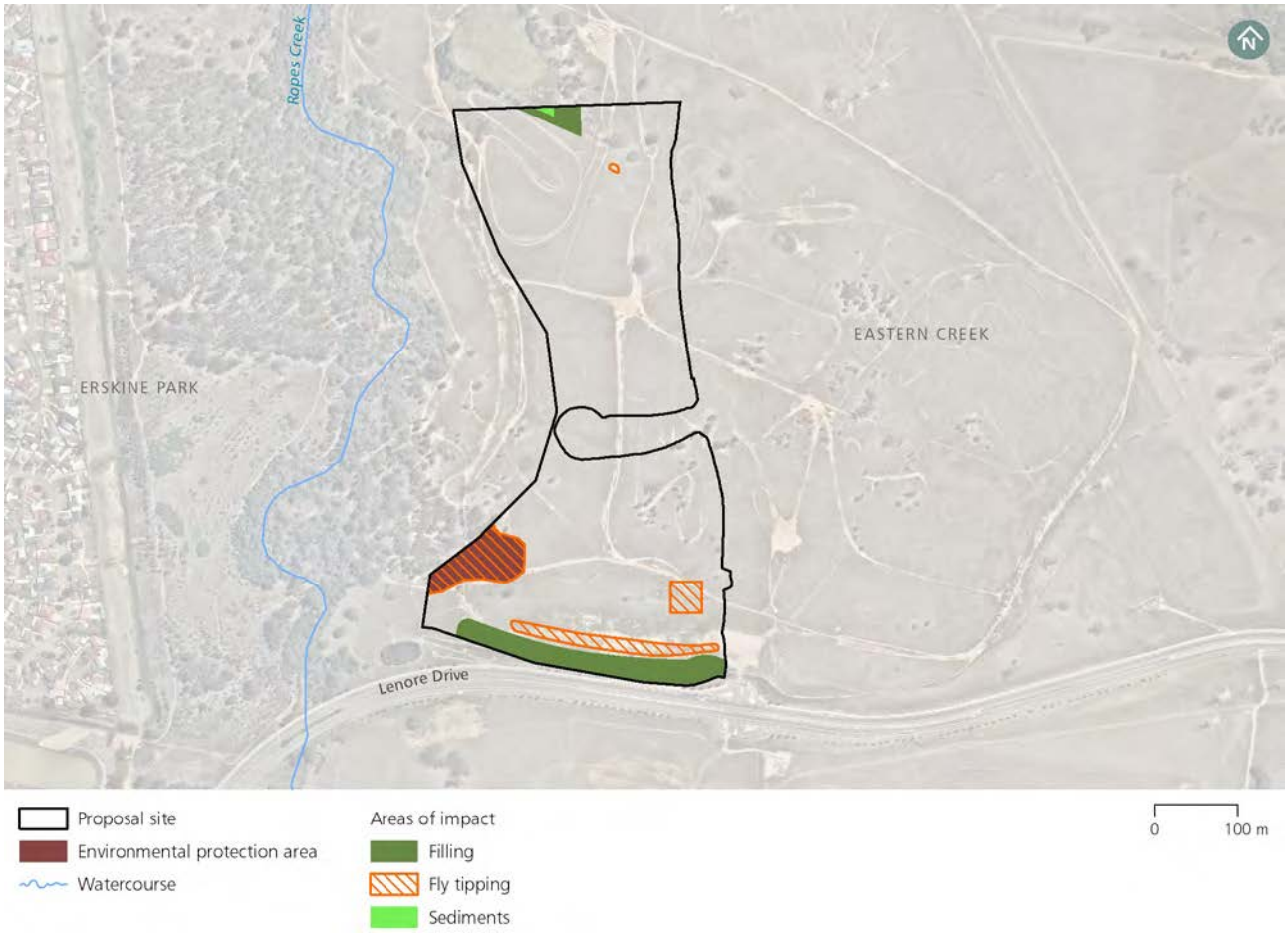



Figure 8-1 Moderate potential contamination impact areas

Table 8-1: High-level contamination prioritisation

| Areas of interest | Contamination severity and extent assessment | | | Pathways and receptors<br>Assessment of relationship to construction and operational footprint and scope | | | | Potential contamination impact |
|---|---|---|---|---|---|---|---|---|
| | Media and COPCs | Contamination status | Reference to Table 3-1 criteria | Location relative to proposal site | Potential for contamination to be intersected | Exposure pathways<br>(der – direct contact, ing – ingestion or inh – inhalation) | Reference to Table 3-1 criteria | |
| Filling (material of unknown quality) - Earthen embankment adjacent to Lenore Drive (southern precast site) and the bund of the stormwater retention pond (northern precast site). | Soils (to the depth of filling)<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), pesticides, phenols, asbestos | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent | SE2 | Within the northern and southern precast sites | Soils would be exposed during construction<br><br>Contaminated deeper soils (if present) may remain below the site during operation | Construction workers and site users could be exposed to contamination via contact (der, ing, inh) with contaminated soils and dust<br><br>Adjacent site users could be exposed to contamination via dust emissions (inh), namely asbestos | PR3 | Moderate |
| | Groundwater<br>Heavy metals, nutrients, hydrocarbons (TRH, BTEX, PAH) | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent. Any groundwater contamination from fill areas would be limited to the northern and southern extents of the proposal footprint | SE2 | | Contaminated groundwater (if present) from overlying fill material could be intersected during construction. If encountered, is likely to represent relatively small volumes.<br><br>Contaminated groundwater (if present) may remain below the proposal site during operation | Construction workers and site users could be exposed to contamination via contact (der, ing) with contaminated groundwater | PR2 | Low |
| Historical /current land use (incl. agricultural land use) – Inappropriate chemical storage and use, miscellaneous waste disposal etc. | Surface soil<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), pesticides, herbicides, asbestos | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent | SE2 | Within the northern and southern precast sites | Soils would be exposed during construction<br><br>No residual contaminated surface soils likely to be present during operation | Construction workers could be exposed to contamination via contact (der, ing, inh) with contaminated soils and dust<br><br>Adjacent site users could be exposed to contamination via dust emissions (inh), namely asbestos | PR3 | Moderate |
| Former and existing structures – Hazardous building materials within or from buildings / structures (including transmission towers) within the contamination study area, demolition wastes | Surface soil<br>Heavy metals, hydrocarbons (TRH, PAH), pesticides, asbestos | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent | SE2 | Minimum of 100m north, east and south | Surficial contamination (if present) from adjoining structures unlikely to migrate and be exposed during construction or operation | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors | PR1 | Low |
| Sediments within on-site dam / stormwater retention pond (potential contaminant sink) | Sediments<br>Heavy metals, hydrocarbons (TRH, PAH), pesticides, microbiological, nutrients | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent | SE2 | Within the northern precast site | Sediments would be exposed during construction<br><br>No sediments likely to be present during operation | Construction workers could be exposed to contamination via contact (der, ing, inh) with contaminated sediments | PR3 | Moderate |
| Fly tipping ('illegal dumping') of wastes | Wastes and surface soils<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), pesticides, phenols, asbestos | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent | SE2 | Within the northern and southern precast sites | Wastes and soils would be exposed during construction<br><br>No residual fly tipped wastes likely to be present during operation | Construction workers could be exposed to contamination via contact (der, ing, inh) with contaminated soils and dust<br>Adjacent site users could be exposed to contamination via dust emissions (inh), namely asbestos | PR3 | Moderate |

| Areas of interest | Contamination severity and extent assessment | | | Pathways and receptors<br>Assessment of relationship to construction and operational footprint and scope | | | | Potential contamination impact |
|---|---|---|---|---|---|---|---|---|
| | Media and COPCs | Contamination status | Reference to Table 3-1 criteria | Location relative to proposal site | Potential for contamination to be intersected | Exposure pathways<br>(der – direct contact, ing – ingestion or inh – inhalation) | Reference to Table 3-1 criteria | |
| Waste management facility - offsite migration of chemicals (via infiltration into underlying groundwater or surface water discharge) | Surface water and groundwater<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), organic contaminants, PFAS | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent | SE2 | Approx. 1km north east | Contaminated groundwater (if present) from the landfill is unlikely to be present beneath the proposal site because of the spatial separation, the quarry void is not filled and current void would acts a groundwater sink – groundwater would flow towards and not away from the void, cross gradient locations and geological conditions.<br><br>Groundwater is unlikely to be exposed during operation<br><br>Surface water could be intersected during construction (potentially during dewatering of on-site stormwater retention pond) | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors | PR1 | Low |
| | Landfill gas<br>Methane, hydrogen sulphide, carbon dioxide | Low potential for contamination to be present at concentrations above the relevant assessment criteria and limited in extent | SE1 | | Landfill gas only likely to be an issue following completion of landfilling activities | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors | PR1 | Very low |
| Historical commercial / industrial use within locality – Inappropriate chemical storage and use, industrial operations, waste disposal and management etc. | Surface soil<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH) | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent | SE2 | Minimum of 300m north east | Surficial contamination (if present) from adjoining source sites unlikely to migrate and be exposed during construction or operation | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors | PR1 | Low |
| | Groundwater<br>Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC | Contamination possibly present at concentrations above the relevant assessment criteria and widespread | SE3 | | Contaminated groundwater (if present) from these land uses is unlikely to be present beneath the proposal site because of the spatial separation and geological conditions.<br><br>Groundwater is unlikely to be exposed during operation<br><br>Contaminated groundwater (if present) may remain below the site during operation | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors | PR1 | Low |
| Substation – Transformer oils and potential firefighting activities | Surface soils<br>Polychlorinated biphenyls (PCB) and PFAS | Contamination possibly present at concentrations above the relevant assessment criteria and limited in extent | SE2 | Approx. 700 m south east | Surficial contamination (if present) from adjoining source site unlikely to migrate and be exposed during construction or operation | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors | PR1 | Low |
| | Groundwater<br>PFAS | Contamination possibly present at concentrations above the relevant assessment criteria and widespread | SE3 | | Contaminated groundwater (if present) from the substation are unlikely to be exposed during construction or operation (site is likely to be cross-gradient with groundwater flows for the substation) | Contamination unlikely to be exposed during construction and/or operation and therefore unlikely to impact upon human and environmental receptors | PR1 | Low |

# 9. Potential impacts

The following information details potential impacts to the site from contamination identified as part of this PCSI.

## 9.1 Construction

### 9.1.1 Contamination – soil

The results of this assessment have identified areas across the proposal site which have moderate potential for contamination impact as a result of historic filling activities, the former use of the proposal site and surrounding areas (agricultural land use), potential for contaminated sediments within farm dams and the presence of fly tipped wastes ('illegal dumping'). Further review of information and/or investigation would be required to quantify the contamination risks associated with on-site fill, soil and sediment materials. If contamination risks are not quantified in these areas and appropriately managed, construction activities may expose workers, the public, and the environmental receptors to contaminated fill materials, soil and sediment.

Potential impacts as a result of disturbance of contaminated wastes/fill/soil/sediment without appropriate management and/or remediation may include:

- Contaminant exposure risk to construction personnel and the general public
- Contaminant exposure to environmental receptors
- Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds
- Contamination of previously clean areas.

Should contaminated wastes/fill/soil/sediment be identified, these materials can be managed with the implementation of appropriate management measures and/or remediation.

Higher risks and increased management and/or remediation effort during construction could be associated where materials have the potential to:

- Contain dispersible fibres (e.g. asbestos)
- Generate vapours (e.g. hydrocarbons and volatile organic compounds)
- Contain concentrations of contaminants or constituents that categorise the material at a higher waste classification (e.g. restricted waste, special waste, hazardous waste).

The appropriate management measures and/or remediation can only be determined based on the results of additional information reviews and investigations, which would be completed prior to the commencement of construction.

Any fill materials and/or soils disturbed as part of site construction activities have the potential to become mobilised into stormwater drainage networks during rainfall events if not appropriately managed. As such there is potential for on-site fill materials and/or soils disturbed as part of construction to migrate and impact off site receiving environments.

Potential management and mitigation measures during the construction of the proposal site with respect to soil contamination are discussed in Section 10.

### 9.1.2 Contamination – groundwater

Contaminated groundwater may be encountered during the construction activities, principally during excavation / excavation dewatering. It is anticipated that the quantum of groundwater required to be managed as part of construction activities would be minimal. If groundwater contamination is not appropriately managed,

construction activities may expose workers, the public and environmental receptors to contaminated groundwater via direct contact or discharge to surface waters.

Potential impacts as a result of contact with or discharge of contaminated groundwater may include:

- Contaminant exposure risk to project personnel and the general public
- Contaminant exposure to environmental receptors
- Degradation of aquatic ecosystems.

All potential groundwater contamination identified can be managed subject to the implementation of appropriate management and mitigation measures such as collection and off-site disposal and treatment. The appropriate management measures should be detailed in an appropriate Construction Environmental Management Plan (CEMP).

Sources of potential groundwater contamination could include leachate generated from on-site fill materials.

Potential management and mitigation measures during the construction of the proposal site with respect to groundwater contamination are discussed in Section 10.

## 9.2 Operation

### 9.2.1 Contamination – soil

The results of this assessment have identified that filling across the proposal site (mainly fill embankments adjacent to Lenore Drive) has a moderate potential for contamination impact as a result of historic filling activities and the unknown nature of these underlying fill materials. These materials have the potential to impact site users, site staff and local ecology through direct exposure if they remain on-site or have migrated from the site as part of operation if appropriate management / mitigation measures are not adopted as part of the design, construction and ongoing operation.

The proposal site is proposed to be operated as two precast facilities. The operation of the proposal site would potentially require the storage and use of chemicals and generate wastes. The chemicals used and waste generated could result in the contamination of soil if not appropriately managed.

Potential management and mitigation measures for the operation of the proposal site with respect to soil contamination are discussed in Section 10.

### 9.2.2 Contamination – groundwater

Impacts to groundwater as a result of operation of the site may include leaks / spills of fuels / chemical additives / wastes to groundwater from on-site storage and use.

The potential impacts to groundwater from these sources of contamination include deterioration of groundwater quality and impacts to local creeks (Ropes Creek) through baseflow – interflow pathways.

Potential impacts from on-site groundwater to operation of the proposal site could occur if contaminated groundwater (if present) is exposed during future subsurface maintenance activities.

Potential mitigation and management measures for operation of the proposal site with respect to groundwater contamination are discussed in Section 10.

# 10. Mitigation and management measures

Potential contamination impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework. Of relevance, the Construction Environmental Framework includes contamination management objectives to avoid or minimise potential contamination impacts.

## 10.1 Construction

Based on the assessed level of potential contamination impact to construction detailed in Sections 8 and 9, a range of mitigation and management measures have been developed in order to manage potential contamination during construction (refer to Table 10-1). These have been termed mitigation measures C1 to C5.

The Construction Environmental Management Framework includes a requirement to prepare a Soil and Water Management Plan which would include management measures for contaminated material (soils, water and building materials) and a contingency plan in the case of unanticipated discovery of contaminated material. For AEIs that have been assessed to have a moderate contamination impact potential, additional measures would be implemented. These additional mitigation and management measures would be dependent on the outcomes from further investigations, noting:

- A Remedial Action Plan would typically be prepared where there is more significant, widespread contamination that requires detailed remedial planning, followed by implementation of standard construction practices such as excavation and off-site disposal or capping and containment
- Involvement of an accredited Site Auditor, and issue of a Site Audit Statement and Site Audit Report would occur where contamination is highly complex, such as significant groundwater contamination; contamination associated with vapour; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction.

Table 10-1: Summary of mitigation and management measures for potential construction impacts

| Ref | Impact | Mitigation measure |
|---|---|---|
| C1 | Management of low risk contamination | For areas that have been identified as having moderate contamination impact potential, a further review of data would be performed.<br>Should the additional data review confirm that contamination is likely to have a very low or low impact potential, the areas would then be managed in accordance with the Soil and Water Management Plan. This would typically occur where there is minor, isolated contamination that can be readily remediated through standard construction practices such as excavation and off-site disposal. |
| C2 | Detailed Site Investigation | Where data from the additional data review (mitigation measure C1) is insufficient to understand the impact of contamination, a Detailed Site Investigation would be carried out in accordance with the NEPM (2013) and other guidelines made or endorsed by the NSW EPA.<br>The areas requiring Detailed Site Investigation would be confirmed following the additional data review (mitigation measure C1), however on the basis of the PSCI, it is anticipated that a Detailed Site Investigation would be required to characterise fill materials, and sediment from dam / retention pond for on-site reuse and/or off-site disposal. Fly tipped wastes and deposited wastes (from former land use) would need to be characterised for off-site disposal. |

| Ref | Impact | Mitigation measure |
|---|---|---|
| C3 | Remediation | Where data from additional data review (mitigation measure C1) or the Detailed Site Investigation (mitigation measure C2) confirms that contamination would have a moderate to very high risk, a Remedial Action Plan (RAP) would be developed for the area of the construction footprint.<br>The RAP would detail the remediation works required to mitigate impacts from contamination throughout and following completion of construction. The RAP would be prepared in accordance with relevant NSW EPA guidelines and where applicable, detail remediation methodologies in accordance with Australian Standards and other relevant government guidelines and codes of practice.<br>Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land.<br>The requirements for a RAP and remediation would be confirmed following the additional data review (mitigation measure C1) and Detailed Site Investigation (mitigation measure C2). |
| C4 | Site Audit Statement | Where contamination is highly complex, such as significant groundwater contamination; contamination associated with vapour; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction, an accredited Site Auditor would review and approve the RAP, and would develop a Site Audit Statement and Site Audit Report upon completion of remediation.<br>The requirement for a Site Audit Statement would be confirmed following the preparation of the Remediation Action Plan (mitigation measure C3). |
| C5 | Residual contamination following construction | Ongoing management and monitoring measures would be documented in an appropriate form and implemented for any areas where minor, residual contamination remains following construction. |

It should be noted that the appropriate management and mitigation measures and/or remediation for soil and groundwater as part of construction of the proposal site can only be determined based on the results of additional information reviews and investigations, which would be completed to inform the design and the commencement of construction.

## 10.2 Operation

Operational management and mitigation measures should address potential risks from contamination and to the contamination status within the site and surrounding area. Operational management and mitigation measures will depend on the outcome of further investigations that should also be used to inform potential impacts associated with construction. The operational management and mitigation measures should also be considered as part of the detailed design for the proposal site.

Potential management and mitigation measures for operation of the proposal site are discussed in Table 10-2.

Table 10-2: Summary of mitigation and management measures for potential operation impacts

| Ref | Impact | Mitigation measure |
|---|---|---|
| C6 | Accidental leaks or spills | The operational environmental management plan (OEMP) for the proposal would include an Emergency Response Plan (or equivalent) which would specify the procedure to be followed in the event of a spill, including the notification requirements and use of absorbent material to contain the spill. |

| Ref | Impact | Mitigation measure |
|---|---|---|
| C7 | Contaminated soil | Where contaminated soils are to remain on-site, an appropriate OEMP would be prepared and implemented. The OEMP would include relevant ongoing management requirements developed in accordance with the NEPM (2013) and relevant guidelines made or approved by the NSW EPA. Measures may include but are not limited to procedures for excavation works, inspections and audits. |
| C8 | Contaminated groundwater | Potential impacts from existing groundwater contamination (if present) during operation of the proposal would be managed through management and mitigation measures:<br>▪ Emplacement of appropriate topographic / drainage controls to minimise seepage and ponding of water across the site<br>▪ Drainage from sealed areas would be directed to stormwater drains (e.g. pipes, swales) via gross pollutant traps and sediment basins (if necessary) to mitigate potential impacts from sediments or wastes on receiving environments. |

# 11. Conclusions and recommendations

Jacobs has undertaken a preliminary contaminated site investigation (PCSI) of the proposed precast facility sites (the proposal site) located at Lenore Drive, Eastern Creek NSW as part of key deliverables and scope to inform a Review of Environmental Factors (REF).

The PCSI has included a review of desktop information, a site walkover inspection, an assessment of potential areas and sources of on-site and off-site contamination, an assessment of the potential impacts to human health and the environment from exposure to contamination during construction / operation of the proposal site, potential management and mitigation measures, and recommendations for further works where necessary.

The findings of the PCSI have identified a moderate potential for on-site contamination (soil) as a result of historic filling activities, the former use of the proposal site (agricultural land use), potential for contaminated sediments within farm dams (northern portion of proposal site) and the presence of fly tipped wastes.

On-site soil and groundwater contamination if exposed during construction activities and operation of the site could impact upon human health and environmental receptors if appropriate management / remediation measures are not adopted in response to contamination risks.

To quantify the potential contamination impacts identified, the following is recommended:

- For areas that have been identified as having moderate contamination impact potential, a further review of data would be performed
- Where data from the additional data review is insufficient to understand the impact of contamination, a Detailed Site Investigation would be carried out in accordance with the NEPM (2013) and other guidelines made or endorsed by the NSW EPA.

# 12. References


- ADE Consulting Group (13 June 2014) Phase 1 Preliminary Site Investigation. Honeycomb Drive, Eastern Creek NSW
- Artefact (2020) Statement of Heritage Impact
- Aurecon (23 October 2019) Development Application. Preliminary Site Investigation for Contamination Risks. 10 Eastern Creek Drive, Eastern Creek NSW
- Australian Standard (AS 4482.1-2005) Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds
- Australian Standard (AS 4482.2-1999) Guide to the sampling and investigation of potentially contaminated soils – Volatile substances
- ANZG (2018): Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2018)
- DEC (2005): Information for the assessment of former gasworks sites. Department of Environment and Conservation, 2005
- DEC (2007): Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination. Department of Environment and Conservation, 2007
- Department of Urban Affairs and Planning & Environment Protection Authority (1998) Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land
- Douglas Partners (September 2018) Preliminary Site (Contamination) Investigation. Oakdale East Industrial Estate. 224-398 Burley Road, Horsley Park
- Edson Environmental & Engineering (12 April 2015) Assessment of Soil and Water Impacts: Proposed Energy from Waste Facility, Eastern Creek
- HEPA (2020) PFAS National Environmental Management Plan Ver. 2.0. Heads of Environment Protection Agency, 2020
- Lotsearch (2020): LS011112 EP – Lenore Drive, Eastern Creek, NSW, 2766. 3 April 2020
- Managing asbestos in or on soil (WorkCover NSW, 2014). [Online] Available at: http://www.safework.nsw.gov.au/__data/assets/pdf_file/0005/329171/Managing-asbestos-in-soil-guide.pdf
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (as revised 2013)
- NSW EPA (1995): Contaminated Sites: Sampling Design Guidelines. NSW Environment Protection Agency, 1995
- NSW EPA (1997): Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition). NSW Environment Protection Agency, 2017
- NSW EPA (2012): Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases New South Wales Environment Protection Agency, 2012
- NSW EPA (2014): Waste Classification Guidelines. NSW Environment Protection Agency, 2014
- NSW EPA (2015): Technical Note: Light Non-Aqueous Phase Liquid Assessment and Remediation. New South Wales Environment Protection Agency, 2015
- NSW OEH (2011): Guidelines for Consultants Reporting on Contaminated Sites. New South Wales Office of Environment and Heritage, 2011.
- WSP / Parsons Brinkerhoff (October, 2016) Land Capability, Salinity and Contamination Assessment, Ropes Creek, NSW

# Appendix A. Lotsearch Report

# LOTSEARCH

## LOTSEARCH ENVIRO PROFESSIONAL

**Date: 03 Apr 2020 09:36:13**
**Reference: LS011866 EP**
**Address: Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

# Dataset Listing

Datasets contained within this report, detailing their source and data currency:

| Dataset Name | Custodian | Supply Date | Currency Date | Update Frequency | Dataset Buffer (m) | No. Features Onsite | No. Features within 100m | No. Features within Buffer |
|---|---|---|---|---|---|---|---|---|
| Cadastre Boundaries | NSW Department of Finance, Services & Innovation | 13/02/2020 | 13/02/2020 | Quarterly | - | - | - | - |
| Topographic Data | NSW Department of Finance, Services & Innovation | 25/06/2019 | 25/06/2019 | As required | - | - | - | - |
| List of NSW contaminated sites notified to EPA | Environment Protection Authority | 16/03/2020 | 16/03/2020 | Monthly | 1000 | 0 | 0 | 1 |
| Contaminated Land Records of Notice | Environment Protection Authority | 17/03/2020 | 17/03/2020 | Monthly | 1000 | 0 | 0 | 0 |
| Former Gasworks | Environment Protection Authority | 16/03/2020 | 11/10/2017 | Monthly | 1000 | 0 | 0 | 0 |
| National Waste Management Facilities Database | Geoscience Australia | 12/02/2020 | 07/03/2017 | Quarterly | 1000 | 0 | 0 | 1 |
| National Liquid Fuel Facilities | Geoscience Australia | 05/02/2020 | 13/07/2012 | Quarterly | 1000 | 0 | 0 | 0 |
| EPA PFAS Investigation Program | Environment Protection Authority | 18/03/2020 | 18/03/2020 | Monthly | 2000 | 0 | 0 | 0 |
| Defence PFAS Investigation & Management Program – Investigation Sites | Department of Defence | 12/02/2020 | 12/02/2020 | Monthly | 2000 | 0 | 0 | 0 |
| Defence PFAS Investigation & Management Program – Management Sites | Department of Defence | 12/02/2020 | 12/02/2020 | Monthly | 2000 | 0 | 0 | 0 |
| Airservices Australia National PFAS Management Program | Airservices Australia | 20/03/2020 | 20/03/2020 | Monthly | 2000 | 0 | 0 | 0 |
| Defence 3 Year Regional Contamination Investigation Program | Department of Defence | 04/03/2020 | 04/03/2020 | Monthly | 2000 | 0 | 0 | 0 |
| EPA Other Sites with Contamination Issues | Environment Protection Authority | 04/02/2020 | 13/12/2018 | Annually | 1000 | 0 | 0 | 0 |
| Licensed Activities under the POEO Act 1997 | Environment Protection Authority | 11/03/2020 | 11/03/2020 | Monthly | 1000 | 0 | 0 | 7 |
| Delicensed POEO Activities still regulated by the EPA | Environment Protection Authority | 13/03/2020 | 13/03/2020 | Monthly | 1000 | 0 | 0 | 0 |
| Former POEO Licensed Activities now revoked or surrendered | Environment Protection Authority | 13/03/2020 | 13/03/2020 | Monthly | 1000 | 3 | 9 | 10 |
| UBD Business Directories (Premise & Intersection Matches) | Hardie Grant | | | Not required | 150 | 0 | 0 | 0 |
| UBD Business Directories (Road & Area Matches) | Hardie Grant | | | Not required | 150 | - | 0 | 0 |
| UBD Business Directory Dry Cleaners & Motor Garages/Service Stations (Premise & Intersection Matches) | Hardie Grant | | | Not required | 500 | 0 | 0 | 0 |
| UBD Business Directory Dry Cleaners & Motor Garages/Service Stations (Road & Area Matches) | Hardie Grant | | | Not required | 500 | - | 0 | 0 |
| Points of Interest | NSW Department of Finance, Services & Innovation | 18/10/2019 | 18/10/2019 | Quarterly | 1000 | 0 | 0 | 29 |
| Tanks (Areas) | NSW Department of Customer Service - Spatial Services | 18/10/2019 | 18/10/2019 | Quarterly | 1000 | 0 | 0 | 0 |
| Tanks (Points) | NSW Department of Customer Service - Spatial Services | 18/10/2019 | 18/10/2019 | Quarterly | 1000 | 0 | 0 | 0 |
| Major Easements | NSW Department of Finance, Services & Innovation | 18/10/2019 | 18/10/2019 | Quarterly | 1000 | 1 | 1 | 12 |
| State Forest | Forestry Corporation of NSW | 18/01/2018 | 18/01/2018 | As required | 1000 | 0 | 0 | 0 |
| NSW National Parks and Wildlife Service Reserves | NSW Office of Environment & Heritage | 21/01/2020 | 30/09/2019 | Annually | 1000 | 0 | 0 | 0 |
| Hydrogeology Map of Australia | Commonwealth of Australia (Geoscience Australia) | 08/10/2014 | 17/03/2000 | As required | 1000 | 1 | 1 | 1 |
| Botany Groundwater Management Zones | NSW Department of Planning, Industry and Environment | 15/03/2018 | 01/10/2005 | As required | 1000 | 0 | 0 | 0 |

| Dataset Name | Custodian | Supply Date | Currency Date | Update Frequency | Dataset Buffer (m) | No. Features Onsite | No. Features within 100m | No. Features within Buffer |
|---|---|---|---|---|---|---|---|---|
| Groundwater Boreholes | NSW Dept. of Primary Industries - Water NSW; Commonwealth of Australia (Bureau of Meteorology) | 24/07/2018 | 23/07/2018 | Annually | 2000 | 0 | 0 | 20 |
| Geological Units 1:100,000 | NSW Department of Planning, Industry and Environment | 20/08/2014 | | None planned | 1000 | 2 | - | 3 |
| Geological Structures 1:100,000 | NSW Department of Planning, Industry and Environment | 20/08/2014 | | None planned | 1000 | 0 | - | 1 |
| Naturally Occurring Asbestos Potential | NSW Dept. of Industry, Resources & Energy | 04/12/2015 | 24/09/2015 | Unknown | 1000 | 0 | 0 | 0 |
| Atlas of Australian Soils | Australian Bureau of Agriculture and Resource Economics and Sciences (ABARES) | 19/05/2017 | 17/02/2011 | As required | 1000 | 2 | 2 | 3 |
| Soil Landscapes | NSW Department of Planning, Industry and Environment | 12/08/2014 | | None planned | 1000 | 2 | - | 3 |
| Environmental Planning Instrument Acid Sulfate Soils | NSW Department of Planning, Industry and Environment | 26/03/2020 | 28/02/2020 | Monthly | 500 | 0 | - | - |
| Atlas of Australian Acid Sulfate Soils | CSIRO | 19/01/2017 | 21/02/2013 | As required | 1000 | 1 | 1 | 1 |
| Dryland Salinity - National Assessment | National Land and Water Resources Audit | 18/07/2014 | 12/05/2013 | None planned | 1000 | 1 | 1 | 2 |
| Dryland Salinity Potential of Western Sydney | NSW Department of Planning, Industry and Environment | 12/05/2017 | 01/01/2002 | None planned | 1000 | 2 | 5 | 8 |
| Mining Subsidence Districts | NSW Department of Customer Service - Subsidence Advisory NSW | 18/10/2019 | 18/10/2019 | Quarterly | 1000 | 0 | 0 | 0 |
| Environmental Planning Instrument SEPP State Significant Precincts | NSW Department of Planning, Industry and Environment | 26/03/2020 | 07/12/2018 | Monthly | 1000 | 0 | 0 | 0 |
| Environmental Planning Instrument Land Zoning | NSW Department of Planning, Industry and Environment | 26/03/2020 | 13/03/2020 | Monthly | 1000 | 4 | 9 | 52 |
| Commonwealth Heritage List | Australian Government Department of the Agriculture, Water and the Environment | 04/02/2020 | 31/07/2018 | Quarterly | 1000 | 0 | 0 | 0 |
| National Heritage List | Australian Government Department of the Agriculture, Water and the Environment | 04/02/2020 | 20/11/2019 | Quarterly | 1000 | 0 | 0 | 0 |
| State Heritage Register - Curtilages | NSW Department of Planning, Industry and Environment | 12/02/2020 | 09/11/2018 | Quarterly | 1000 | 0 | 0 | 0 |
| Environmental Planning Instrument Heritage | NSW Department of Planning, Industry and Environment | 26/03/2020 | 28/02/2020 | Monthly | 1000 | 0 | 0 | 0 |
| Bush Fire Prone Land | NSW Rural Fire Service | 04/02/2020 | 14/12/2019 | Quarterly | 1000 | 1 | 3 | 3 |
| Remnant Vegetation of the Cumberland Plain | NSW Office of Environment & Heritage | 07/10/2014 | 04/08/2011 | Unknown | 1000 | 6 | 6 | 10 |
| Ramsar Wetlands of Australia | Department of the Agriculture, Water and the Environment | 08/10/2014 | 24/06/2011 | As required | 1000 | 0 | 0 | 0 |
| Groundwater Dependent Ecosystems | Bureau of Meteorology | 14/08/2017 | 15/05/2017 | Unknown | 1000 | 2 | 2 | 4 |
| Inflow Dependent Ecosystems Likelihood | Bureau of Meteorology | 14/08/2017 | 15/05/2017 | Unknown | 1000 | 2 | 3 | 5 |
| NSW BioNet Species Sightings | NSW Office of Environment & Heritage | 26/03/2020 | 26/03/2020 | Weekly | 10000 | - | - | - |

# Site Diagram

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**


**Legend**

- Site Boundary
- Internal Parcel Boundaries

**Total Area:** 1.25km²

**Total Perimeter:** 6133m

Disclaimers:

Measurements are approximate only and may have been simplified or smaller lengths removed for readability.

Parcels that make up a small percentage of the total site area have not been labelled for increased legibility.

Scale: 0 100 200 300 400 500 Metres

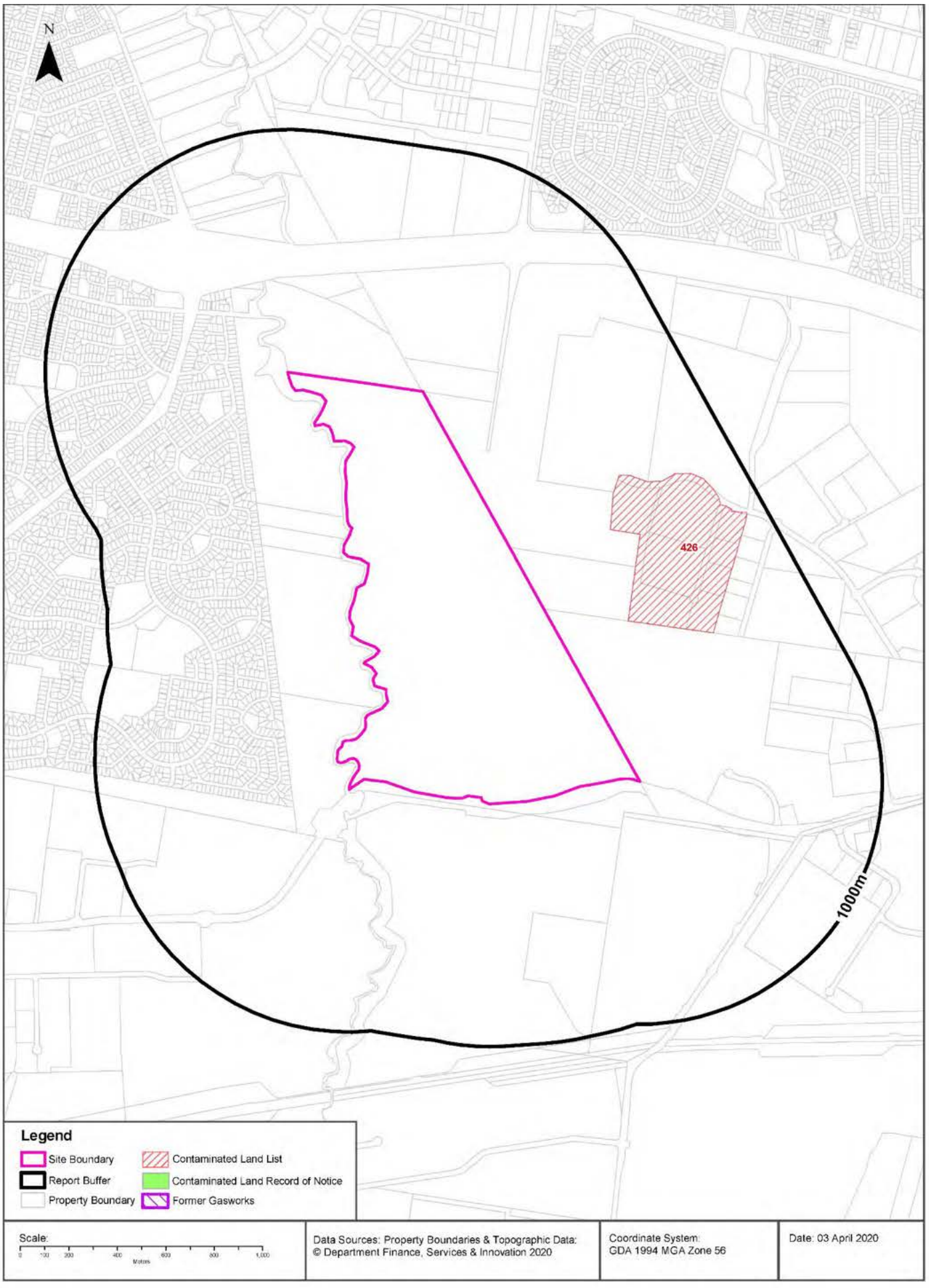
Data Sources: Aerial Imagery: © Aerometrex Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

Date: 03 April 2020

# Contaminated Land

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Contaminated Land

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## List of NSW contaminated sites notified to EPA

Records from the NSW EPA Contaminated Land list within the dataset buffer:

| Map Id | Site | Address | Suburb | Activity | Management Class | Status | Location Confidence | Dist (m) | Direction |
|---|---|---|---|---|---|---|---|---|---|
| 426 | Fulton Hogan Industries (formerly Pioneer Road Services) | Honeycomb Drive | Eastern Creek | Other Industry | Regulation under CLM Act not required | Current EPA List | Premise Match | 280m | East |

The values within the EPA site management class in the table above, are given more detailed explanations in the table below:

| EPA site management class | Explanation |
|---|---|
| Contamination being managed via the planning process (EP&A Act) | The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the Environmental Planning and Assessment Act 1979 (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment. |
| Contamination currently regulated under CLM Act | The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record of Notices. |
| Contamination currently regulated under POEO Act | The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. Management of the contamination is regulated under the Protection of the Environment Operations Act 1997 (POEO Act). The EPA's regulatory actions under the POEO Act are available on the POEO public register. |
| Contamination formerly regulated under the CLM Act | The EPA has determined that the contamination is no longer significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). The contamination was addressed under the CLM Act. |
| Contamination formerly regulated under the POEO Act | The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the Protection of the Environment Operations Act 1997 (POEO Act). |
| Contamination was addressed via the planning process (EP&A Act) | The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the Environmental Planning and Assessment Act 1979 (EP&A Act). |
| Ongoing maintenance required to manage residual contamination (CLM Act) | The EPA has determined that ongoing maintenance, under the Contaminated Land Management Act 1997 (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record of Notices. |
| Regulation being finalised | The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997. A regulatory approach is being finalised. |
| Regulation under the CLM Act not required | The EPA has completed an assessment of the contamination and decided that regulation under the Contaminated Land Management Act 1997 is not required. |
| Under assessment | The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or Protection of the Environment Operations Act 1997. Alternatively, the EPA may require information via a notice issued under s77 of the Contaminated Land Management Act 1997 or issue a Preliminary Investigation Order. |

NSW EPA Contaminated Land List Data Source: Environment Protection Authority

# Contaminated Land

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Contaminated Land: Records of Notice

Record of Notices within the dataset buffer:

| Map Id | Name | Address | Suburb | Notices | Area No | Location Confidence | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | | | |

Contaminated Land Records of Notice Data Source: Environment Protection Authority


## Former Gasworks

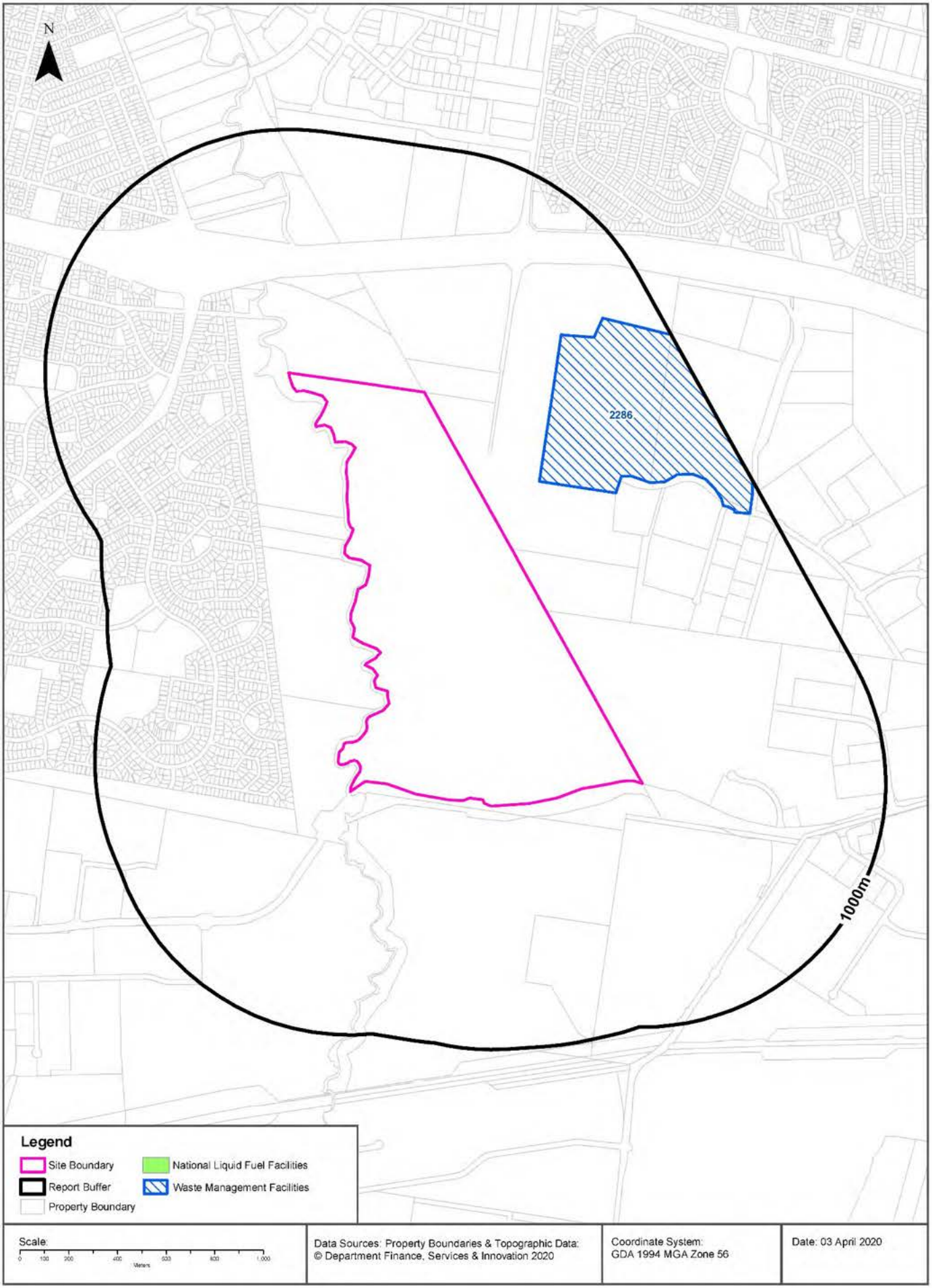
Former Gasworks within the dataset buffer:

| Map Id | Location | Council | Further Info | Location Confidence | Distance | Direction |
|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | |

Former Gasworks Data Source: Environment Protection Authority

# Waste Management & Liquid Fuel Facilities

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Waste Management & Liquid Fuel Facilities

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

| Site Id | Owner | Name | Address | Suburb | Class | Landfill | Reprocess | Transfer | Comments | Loc Conf | Dist (m) | Direction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2286 | Genesis | Genesis Xero Waste – Landfill and Recycling | Honeycomb Dr | Eastern Creek | Reprocessing | | <Null> | | | Premise Match | 234 m | North East |

Waste Management Facilities Data Source: Geoscience Australia


## National Liquid Fuel Facilities

National Liquid Fuel Facilties within the dataset buffer:

| Map Id | Owner | Name | Address | Suburb | Class | Operational Status | Operator | Revision Date | Loc Conf | Dist (m) | Direction |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | | | | | | |

National Liquid Fuel Facilities Data Source: Geoscience Australia

# PFAS Investigation & Management Programs

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## EPA PFAS Investigation Program

Sites that are part of the EPA PFAS investigation program, within the dataset buffer:

| Id | Site | Address | Loc Conf | Dist | Dir |
|---|---|---|---|---|---|
| N/A | No records in buffer | | | | |

EPA PFAS Investigation Program: Environment Protection Authority



## Defence PFAS Investigation Program

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

| Map ID | Base Name | Address | Loc Conf | Dist | Dir |
|---|---|---|---|---|---|
| N/A | No records in buffer | | | | |

Defence PFAS Investigation Program Data Custodian: Department of Defence, Australian Government

## Defence PFAS Management Program

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

| Map ID | Base Name | Address | Loc Conf | Dist | Dir |
|---|---|---|---|---|---|
| N/A | No records in buffer | | | | |

Defence PFAS Management Program Data Custodian: Department of Defence, Australian Government

## Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

| Map ID | Site Name | Impacts | Loc Conf | Dist | Dir |
|---|---|---|---|---|---|
| N/A | No records in buffer | | | | |

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

# Defence Sites

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

| Property ID | Base Name | Address | Known Contamination | Loc Conf | Dist | Dir |
|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | |

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

# EPA Other Sites with Contamination Issues

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## EPA Other Sites with Contamination Issues

This dataset contains other sites identified on the EPA website as having contamination issues. This dataset currently includes:

- James Hardie asbestos manufacturing and waste disposal sites
- Radiological investigation sites in Hunter's Hill
- Pasminco Lead Abatement Strategy Area

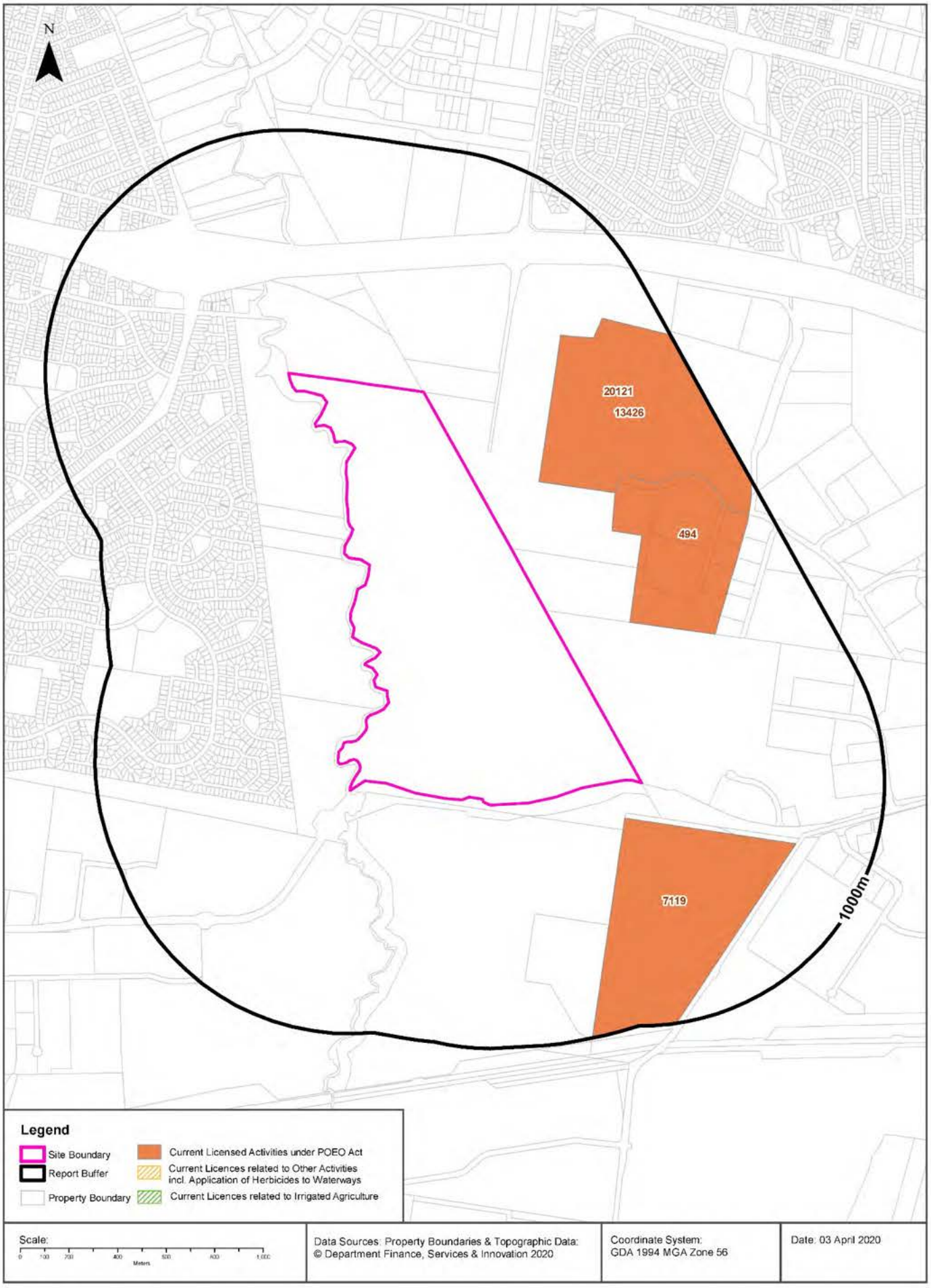
Sites within the dataset buffer:

| Site Id | Site Name | Site Address | Dataset | Comments | Location Confidence | Distance | Direction |
|---|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | | |

EPA Other Sites with Contamination Issues: Environment Protection Authority

# Current EPA Licensed Activities

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# EPA Activities

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Licensed Activities under the POEO Act 1997

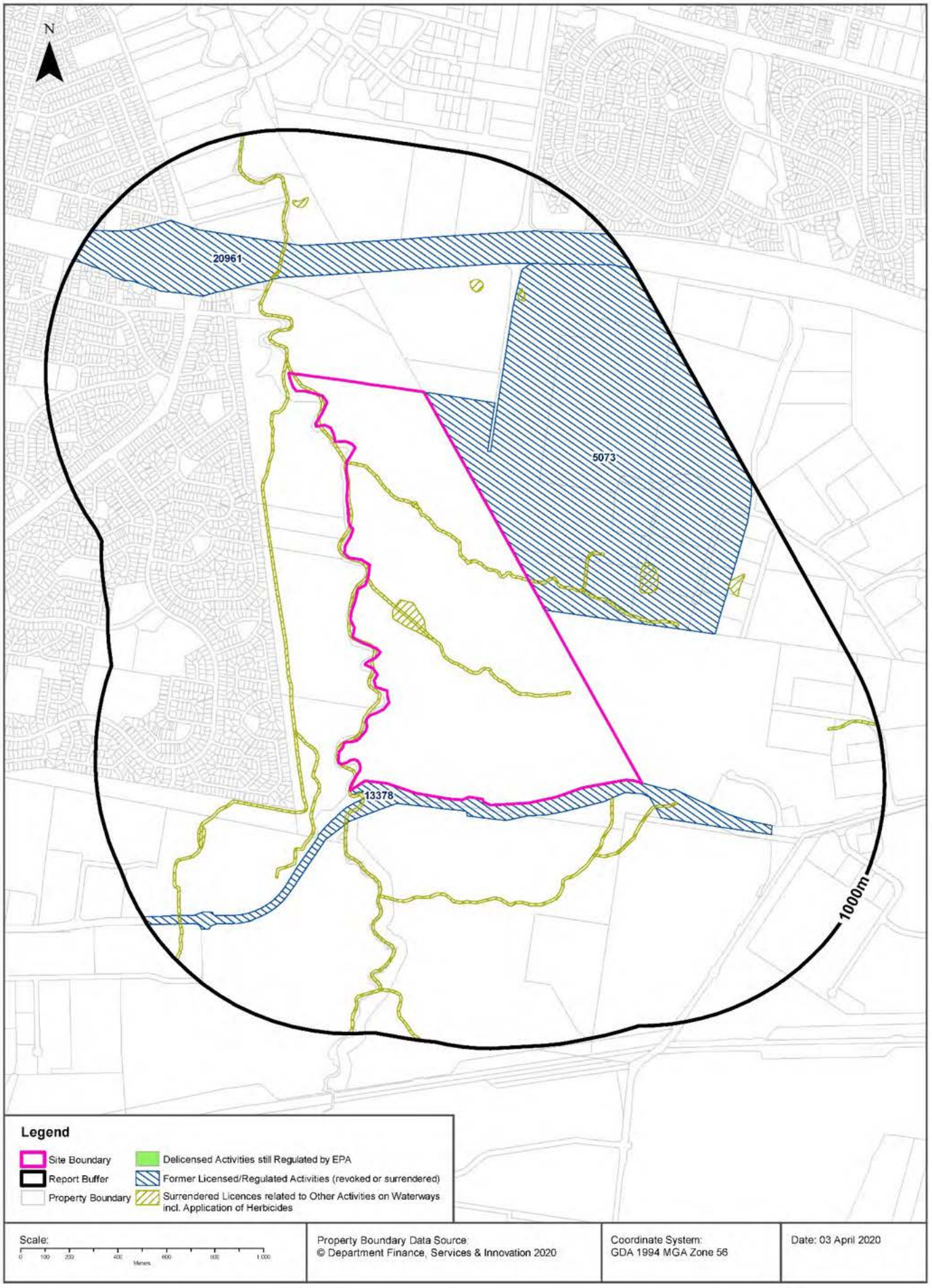
Licensed activities under the Protection of the Environment Operations Act 1997, within the dataset buffer:

| EPL | Organisation | Name | Address | Suburb | Activity | Loc Conf | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| 7119 | NSW ELECTRICITY NETWORKS OPERATIONS PTY LIMITED | TRANSGRID | 200 OLD WALLGROVE ROAD | EASTERN CREEK | Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste | Premise Match | 153m | South East |
| 13426 | Dial-A-Dump (EC) Pty Ltd | Genesis Facility | Honeycomb Drive | EASTERN CREEK | Waste disposal by application to land | Premise Match | 234m | North East |
| 13426 | Dial-A-Dump (EC) Pty Ltd | Genesis Facility | Honeycomb Drive | EASTERN CREEK | Waste storage - other types of waste | Premise Match | 234m | North East |
| 20121 | Dial-A-Dump (EC) Pty Ltd | Genesis Recycling Facility | Honeycomb Drive | EASTERN CREEK | Composting | Premise Match | 234m | North East |
| 20121 | Dial-A-Dump (EC) Pty Ltd | Genesis Recycling Facility | Honeycomb Drive | EASTERN CREEK | Recovery of general waste | Premise Match | 234m | North East |
| 20121 | Dial-A-Dump (EC) Pty Ltd | Genesis Recycling Facility | Honeycomb Drive | EASTERN CREEK | Waste storage - other types of waste | Premise Match | 234m | North East |
| 494 | FULTON HOGAN INDUSTRIES PTY LTD | FULTON HOGAN INDUSTRIES PTY LTD | Honeycomb Drive | EASTERN CREEK | Recovery of general waste; Waste storage - other types of waste | Premise Match | 280m | East |

POEO Licence Data Source: Environment Protection Authority

# Delicensed & Former Licensed EPA Activities

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# EPA Activities

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Delicensed Activities still regulated by the EPA

Delicensed activities still regulated by the EPA, within the dataset buffer:

| Licence No | Organisation | Name | Address | Suburb | Activity | Loc Conf | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | | | |



## Former Licensed Activities under the POEO Act 1997, now revoked or surrendered

Former Licensed activities under the Protection of the Environment Operations Act 1997, now revoked or surrendered, within the dataset buffer:

| Licence No | Organisation | Location | Status | Issued Date | Activity | Loc Conf | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| 4653 | LUHRMANN ENVIRONMENT MANAGEMENT PTY LTD | WATERWAYS THROUGHOUT NSW | Surrendered | 06/09/2000 | Other Activities / Non Scheduled Activity - Application of Herbicides | Network of Features | 0m | Onsite |
| 4838 | Robert Orchard | Various Waterways throughout New South Wales - SYDNEY NSW 2000 | Surrendered | 07/09/2000 | Other Activities / Non Scheduled Activity - Application of Herbicides | Network of Features | 0m | Onsite |
| 6630 | SYDNEY WEED & PEST MANAGEMENT PTY LTD | WATERWAYS THROUGHOUT NSW - PROSPECT, NSW, 2148 | Surrendered | 09/11/2000 | Other Activities / Non Scheduled Activity - Application of Herbicides | Network of Features | 0m | Onsite |
| 5073 | HANSON CONSTRUCTION MATERIALS PTY LTD | HANSON CONSTRUCTION MATERIALS PTY LTD, Off Wallgrove Road, EASTERN CREEK | Surrendered | 02/11/2000 | Concrete works | Premise Match | 0m | North East |
| 5073 | HANSON CONSTRUCTION MATERIALS PTY LTD | HANSON CONSTRUCTION MATERIALS PTY LTD, Off Wallgrove Road, EASTERN CREEK | Surrendered | 02/11/2000 | Crushing, grinding or separating | Premise Match | 0m | North East |
| 5073 | HANSON CONSTRUCTION MATERIALS PTY LTD | HANSON CONSTRUCTION MATERIALS PTY LTD, Off Wallgrove Road, EASTERN CREEK | Surrendered | 02/11/2000 | Land-based extractive activity | Premise Match | 0m | North East |
| 5073 | HANSON CONSTRUCTION MATERIALS PTY LTD | HANSON CONSTRUCTION MATERIALS PTY LTD, Off Wallgrove Road, EASTERN CREEK | Surrendered | 02/11/2000 | Recovery of general waste | Premise Match | 0m | North East |
| 5073 | HANSON CONSTRUCTION MATERIALS PTY LTD | HANSON CONSTRUCTION MATERIALS PTY LTD, Off Wallgrove Road, EASTERN CREEK | Surrendered | 02/11/2000 | Waste storage - other types of waste | Premise Match | 0m | North East |

| Licence No | Organisation | Location | Status | Issued Date | Activity | Loc Conf | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| 13378 | NACE CIVIL ENGINEERING PTY. LIMITED | Erskine Park Link Road, between Lenore Lane & Old Wallgrove Road, ERSKINE PARK | Surrendered | 11/03/2011 | Road construction | Road Match | 0m | South |
| 5073 | FULTON HOGAN CONSTRUCTION PTY LTD | , M4 - East of Reservoir Road to East of Mamre Road, PARRAMATTA, NSW 2150, | Surrendered | 30/06/2017 | Road construction | Road Match | 389m | North |

Former Licensed Activities Data Source: Environment Protection Authority

# Historical Business Directories

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Business Directory Records 1950-1991 Premise or Road Intersection Matches

Universal Business Directory records from years 1991, 1986, 1982, 1978, 1975, 1970, 1965, 1961 & 1950, mapped to a premise or road intersection within the dataset buffer:

| Map Id | Business Activity | Premise | Ref No. | Year | Location Confidence | Distance to Property Boundary or Road Intersection | Direction |
|---|---|---|---|---|---|---|---|
| | No records in buffer | | | | | | |

## Business Directory Records 1950-1991
## Road or Area Matches

Universal Business Directory records from years 1991, 1986, 1982, 1978, 1975, 1970, 1965, 1961 & 1950, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published:

| Map Id | Business Activity | Premise | Ref No. | Year | Location Confidence | Distance to Road Corridor or Area |
|---|---|---|---|---|---|---|
| | No records in buffer | | | | | |

# Historical Business Directories

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Dry Cleaners, Motor Garages & Service Stations 1948-1993 Premise or Road Intersection Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a premise or road intersection, within the dataset buffer.

Note: The Universal Business Directories were published between 1948 and 1993. Dry Cleaners, Motor Garages & Service Stations have been extracted from all of these directories except the following years 1951, 1955, 1957, 1960, 1963, 1973, 1974, 1977, 1987.

| Map Id | Business Activity | Premise | Ref No. | Year | Location Confidence | Distance to Property Boundary or Road Intersection | Direction |
|---|---|---|---|---|---|---|---|
| | No records in buffer | | | | | | |

# Dry Cleaners, Motor Garages & Service Stations 1948-1993 Road or Area Matches

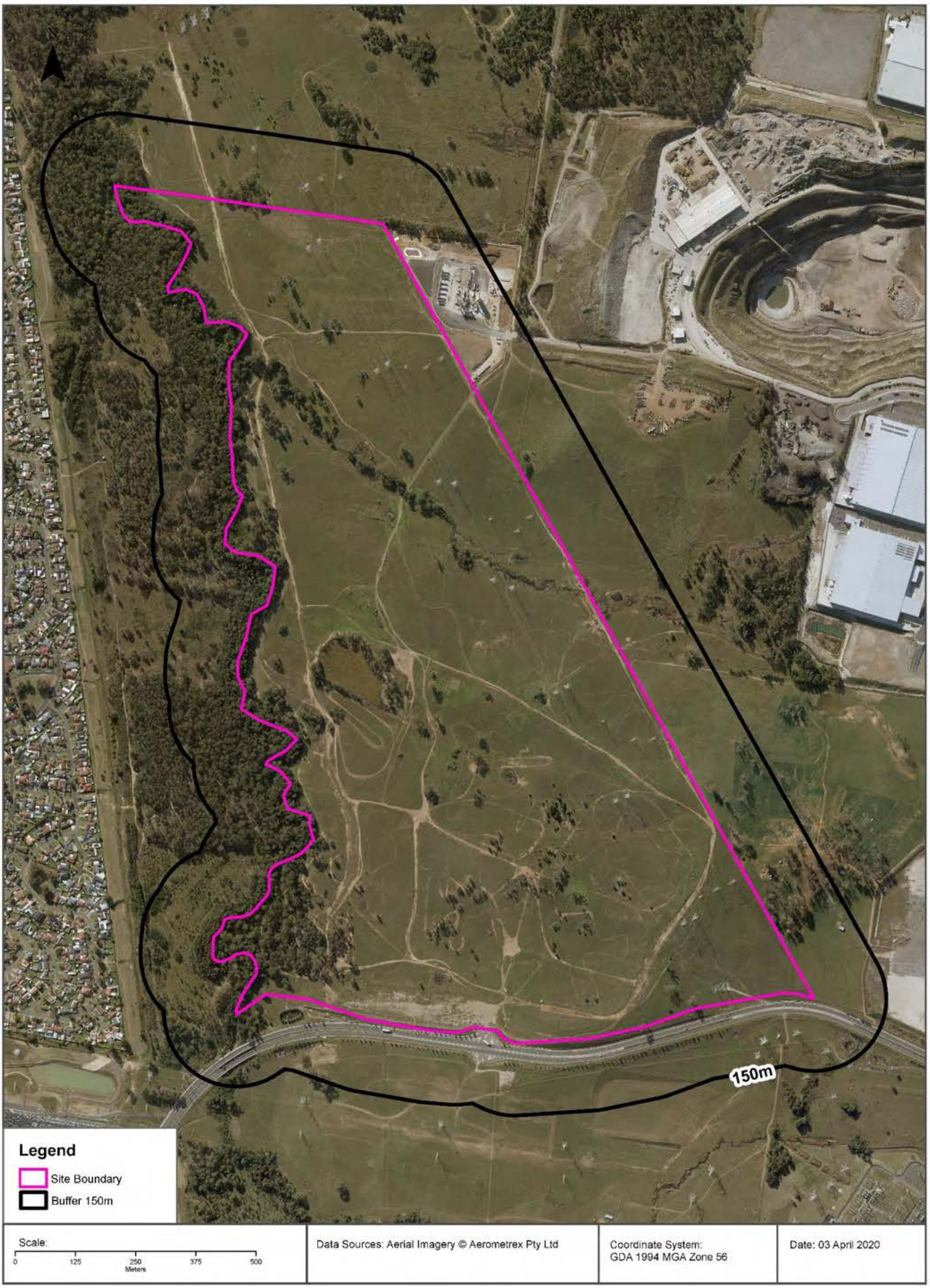
Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published.

Note: The Universal Business Directories were published between 1948 and 1993. Dry Cleaners, Motor Garages & Service Stations have been extracted from all of these directories except the following years 1951, 1955, 1957, 1960, 1963, 1973, 1974, 1977, 1987.

| Map Id | Business Activity | Premise | Ref No. | Year | Location Confidence | Distance to Road Corridor or Area |
|---|---|---|---|---|---|---|
| | No records in buffer | | | | | |

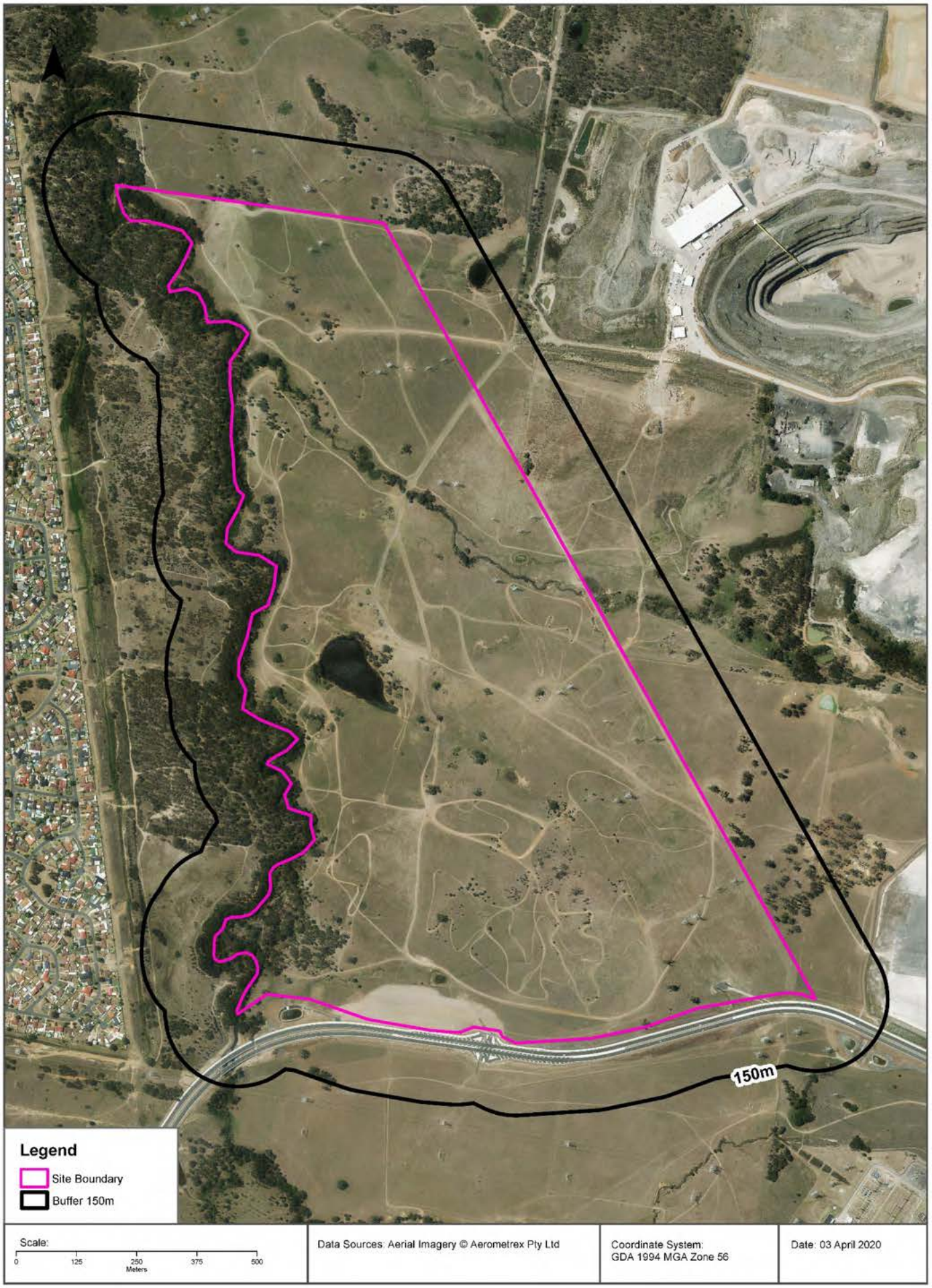
# Aerial Imagery 2019

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Aerial Imagery 2014

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

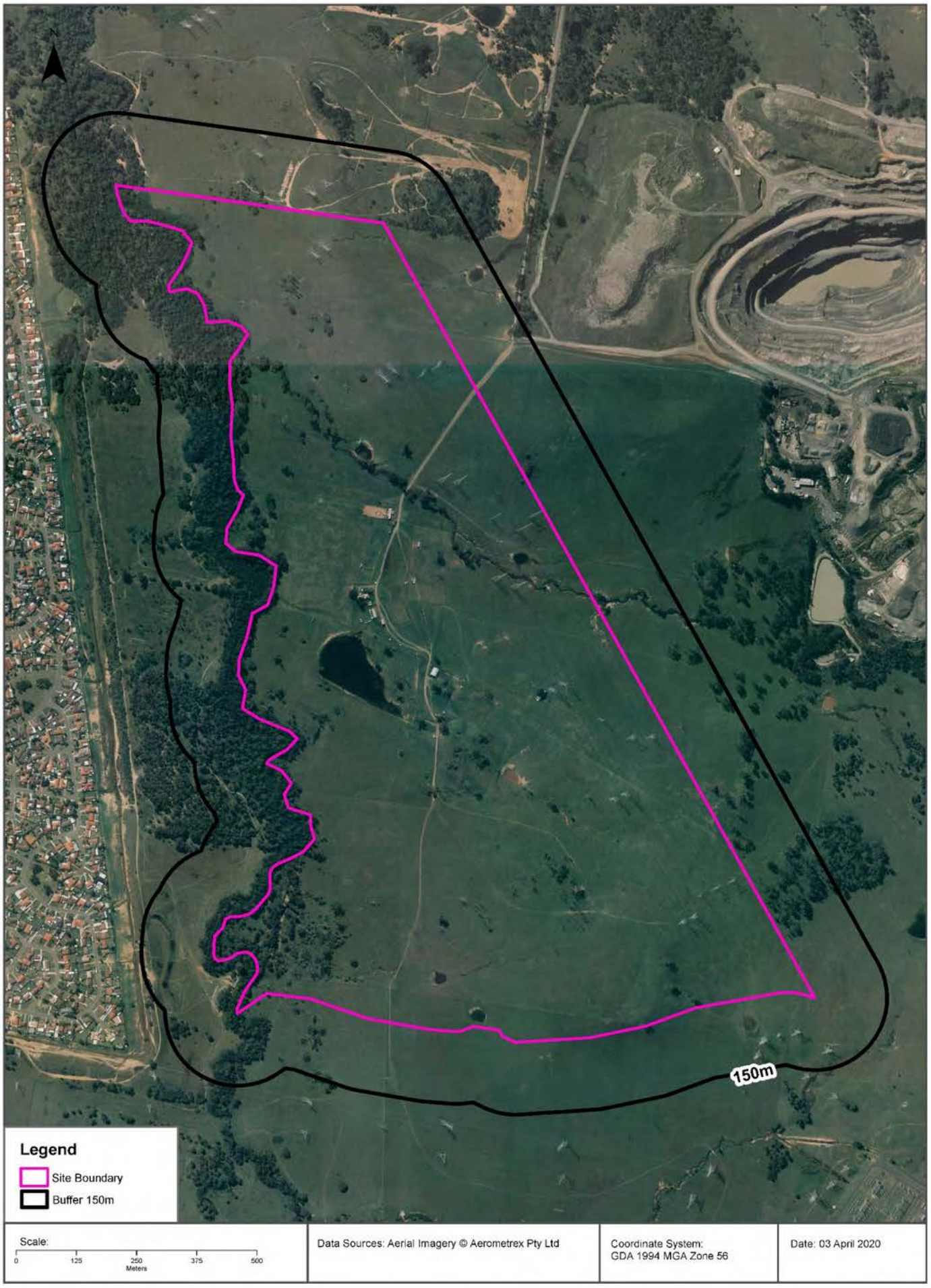


# Aerial Imagery 2007

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

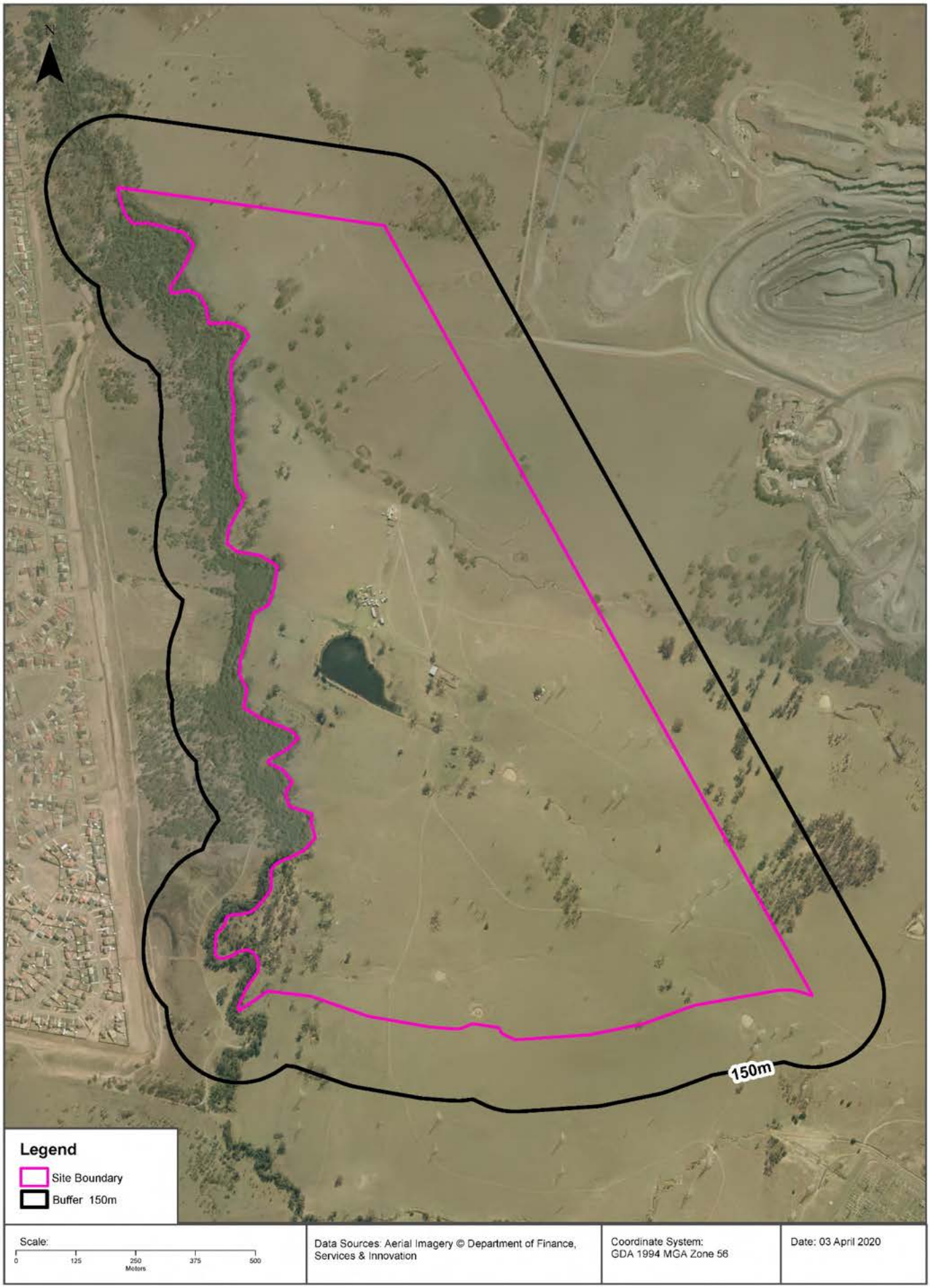
# Aerial Imagery 2000

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



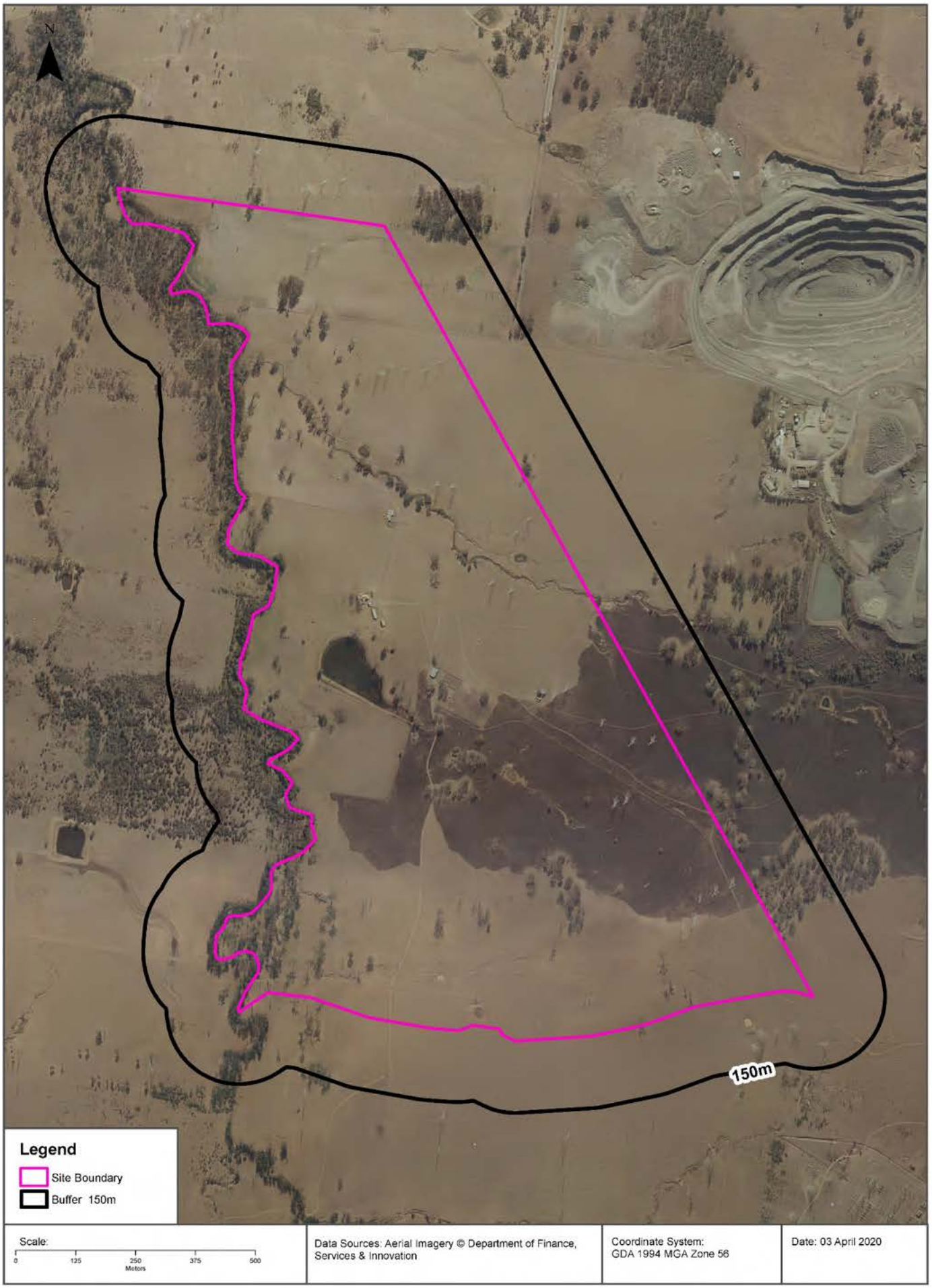
# Aerial Imagery 1991

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Aerial Imagery 1982

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

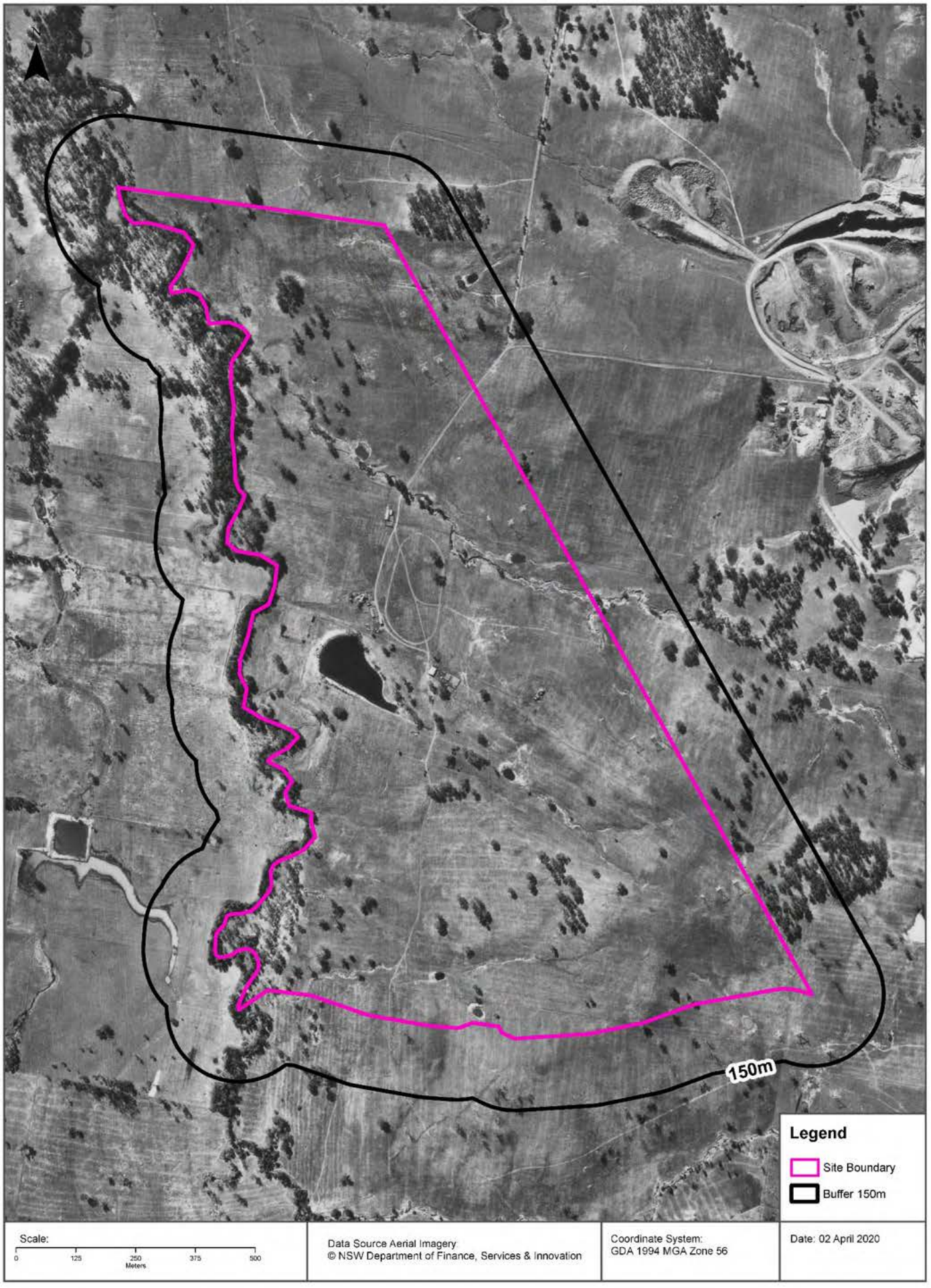


# Aerial Imagery 1970

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

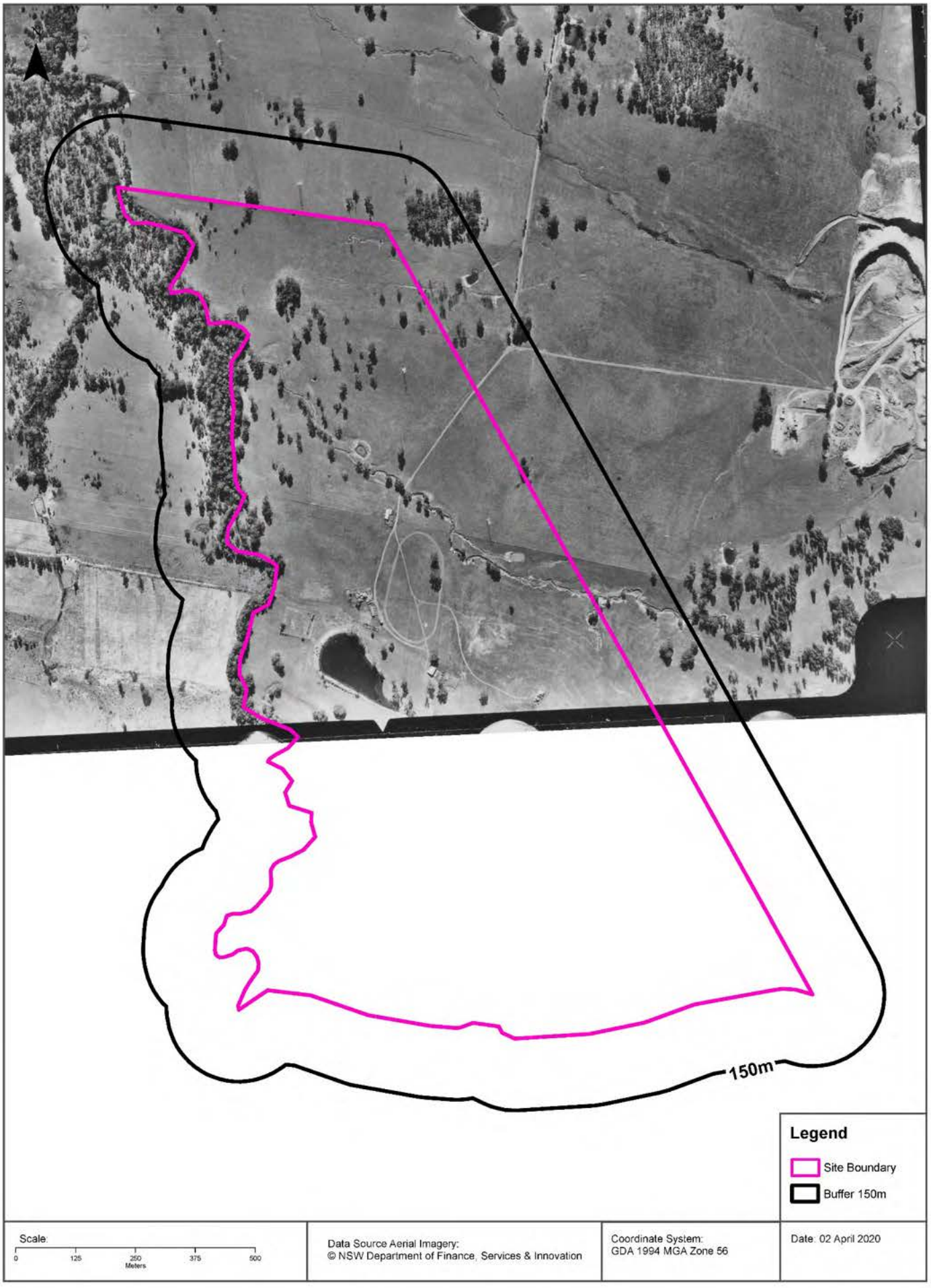
# Aerial Imagery 1965

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



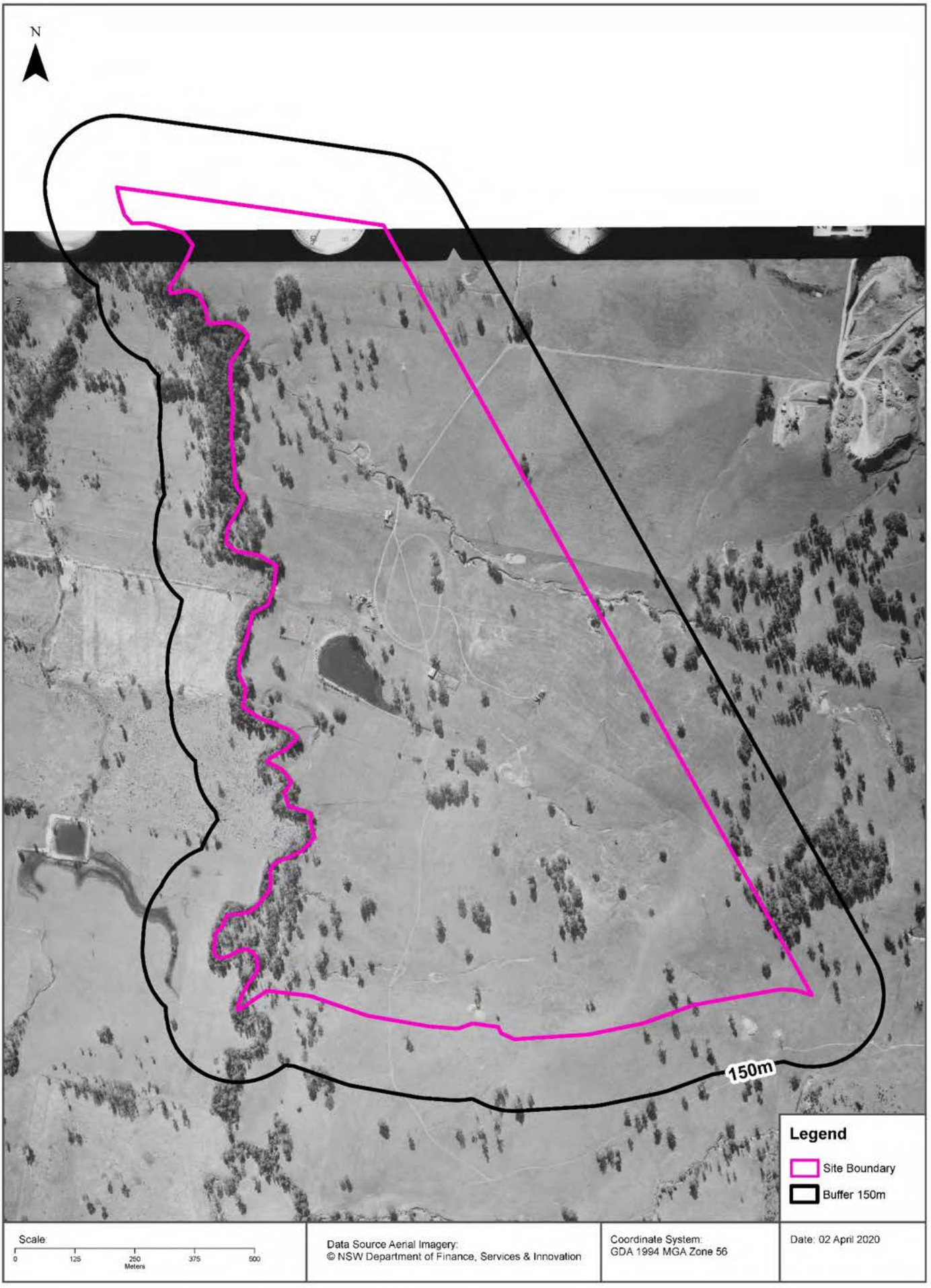
# Aerial Imagery 1961

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



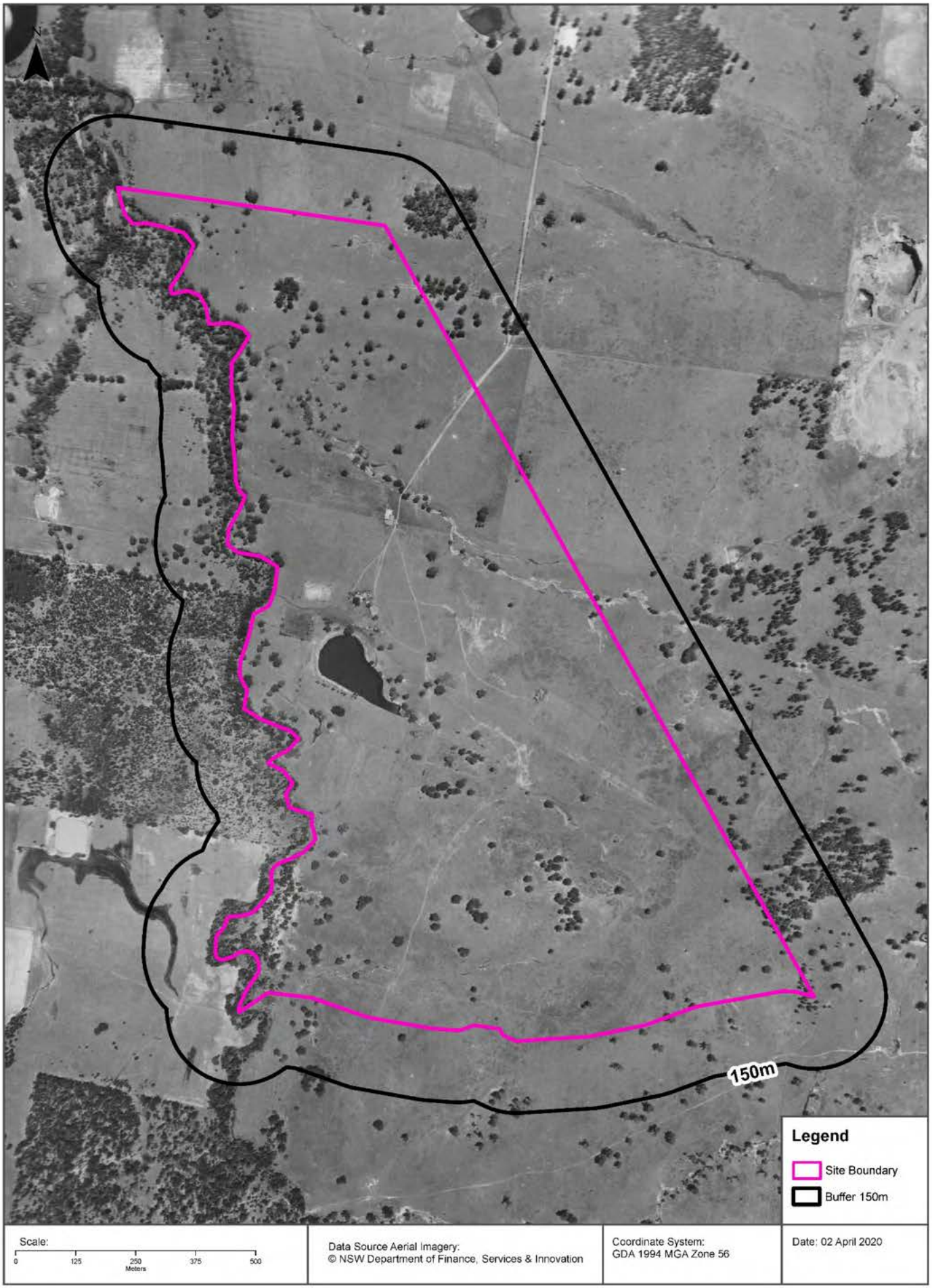
# Aerial Imagery 1961

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



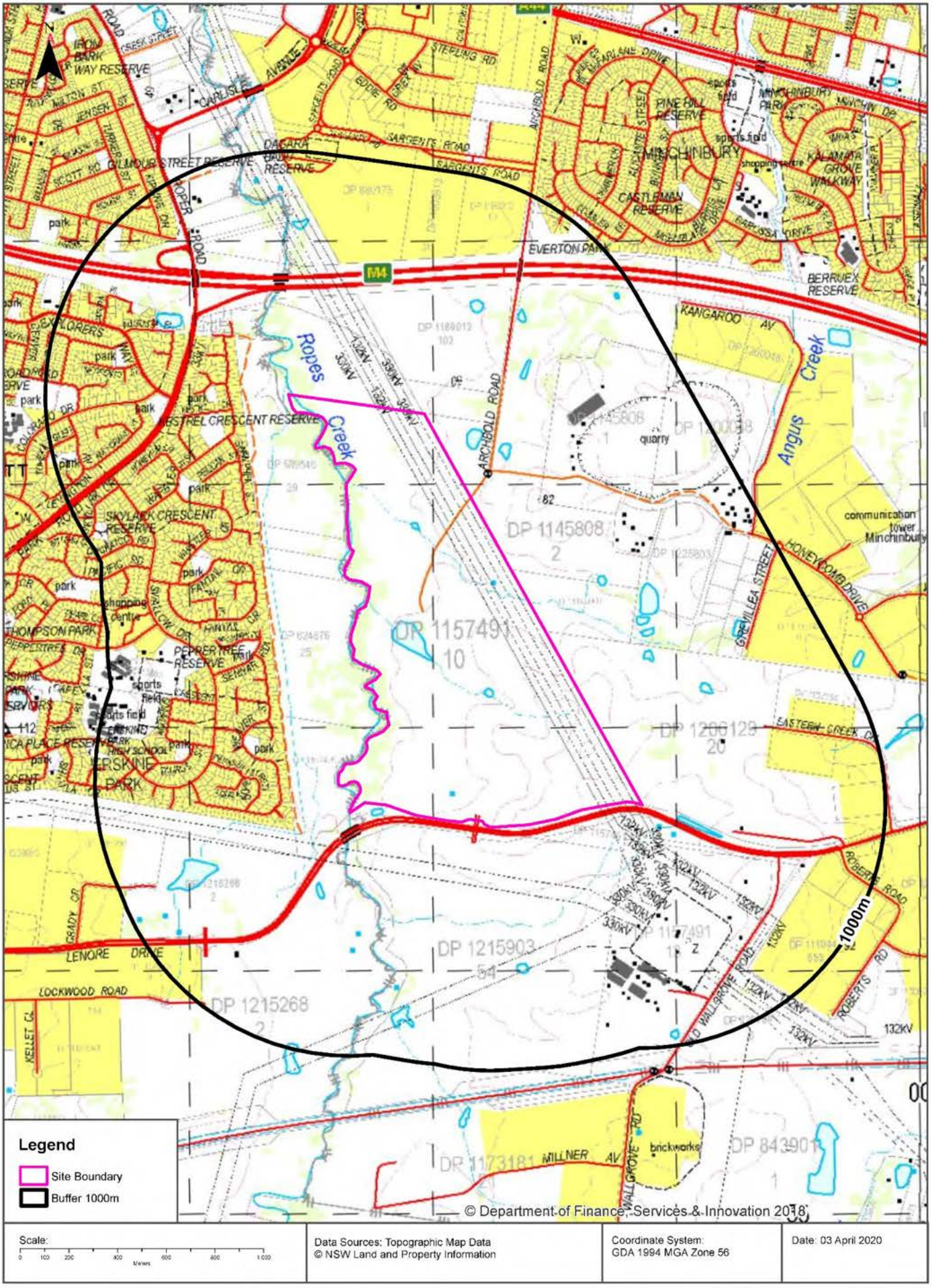
# Aerial Imagery 1956

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



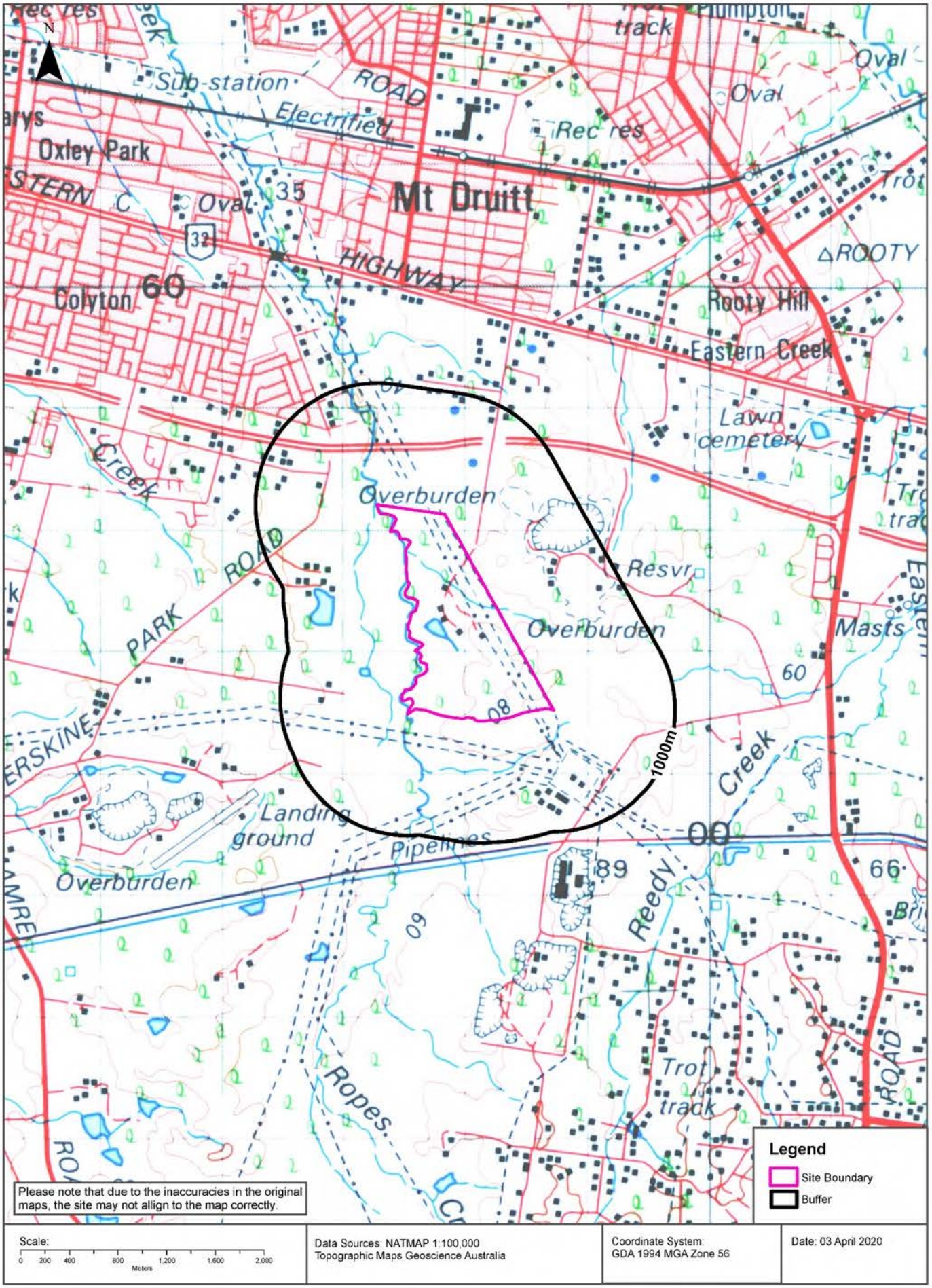
# Topographic Map 2015

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



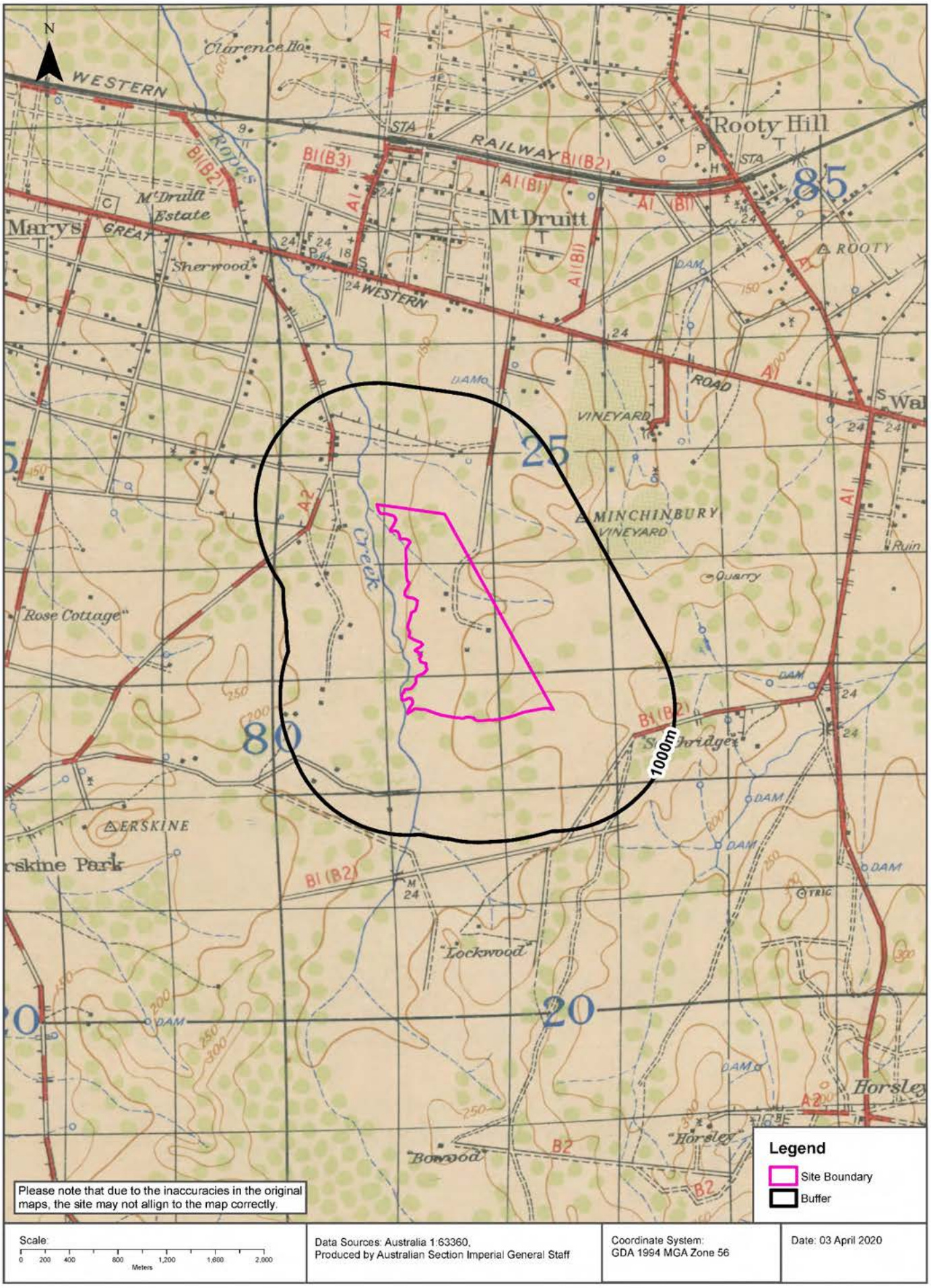
# Historical Map 1975

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



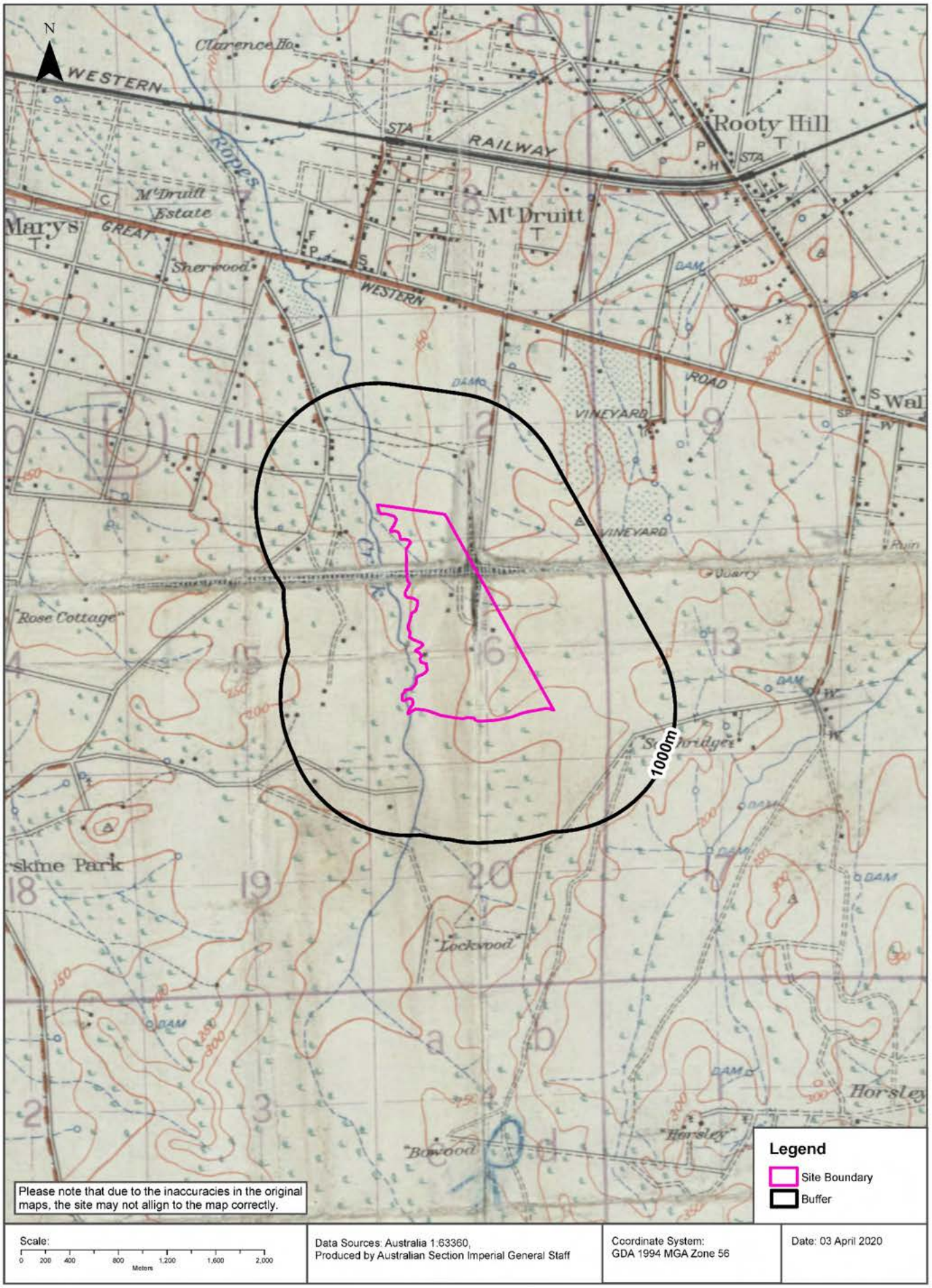
# Historical Map c.1942

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



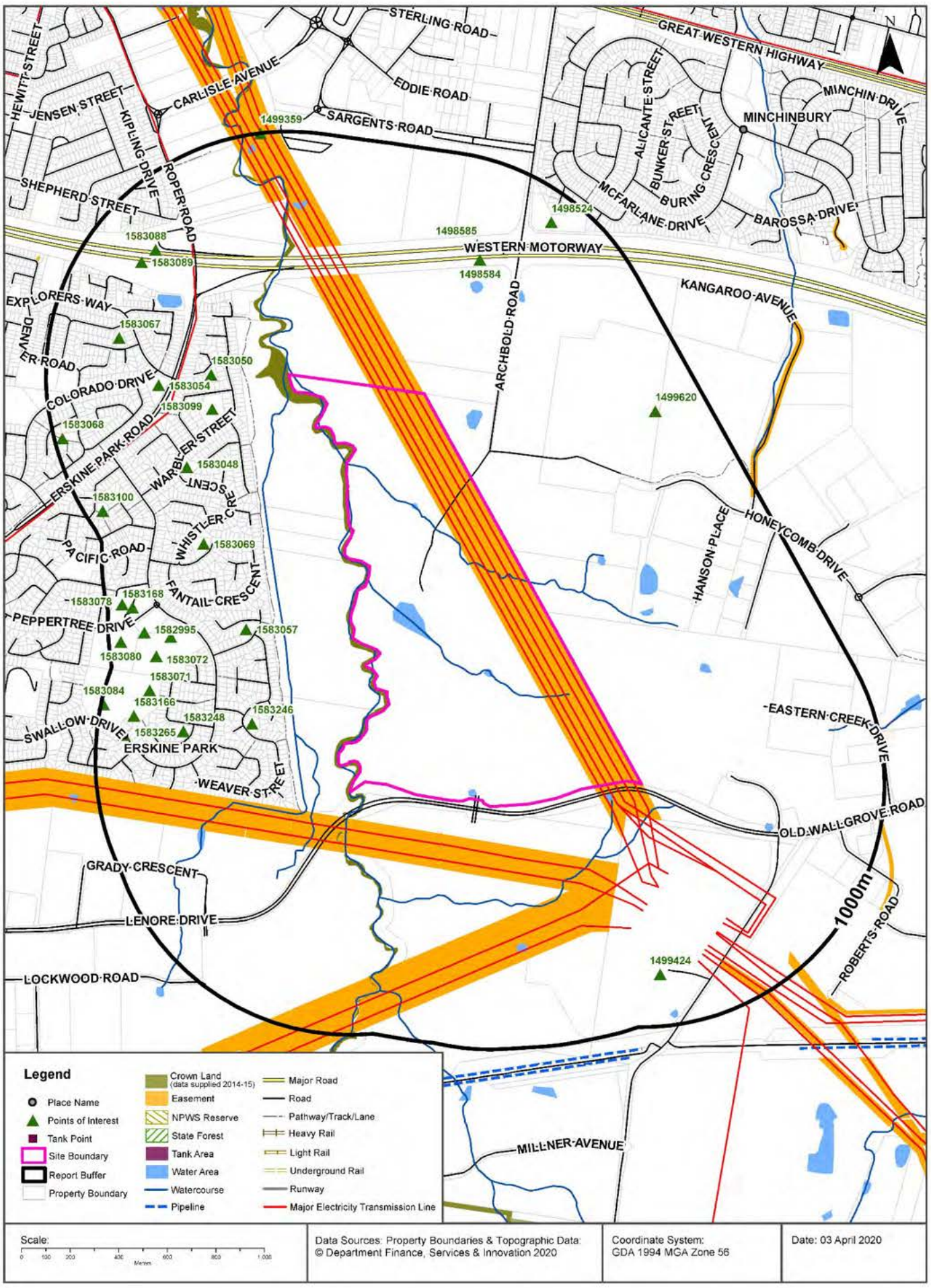
# Historical Map c.1929

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Topographic Features

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Topographic Features

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Points of Interest

What Points of Interest exist within the dataset buffer?

| Map Id | Feature Type | Label | Distance | Direction |
|---|---|---|---|---|
| 1583050 | Park | Park | 320m | North West |
| 1583099 | Park | KESTREL CRESCENT RESERVE | 341m | North West |
| 1583246 | Park | Park | 378m | South West |
| 1583057 | Park | Park | 431m | West |
| 1583054 | Park | Park | 538m | North West |
| 1583048 | Park | Park | 543m | North West |
| 1583069 | Park | Park | 582m | West |
| 1498584 | Roadside Emergency Telephone | 371 | 597m | North |
| 1583248 | Park | Park | 647m | West |
| 1498585 | Roadside Emergency Telephone | 372 | 651m | North |
| 1583067 | Park | Park | 714m | North West |
| 1583056 | Park | PEPPERTREE RESERVE | 744m | West |
| 1583088 | Roadside Emergency Telephone | 374 | 751m | North West |
| 1583089 | Roadside Emergency Telephone | 373k | 763m | North West |
| 1499424 | Parking Area | Parking Area | 786m | South East |
| 1499620 | Quarry - Open Cut | Quarry - Open Cut | 797m | North East |
| 1583072 | Sports Field | Sports Field | 812m | West |
| 1583071 | Sports Field | Sports Field | 821m | West |
| 1582995 | Community Facility | ERSKINE PARK COMMUNITY CENTRE | 851m | West |
| 1583166 | Parking Area | Parking Area | 858m | West |
| 1498524 | Park | EVERTON PARK | 879m | North |
| 1583265 | Suburb | ERSKINE PARK | 887m | West |
| 1583168 | Parking Area | Parking Area | 898m | West |
| 1583100 | Park | SKYLARK CRESCENT RESERVE | 931m | West |
| 1583078 | Shopping Centre | ERSKINE PARK SHOPPING CENTRE | 937m | West |
| 1583080 | Primary School | JAMES ERSKINE PUBLIC SCHOOL | 950m | West |
| 1583068 | Park | Park | 967m | North West |
| 1583084 | High School | ERSKINE PARK HIGH SCHOOL | 990m | West |
| 1499359 | Park | DAGARA BADU RESERVE | 1000m | North |

# Topographic Features

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Tanks (Areas)

What are the Tank Areas located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

| Map Id | Tank Type | Status | Name | Feature Currency | Distance | Direction |
|---|---|---|---|---|---|---|
| | No records in buffer | | | | | |

## Tanks (Points)

What are the Tank Points located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

| Map Id | Tank Type | Status | Name | Feature Currency | Distance | Direction |
|---|---|---|---|---|---|---|
| | No records in buffer | | | | | |



## Major Easements

What Major Easements exist within the dataset buffer?
Note. Easements provided by LPI are not at the detail of local governments. They are limited to major easements such as Right of Carriageway, Electrical Lines (66kVa etc.), Easement to drain water & Significant subterranean pipelines (gas, water etc.).

| Map Id | Easement Class | Easement Type | Easement Width | Distance | Direction |
|---|---|---|---|---|---|
| 120119382 | Primary | Undefined | | 0m | Onsite |
| 120107751 | Primary | Undefined | | 111m | South |
| 120115487 | Primary | Undefined | | 359m | South |
| 120111578 | Primary | Undefined | | 426m | South |
| 120115466 | Primary | Undefined | | 532m | North |
| 164434019 | Primary | Electricity | 60.96 | 768m | South West |
| 120111700 | Primary | Undefined | | 803m | South East |
| 120115504 | Primary | Undefined | | 808m | North West |
| 120112149 | Primary | Undefined | | 924m | South East |
| 120111606 | Primary | Undefined | | 932m | North West |
| 169752963 | Primary | Right of way | 21.5m | 972m | North East |
| 153761056 | Primary | Right of way | 10m | 986m | South East |

# Topographic Features

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## State Forest

What State Forest exist within the dataset buffer?

| State Forest Number | State Forest Name | Distance | Direction |
|---|---|---|---|
| N/A | No records in buffer | | |



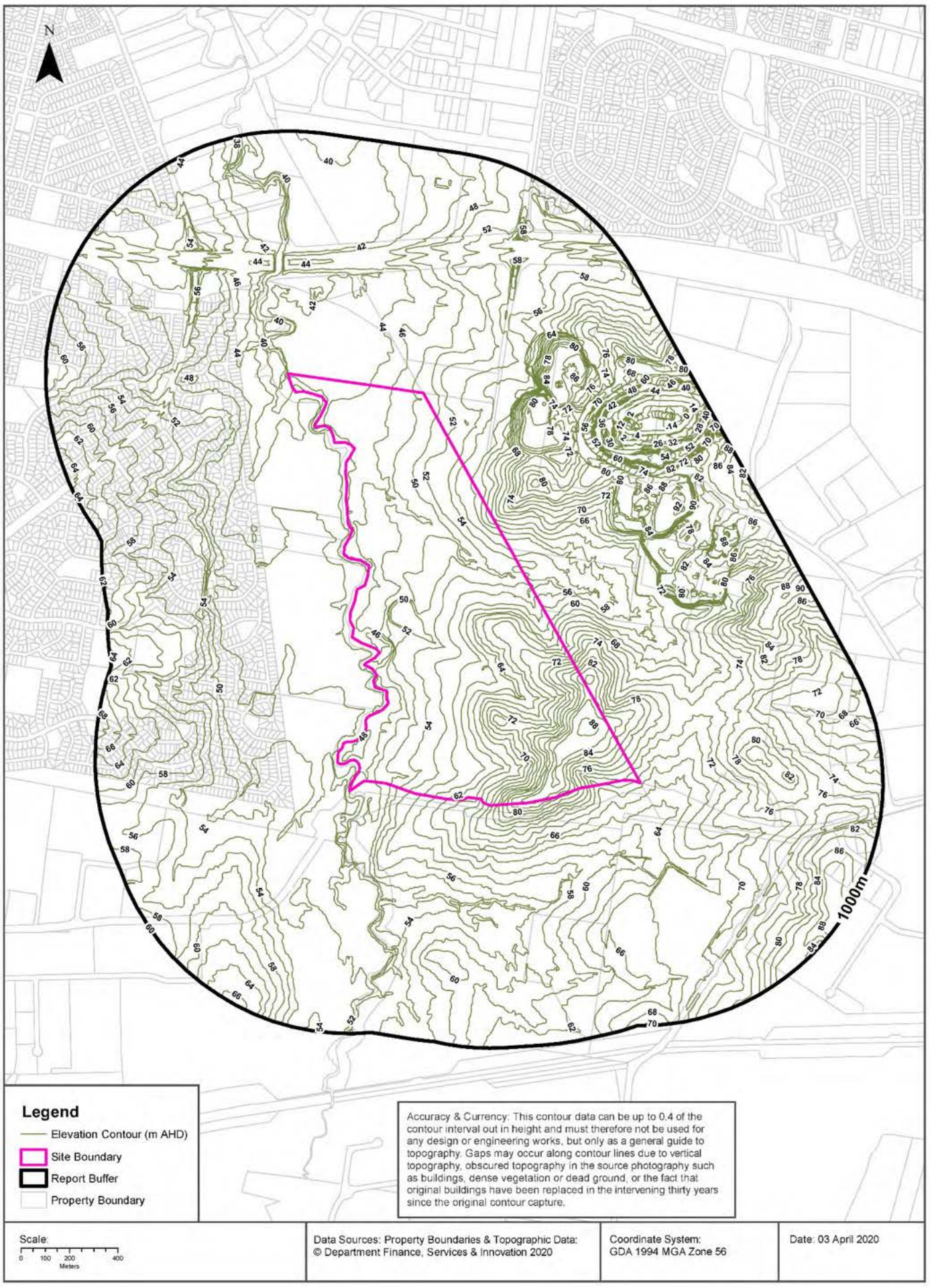
## National Parks and Wildlife Service Reserves

What NPWS Reserves exist within the dataset buffer?

| Reserve Number | Reserve Type | Reserve Name | Gazetted Date | Distance | Direction |
|---|---|---|---|---|---|
| N/A | No records in buffer | | | | |

# Elevation Contours (m AHD)

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Hydrogeology & Groundwater

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Hydrogeology

Description of aquifers on-site:

| Description |
|---|
| Porous, extensive aquifers of low to moderate productivity |

Description of aquifers within the dataset buffer:

| Description |
|---|
| Porous, extensive aquifers of low to moderate productivity |

Hydrogeology Map of Australia : Commonwealth of Australia (Geoscience Australia)


## Botany Groundwater Management Zones

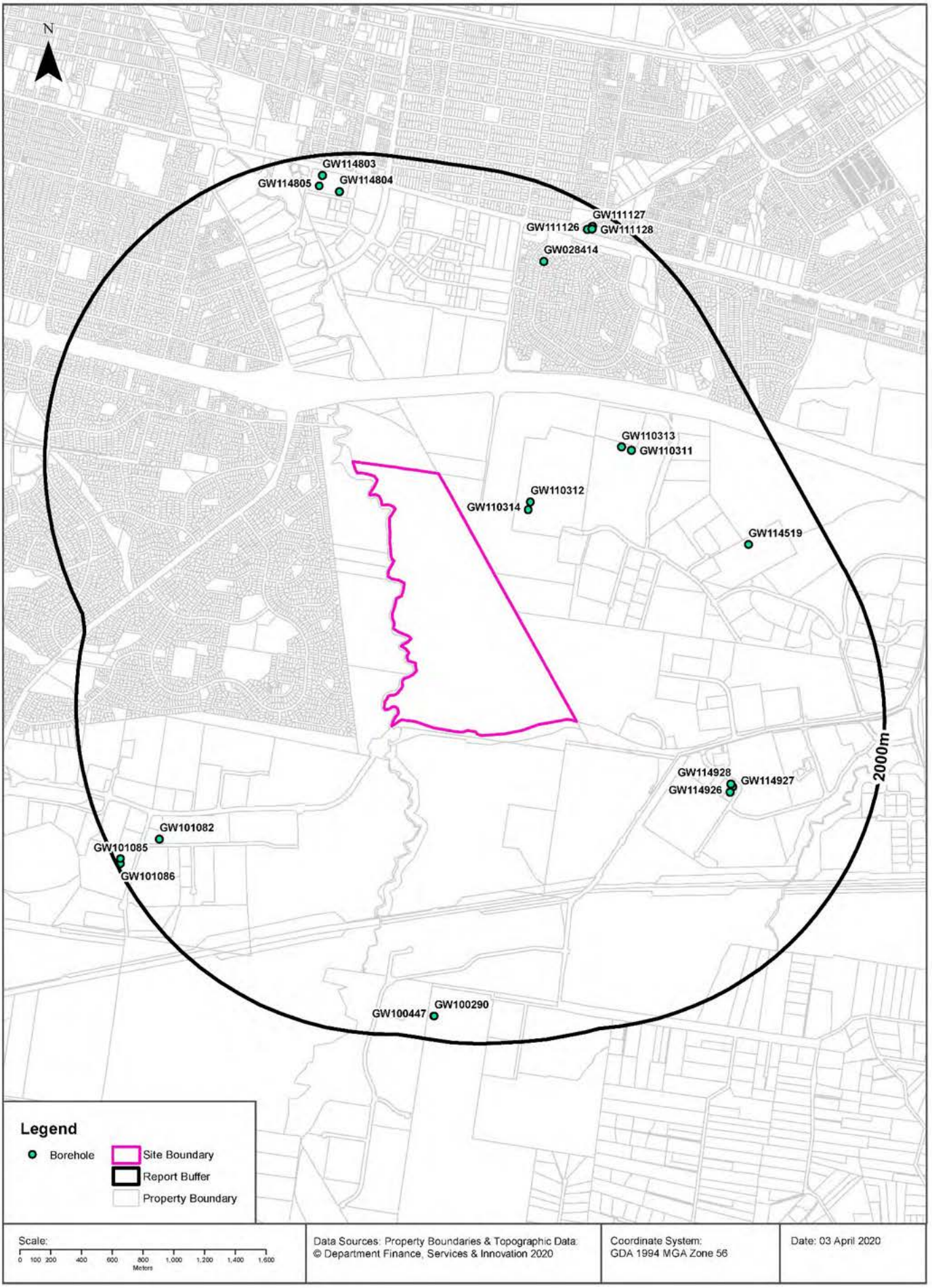
Groundwater management zones relating to the Botany Sand Beds aquifer within the dataset buffer:

| Management Zone No. | Restriction | Distance | Direction |
|---|---|---|---|
| N/A | No records in buffer | | |

Botany Groundwater Management Zones Data Source : NSW Department of Primary Industries

# Groundwater Boreholes

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Hydrogeology & Groundwater

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Groundwater Boreholes

Boreholes within the dataset buffer:

| GW No. | Licence No | Work Type | Owner Type | Authorised Purpose | Intended Purpose | Name | Complete Date | Final Depth (m) | Drilled Depth (m) | Salinity (mg/L) | SWL (m) | Yield (L/s) | Elev (AHD) | Dist | Dir |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GW110314 | 10BL602119 | Well | Private | Monitoring Bore | Monitoring Bore | | 08/07/2009 | 151.00 | 151.00 | | 40.30 | 0.100 | | 397m | North East |
| GW110312 | 10BL602119 | Well | Private | Monitoring Bore | Monitoring Bore | | 08/07/2009 | 100.00 | 100.00 | | 39.80 | 0.200 | | 434m | North East |
| GW114928 | 10BL604993 | | | Monitoring Bore | Monitoring Bore | | 10/10/2011 | 11.50 | 11.50 | | | | | 1084m | South West |
| GW114926 | 10BL604993 | Bore | Private | Monitoring Bore | Monitoring Bore | CALTEX EASTERN CREE | 08/07/2015 | 13.50 | 13.50 | | | | | 1101m | South West |
| GW114927 | 10BL604993 | Bore | Private | Monitoring Bore | Monitoring Bore | CALTEX EASTERN CREE | 08/07/2015 | 18.00 | 18.00 | | | | | 1105m | South West |
| GW110313 | 10BL602119 | Well | Private | Monitoring Bore | Monitoring Bore | | 08/07/2009 | 150.00 | 150.00 | | 40.30 | 0.200 | | 1122m | North East |
| GW110311 | 10BL602119 | Well | Private | Monitoring Bore | Monitoring Bore | | 08/07/2009 | 100.00 | 100.00 | | 31.60 | 0.200 | | 1169m | North East |
| GW114519 | 10BL603793 | Bore | Private | Monitoring Bore | Monitoring Bore | Australand Industrial No111 | 04/08/2014 | 12.00 | 8.00 | | | | | 1535m | East |
| GW028414 | 10BL020250 | Well | Private | Irrigation | Irrigation | | 01/03/1966 | 6.00 | 6.10 | | | | | 1538m | North |
| GW101082 | 10BL157654 | Bore | | Monitoring Bore | Test Bore | | 27/05/1996 | 40.30 | 40.30 | | 12.43 | | | 1675m | South West |
| GW114804 | 10BL604242 | Bore | Private | Monitoring Bore | Monitoring Bore | | 01/01/2010 | 8.50 | 8.50 | | | | | 1753m | North |
| GW114805 | 10BL604242 | Bore | Private | Monitoring Bore | Monitoring Bore | | 01/01/2010 | 7.50 | 7.50 | | | | | 1799m | North |
| GW100290 | 10BL154250 | Bore | Private | Monitoring Bore | Monitoring Bore | | 21/10/1994 | 80.00 | 80.00 | 1970 | | | | 1847m | South |
| GW100447 | 10BL157800 | Bore - Nested (4) | Private | Monitoring Bore | Monitoring Bore | | 11/11/1996 | 29.60 | 29.60 | 22900 | 2.89 | 0.100 | | 1847m | South |
| GW111126 | 10BL604062 | Well | Private | Monitoring Bore | Monitoring Bore | | 23/04/2010 | 10.00 | 10.00 | | | | | 1856m | North |
| GW114803 | 10BL604242 | Bore | Private | Monitoring Bore | Monitoring Bore | | 01/01/2010 | 6.00 | 6.00 | | | | | 1866m | North |
| GW111128 | 10BL604062 | Well | Private | Monitoring Bore | Monitoring Bore | | 23/04/2010 | 10.00 | 10.00 | | | | | 1875m | North |
| GW111127 | 10BL604062 | Well | Private | Monitoring Bore | Monitoring Bore | | 23/04/2010 | 10.00 | 10.00 | | | | | 1892m | North |
| GW101085 | 10BL157654 | Bore | | Monitoring Bore | Test Bore | | 30/05/1996 | 99.30 | 99.30 | | | | | 1960m | South West |
| GW101086 | 10BL157654 | Bore | | Monitoring Bore | Test Bore | | 29/05/1996 | 69.70 | 69.70 | | | | | 1974m | South West |

# Hydrogeology & Groundwater

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Driller's Logs

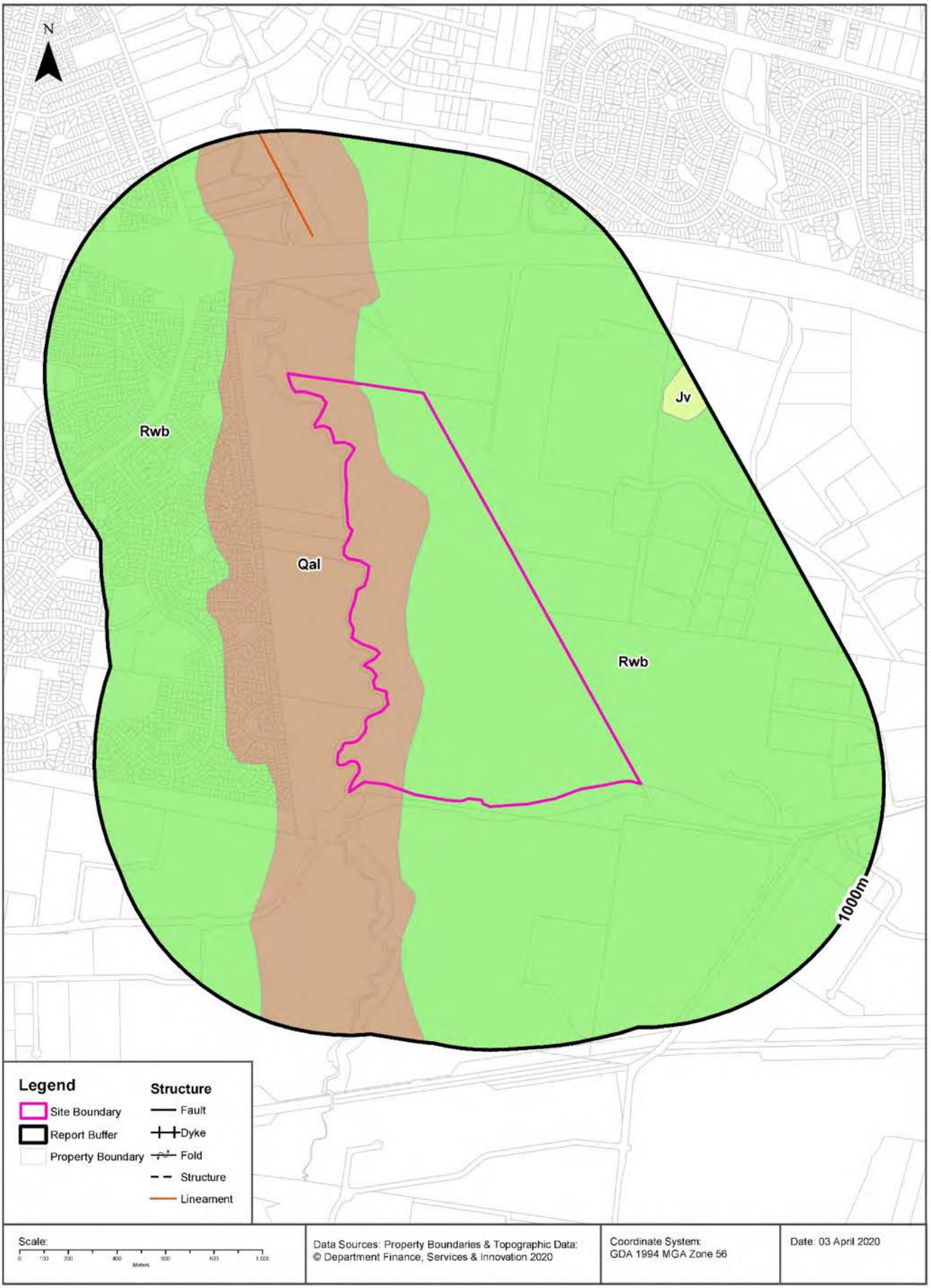
Drill log data relevant to the boreholes within the dataset buffer:

| Groundwater No | Drillers Log | Distance | Direction |
|---|---|---|---|
| GW110314 | 0.00m-3.00m SHALE FILL<br>3.00m-8.00m WEATHERED SHALE,LIGHT BROWN<br>8.00m-96.00m SHALE,LIGHT GREY<br>96.00m-151.00m SHALE,DARK GREY | 397m | North East |
| GW110312 | 0.00m-3.00m SHALE, FILL<br>3.00m-8.00m SHALE WEATHERED,LIGHT BROWN<br>8.00m-96.00m SHALE,LIGHT GREY<br>96.00m-100.00m SHALE,DARK GREY | 434m | North East |
| GW114928 | 0.00m-0.15m FILL<br>0.15m-0.35m SILTY CLAY,LIGHT BROWN L/M PLASTICITY<br>0.35m-3.20m SHALE GREY BROWN<br>3.20m-6.30m AS ABOVE BUT SOFTER<br>6.30m-9.50m SHALE, DARK GREY,HARD, DRY<br>9.50m-11.50m AS ABOVE BUT WET. | 1084m | South East |
| GW114926 | 0.00m-0.15m FILL<br>0.15m-1.70m SILTY CLAY RED BROWN, L.PLASTICITY<br>1.70m-2.20m SILTY CLAY DARK BROWN<br>2.20m-3.00m SHALE, LIGHT BROWN<br>3.00m-4.70m SHALE LIGHT BROWN HARD<br>4.70m-6.80m SHALE GREY BROWN<br>6.80m-12.00m SHALE, DARK GREY,DRY<br>12.00m-13.50m SHALE, DARK GREY, WET | 1101m | South East |
| GW114927 | 0.00m-2.70m SILTY CLAY,RED BROWN MOTTLED L.PLASTICITY<br>2.70m-2.90m SILTY CLAY GRADING INTO EATHERED SHALE<br>2.90m-12.00m SHALE,WEATHERED BEDROCK,DARK GREY,DRY<br>12.00m-18.00m AS ABOVE BUT HARD. | 1105m | South East |
| GW110313 | 0.00m-1.00m CLAY SILTY BROWN<br>1.00m-9.00m WEATHERED SHALE,BROWN<br>9.00m-31.00m SHALE, MEDIUM GREY<br>31.00m-39.00m SANDSTONE LIGHT GREY<br>39.00m-145.00m SHALE, DARK GREY<br>145.00m-150.00m SANDSTONE, LIGHT GREY | 1122m | North East |
| GW110311 | 0.00m-1.00m CLAY SILTY BROWN<br>1.00m-9.00m SHALE WEATHERED,BROWN<br>9.00m-31.00m SHALE,MEDIUM,GREY<br>31.00m-100.00m SHALE,DARK GREY | 1169m | North East |
| GW114519 | 0.00m-0.30m SILTY CLAY<br>0.30m-1.00m SILTY CLAY<br>1.00m-8.00m SHALE | 1535m | North |
| GW028414 | 0.00m-3.66m Clay<br>3.66m-6.10m Shale Soft Broken<br>6.10m-6.11m Shale Grey Hard | 1538m | East |

| Groundwater No | Drillers Log | Distance | Direction |
|---|---|---|---|
| GW100290 | 0.00m-1.00m FILL DOLERITE GRAVEL<br>1.00m-2.00m CLAY/ BLUE/ GREY<br>2.00m-4.00m SANDSTONE/ BROWN / YELLOW<br>4.00m-10.00m INTERBEDDED SILTSTONE / SANDSTONE<br>10.00m-12.00m SILTSTONE / DARK GREY<br>12.00m-15.00m SILTSTONE / SHALE & CLAY INTERBEDS<br>15.00m-17.00m SILTSTONE AND SHALE<br>17.00m-23.00m SILTSTONE MASSIVE<br>23.00m-53.00m SILTSTONE & SHALE INTERBEDDED<br>53.00m-54.00m SANDSTONE & SHALE INTERBEDDED<br>54.00m-57.00m SHALE & SILTSTONE INTERBEDDED<br>57.00m-61.00m SANDSTONE,SHALE,SILTSTONE INTERBEDDED<br>61.00m-63.00m SHALE, CARBONACEOUS<br>63.00m-64.00m SHALE, SILTSTONE, SANDSTONE: INTERBEDDED<br>64.00m-65.00m SHALE: CARBOINACEOUS<br>65.00m-68.00m SILTSTONE, SHALE: INTERBEDDED<br>68.00m-69.00m SHALE: CARBONACEOUS<br>69.00m-70.00m SHALE AND SILTSTONE :INTERBEDDED<br>70.00m-71.00m SHALE, SILTSTONE , SANDSTONE INTERBEDDED<br>71.00m-75.00m SHALE & SILTSTONE INTERBEDDED<br>75.00m-76.00m SHALE, CLAY, SILTSTONE INTERBEDDED<br>76.00m-80.00m SHALE, SILTSTONE: INTERBEDDED | 1847m | South |
| GW100447 | 0.00m-1.00m CLAY<br>1.00m-29.60m SILTSTONE/SHALE | 1847m | South |
| GW111126 | 0.00m-1.50m FILL<br>1.50m-4.00m CLAY FIRM L/BROWN<br>4.00m-5.00m SHALE GREY,L/BROWN CLAY<br>5.00m-8.00m SHALE GREY/ WEATHERED<br>8.00m-10.00m SHALE GREY/ WEATHERED,BLACK,SATURATED CLAY LENSES | 1856m | North |
| GW111128 | 0.00m-1.50m FILL<br>1.50m-4.00m CLAY FIRM L/BROWN<br>4.00m-5.00m CLAY L/BROWN/ GREY SHALE<br>5.00m-8.00m SHALE GREY WEATHERED<br>8.00m-10.00m SHALE GREY WEATHERED,BLACK SATURATED CLAY LENSES | 1875m | North |
| GW111127 | 0.00m-1.50m FILL<br>1.50m-4.00m CLAY FIRM L/BROWN<br>4.00m-5.00m SHALE GREY/L/BROWN CLAY<br>5.00m-8.00m SHALE GREY WEATHERED<br>8.00m-10.00m SHALE GREY WEATHERED,BLACK SATURATED CLAY LENSES | 1892m | North |

# Geology 1:100,000

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Geology

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Geological Units

What are the Geological Units onsite?

| Symbol | Description | Unit Name | Group | Sub Group | Age | Dom Lith | Map Sheet | Dataset |
|---|---|---|---|---|---|---|---|---|
| Qal | Fine-grained sand, silt and clay | | | | Quaternary | | Penrith | 1:100,000 |
| Rwb | Shale, carbonaceous claystone,claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff | Bringelly Shale | Wianamatta Group (undifferentiated) | | Middle Triassic | | Penrith | 1:100,000 |

What are the Geological Units within the dataset buffer?

| Symbol | Description | Unit Name | Group | Sub Group | Age | Dom Lith | Map Sheet | Dataset |
|---|---|---|---|---|---|---|---|---|
| Jv | Volcanic breccia, varying amounts of sedimentary breccia and basalt | | | | Cretaceous | | Penrith | 1:100,000 |
| Qal | Fine-grained sand, silt and clay | | | | Quaternary | | Penrith | 1:100,000 |
| Rwb | Shale, carbonaceous claystone,claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff | Bringelly Shale | Wianamatta Group (undifferentiated) | | Middle Triassic | | Penrith | 1:100,000 |

## Geological Structures

What are the Geological Structures onsite?

| Feature | Name | Description | Map Sheet | Dataset |
|---|---|---|---|---|
| No features | | | | 1:100,000 |

What are the Geological Structures within the dataset buffer?

| Feature | Name | Description | Map Sheet | Dataset |
|---|---|---|---|---|
| Lineament | | | Penrith | 1:100,000 |

Geological Data Source : NSW Department of Industry, Resources & Energy

# Naturally Occurring Asbestos Potential

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

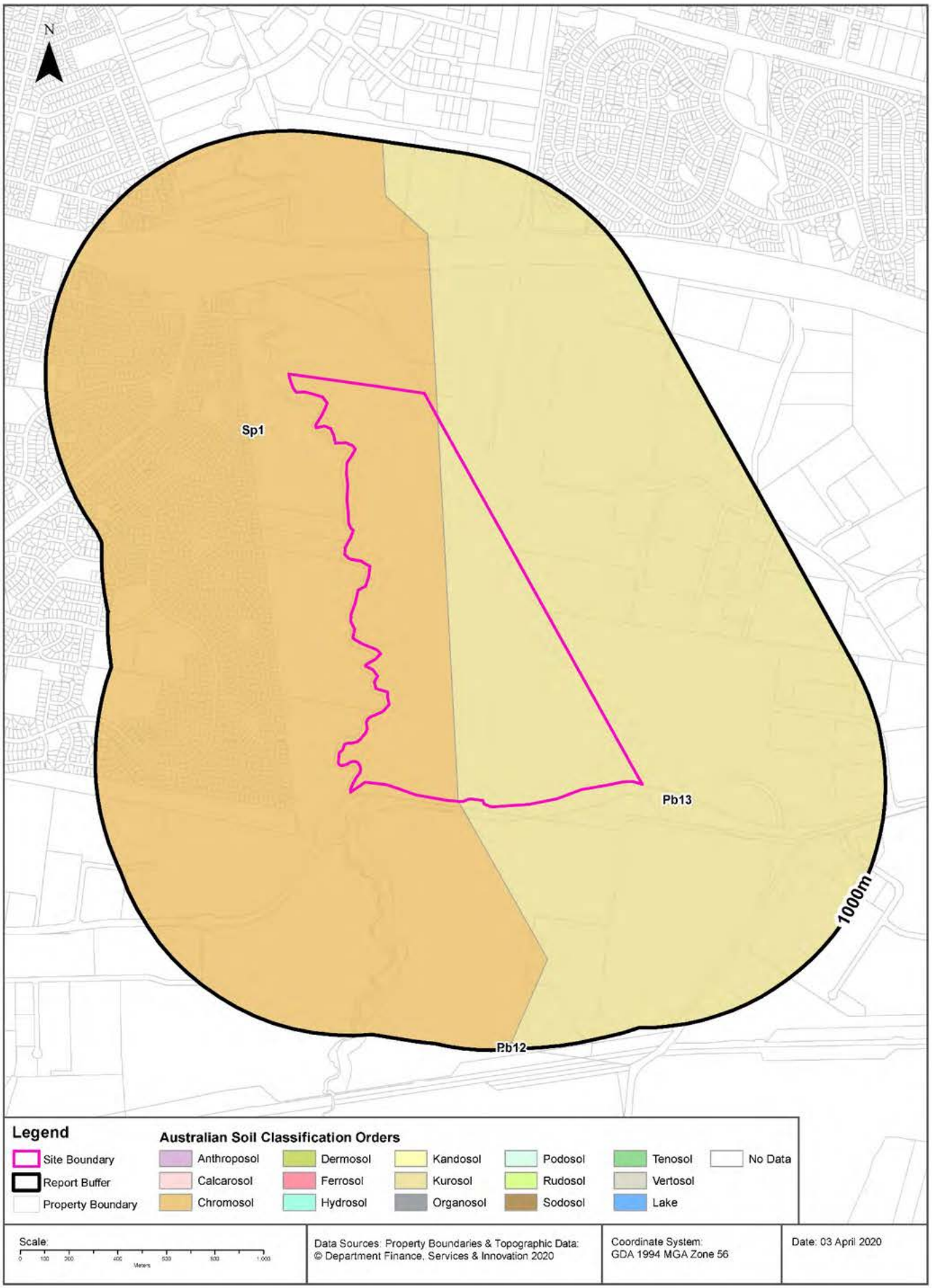
## Naturally Occurring Asbestos Potential

Naturally Occurring Asbestos Potential within the dataset buffer:

| Potential | Sym | Strat Name | Group | Formation | Scale | Min Age | Max Age | Rock Type | Dom Lith | Description | Dist | Dir |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No records in buffer | | | | | | | | | | | | |

# Atlas of Australian Soils

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Soils

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

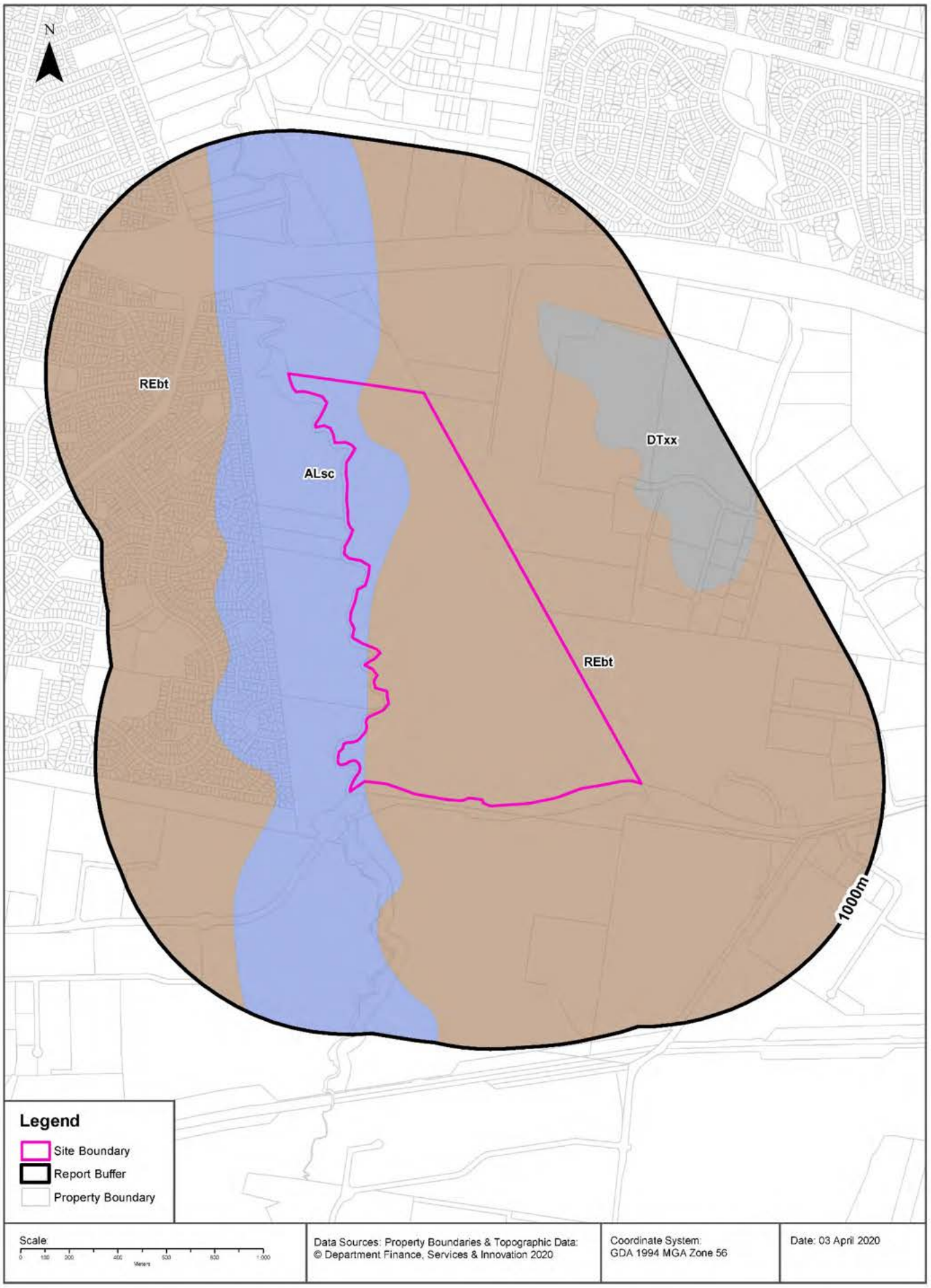
## Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

| Map Unit Code | Soil Order | Map Unit Description | Distance |
|---|---|---|---|
| Pb13 | Kurosol | Ridge and valley country of gently undulating ridge tops and steep side slopes often with slumping, also rounded hilly to steep hilly areas and relatively narrow valleys: chief soils are hard acidic red soils (Dr2.21) with hard acidic yellow mottled soils (Dy3.41); in places some ironstone gravels occur in both these soils. Associated are hard neutral and alkaline red soils (Dr2.22 and Dr2.23) in saddles and some mid-slope positions; (Dy3.42 and Dy3.43) soils, usually in depressions; and small areas of undescribed soils in wet soaks and valley areas. Small areas of other soils are likely throughout. | 0m |
| Sp1 | Chromosol | Gently undulating plain usually with a surface scatter of ironstone gravel: chief soils are hard acidic yellow soils (Dy2.61) on flat-topped ridges and higher situations generally and hard acidic yellow mottled soils (Dy3.41) or (Dy3.81) in lower-lying situations. They all commonly contain ironstone gravel through the profile. Associated are (Dy5.41) or (Dy5.81) soils, containing ironstone gravels; and shallow (Gn2.1) gravelly soils also with indurated materials below the solum. Iron-cemented and/or silica-cemented strata have been recorded in many areas below the soils. As mapped, areas of units X9, Pb12, and Tb35 may be included. | 0m |
| Pb12 | Kurosol | Gently rolling to rounded hilly country with some steep slopes and broad valleys: chief soils are hard acidic red soils (Dr2.21) with hard neutral and acidic yellow mottled soils (Dy3.42 and Dy3.41) on lower slopes and in valleys. Associated are small areas of various soils including (Gn3.54) on some ridges, (Dr3.31) on some slopes; (Dr2.23) in saddles and some mid-slope positions, and some low- lying swampy areas of (Uf6) soils and (Uc1.2) soils with peaty surfaces. Small areas of other soils such as (Db1.2) are likely throughout. | 968m |

# Soil Landscapes

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Soils

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Soil Landscapes

What are the onsite Soil Landscapes?

| Soil Code | Name | Group | Process | Map Sheet | Scale |
|---|---|---|---|---|---|
| ALsc | SOUTH CREEK | | ALLUVIAL | Penrith | 1:100,000 |
| REbt | BLACKTOWN | | RESIDUAL | Penrith | 1:100,000 |

What are the Soil Landscapes within the dataset buffer?

| Soil Code | Name | Group | Process | Map Sheet | Scale |
|---|---|---|---|---|---|
| ALsc | SOUTH CREEK | | ALLUVIAL | Penrith | 1:100,000 |
| DTxx | DISTURBED TERRAIN | | DISTURBED TERRAIN | Penrith | 1:100,000 |
| REbt | BLACKTOWN | | RESIDUAL | Penrith | 1:100,000 |

# Acid Sulfate Soils

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Environmental Planning Instrument - Acid Sulfate Soils

What is the on-site Acid Sulfate Soil Plan Class that presents the largest environmental risk?

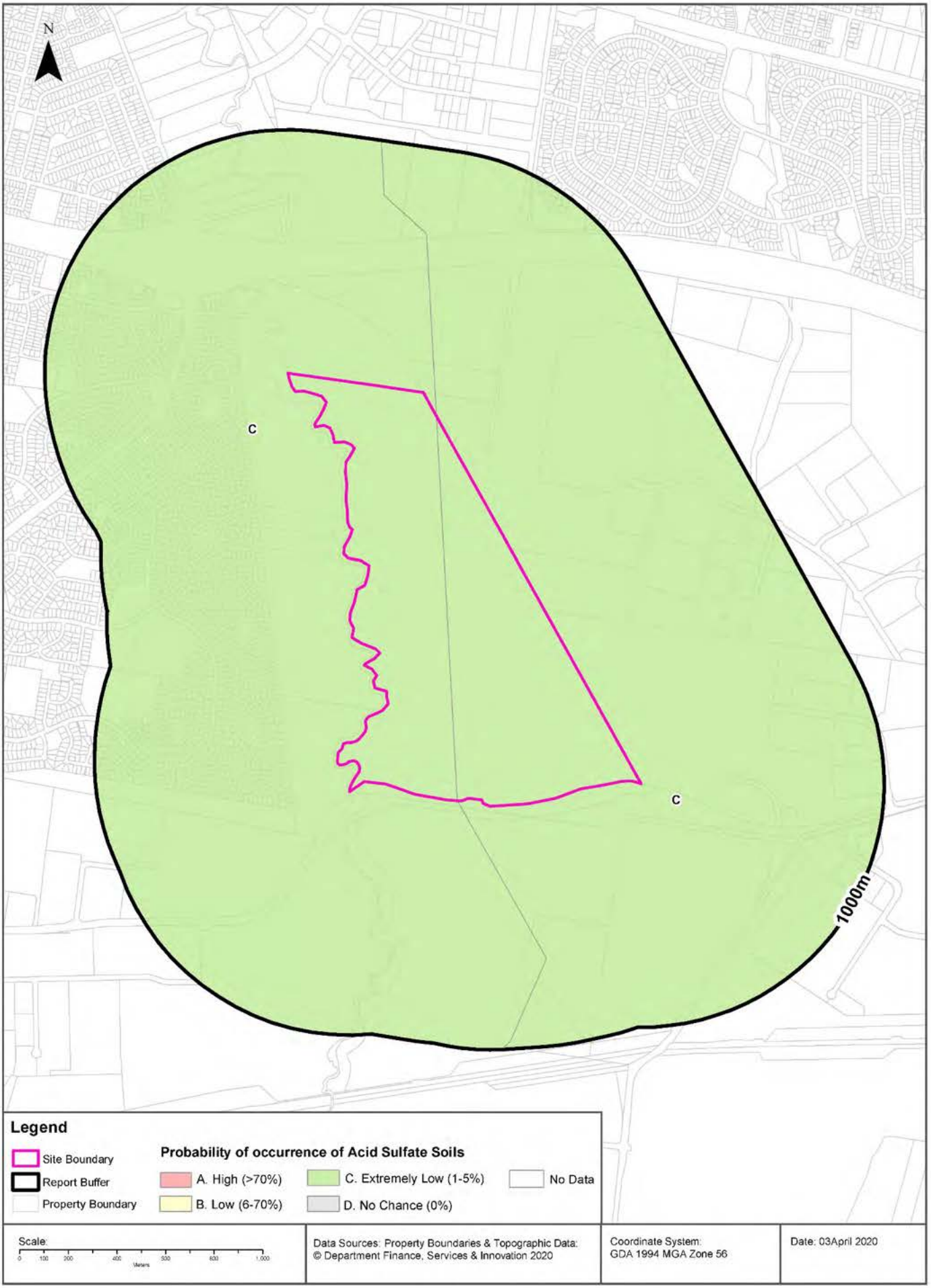
| Soil Class | Description | EPI Name |
|---|---|---|
| N/A | | |

If the on-site Soil Class is 5, what other soil classes exist within 500m?

| Soil Class | Description | EPI Name | Distance | Direction |
|---|---|---|---|---|
| N/A | | | | |

# Atlas of Australian Acid Sulfate Soils

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Acid Sulfate Soils

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

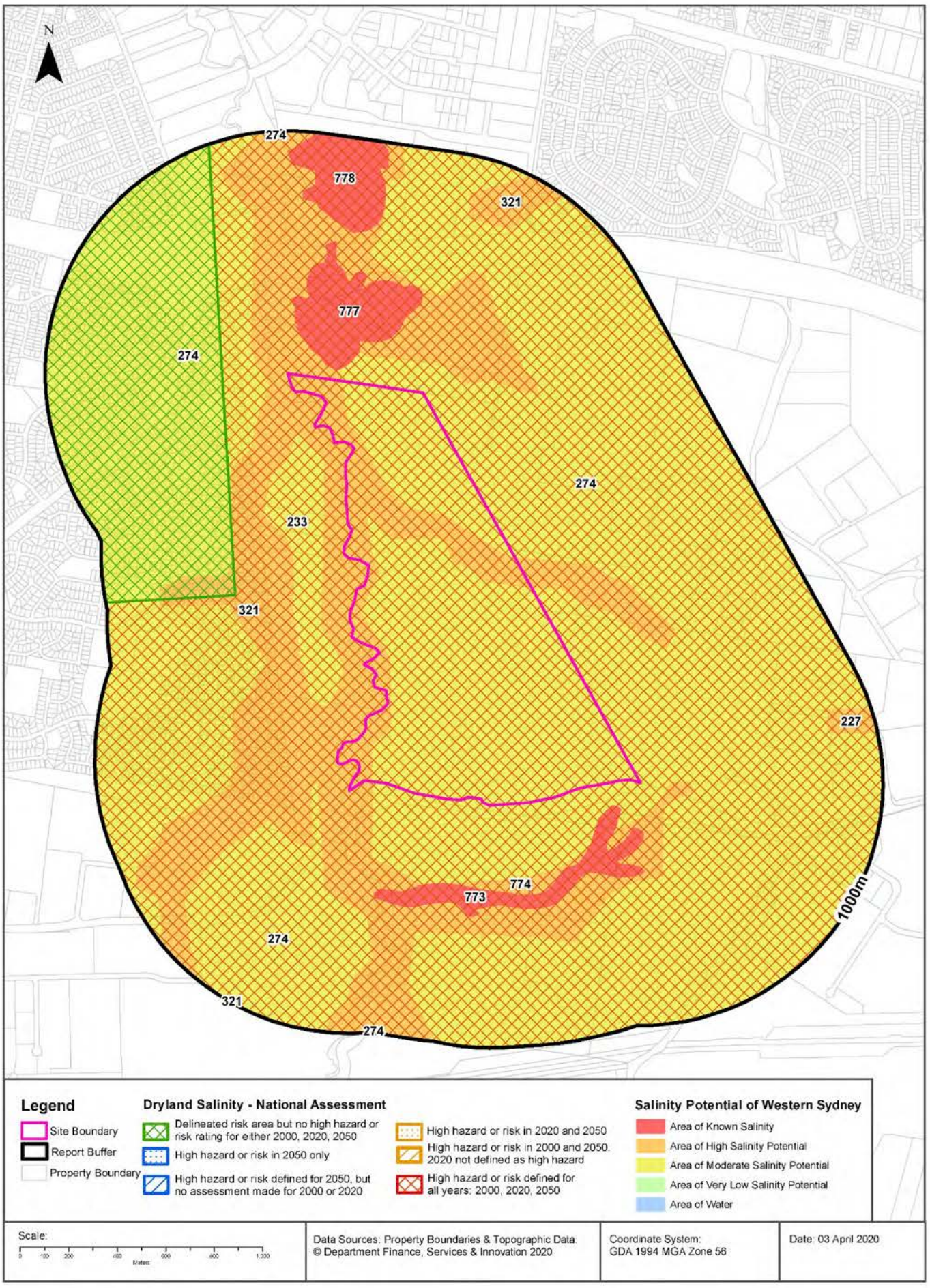
## Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

| Class | Description | Distance |
|---|---|---|
| C | Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas. | 0m |

# Dryland Salinity

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Dryland Salinity

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Dryland Salinity - National Assessment

Is there Dryland Salinity - National Assessment data onsite?

**Yes**

Is there Dryland Salinity - National Assessment data within the dataset buffer?

**Yes**

What Dryland Salinity assessments are given?

| Assessment 2000 | Assessment 2020 | Assessment 2050 | Distance | Direction |
|---|---|---|---|---|
| High hazard or risk | High hazard or risk | High hazard or risk | 0m | Onsite |
| Delineated risk area but no high hazard or risk rating | Delineated risk area but no high hazard or risk rating | Delineated risk area but no high hazard or risk rating | 270m | North West |

Dryland Salinity Data Source : National Land and Water Resources Audit
The Commonwealth and all suppliers of source data used to derive the maps of "Australia, Forecast Areas Containing Land of High Hazard or Risk of Dryland Salinity from 2000 to 2050" do not warrant the accuracy or completeness of information in this product. Any person using or relying upon such information does so on the basis that the Commonwealth and data suppliers shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information. Any persons using this information do so at their own risk.
In many cases where a high risk is indicated, less than 100% of the area will have a high hazard or risk.

## Dryland Salinity Potential of Western Sydney

Dryland Salinity Potential of Western Sydney within the dataset buffer?

| Feature Id | Classification | Description | Distance | Direction |
|---|---|---|---|---|
| 274 | MODERATE | Area of Moderate Salinity Potential | 0m | Onsite |
| 321 | HIGH | Area of High Salinity Potential | 0m | Onsite |
| 777 | SALT | Area of Known Salinity | 40m | North |
| 233 | MODERATE | Area of Moderate Salinity Potential | 71m | North West |
| 773 | SALT | Area of Known Salinity | 94m | South |
| 774 | HIGH | Area of High Salinity Potential | 246m | South |
| 778 | SALT | Area of Known Salinity | 610m | North |
| 227 | HIGH | Area of High Salinity Potential | 797m | South East |

Dryland Salinity Potential of Western Sydney Data Source : NSW Office of Environment and Heritage

# Mining Subsidence Districts

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Mining Subsidence Districts

Mining Subsidence Districts within the dataset buffer:

| District | Distance | Direction |
|---|---|---|
| There are no Mining Subsidence Districts within the report buffer | | |

# State Environmental Planning Policy

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

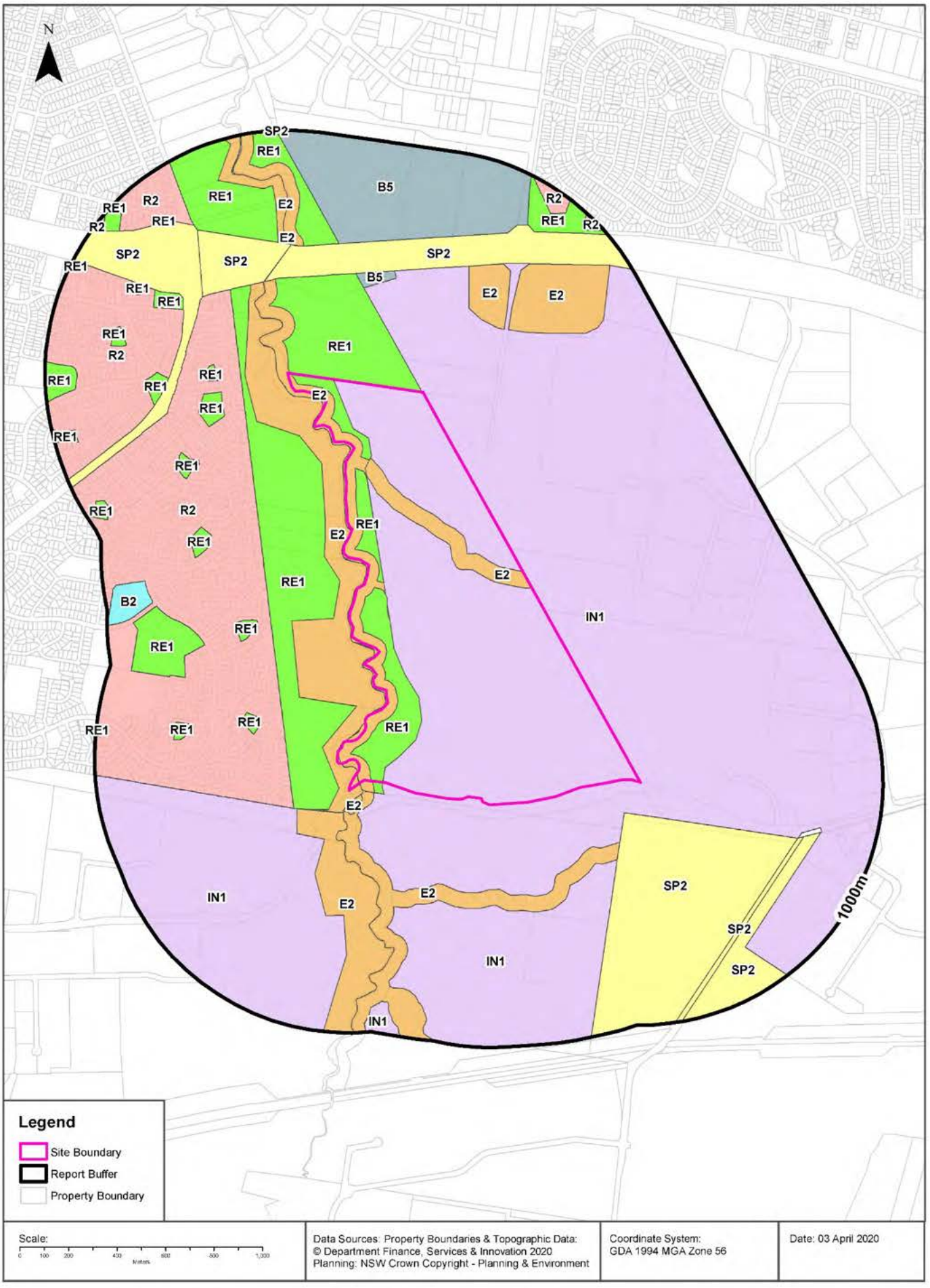
## State Significant Precincts

What SEPP State Significant Precincts exist within the dataset buffer?

| Map Id | Precinct | EPI Name | Published Date | Commenced Date | Currency Date | Amendment | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| N/A | No Records in Buffer | | | | | | | |

# EPI Planning Zones

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Environmental Planning Instrument

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Land Zoning

What EPI Land Zones exist within the dataset buffer?

| Zone | Description | Purpose | EPI Name | Published Date | Commenced Date | Currency Date | Amendment | Distance | Direction |
|---|---|---|---|---|---|---|---|---|---|
| IN1 | General Industrial | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 0m | Onsite |
| RE1 | Private Recreation | | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 0m | Onsite |
| E2 | Environmental Conservation | | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 0m | Onsite |
| E2 | Environmental Conservation | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 0m | Onsite |
| E2 | Environmental Conservation | | Penrith Local Environmental Plan 2010 | 22/09/2010 | 22/09/2010 | 20/12/2019 | | 0m | North West |
| E2 | Environmental Conservation | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 28m | South |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 22/09/2010 | 22/09/2010 | 20/12/2019 | | 36m | West |
| E2 | Environmental Conservation | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 41m | South West |
| E2 | Environmental Conservation | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 96m | South |
| SP2 | Infrastructure | Electricity Transmission & Distribution | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 132m | South East |
| R2 | Low Density Residential | | Penrith Local Environmental Plan 2010 | 22/06/2018 | 22/06/2018 | 20/12/2019 | Amendment No 19 | 194m | West |

| Zone | Description | Purpose | EPI Name | Published Date | Commenced Date | Currency Date | Amendment | Distance | Direction |
|---|---|---|---|---|---|---|---|---|---|
| IN1 | General Industrial | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 226m | South West |
| RE1 | Private Recreation | | Blacktown Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 283m | North West |
| RE1 | Private Recreation | | Blacktown Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 291m | North West |
| IN1 | General Industrial | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 315m | South |
| RE1 | Private Recreation | | Blacktown Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 343m | South West |
| RE1 | Private Recreation | | Blacktown Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 380m | West |
| E2 | Environmental Conservation | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 384m | North |
| SP2 | Infrastructure | Classified Road | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 389m | North East |
| SP2 | Infrastructure | Classified Road | Penrith Local Environmental Plan 2010 | 22/09/2010 | 22/09/2010 | 20/12/2019 | | 390m | North West |
| B5 | Business Development | | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 391m | North |
| SP2 | Infrastructure | Classified Road | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 428m | North West |
| E2 | Environmental Conservation | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 436m | North |
| R2 | Low Density Residential | | Penrith Local Environmental Plan 2010 | 22/06/2018 | 22/06/2018 | 20/12/2019 | Amendment No 19 | 460m | West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 488m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 492m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 504m | North West |
| E2 | Environmental Conservation | | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 527m | North |
| RE1 | Public Recreation | | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 528m | North |
| E2 | Environmental Conservation | | Penrith Local Environmental Plan 2010 | 22/09/2010 | 22/09/2010 | 20/12/2019 | | 531m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 22/09/2010 | 22/09/2010 | 20/12/2019 | | 541m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 548m | West |
| B5 | Business Development | | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 558m | North |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 606m | West |

| Zone | Description | Purpose | EPI Name | Published Date | Commenced Date | Currency Date | Amendment | Distance | Direction |
|---|---|---|---|---|---|---|---|---|---|
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 617m | West |
| SP2 | Infrastructure | Local Road | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 667m | South East |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 673m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 674m | North West |
| SP2 | Infrastructure | Electricity Transmission & Distribution | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 685m | South East |
| R2 | Low Density Residential | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 722m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 794m | North West |
| RE1 | Public Recreation | | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 806m | North |
| B2 | Local Centre | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 810m | West |
| IN1 | General Industrial | | State Environmental Planning Policy (Western Sydney Employment Area) 2009 | 08/11/2013 | 08/11/2013 | 16/11/2018 | Blacktown Local Environmental Plan Amendment (Western Sydney Employment Area) 2013 | 869m | South |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 869m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 901m | West |
| R2 | Low Density Residential | | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 904m | North East |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 904m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 909m | North West |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 28/01/2015 | 25/02/2015 | 20/12/2019 | Amendment No 4 | 956m | North West |
| SP2 | Infrastructure | Drainage | Blacktown Local Environmental Plan 2015 | 26/05/2015 | 07/07/2015 | 06/03/2020 | | 983m | North |
| RE1 | Public Recreation | | Penrith Local Environmental Plan 2010 | 22/06/2018 | 22/06/2018 | 20/12/2019 | Amendment No 19 | 989m | West |

# Heritage

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

| Place Id | Name | Address | Place File No | Class | Status | Register Date | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | | | |

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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## National Heritage List

What are the National Heritage List Items located within the dataset buffer?
Note. Please click on Place Id to activate a hyperlink to online website.

| Place Id | Name | Address | Place File No | Class | Status | Register Date | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | | | |

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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## State Heritage Register - Curtilages

What are the State Heritage Register Items located within the dataset buffer?

| Map Id | Name | Address | LGA | Listing Date | Listing No | Plan No | Distance | Direction |
|---|---|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | | | |

Heritage Data Source: NSW Crown Copyright - Office of Environment & Heritage
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## Environmental Planning Instrument - Heritage

What are the EPI Heritage Items located within the dataset buffer?

| Map Id | Name | Classification | Significance | EPI Name | Published Date | Commenced Date | Currency Date | Distance | Direction |
|---|---|---|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | | | | |

Heritage Data Source: NSW Crown Copyright - Planning & Environment
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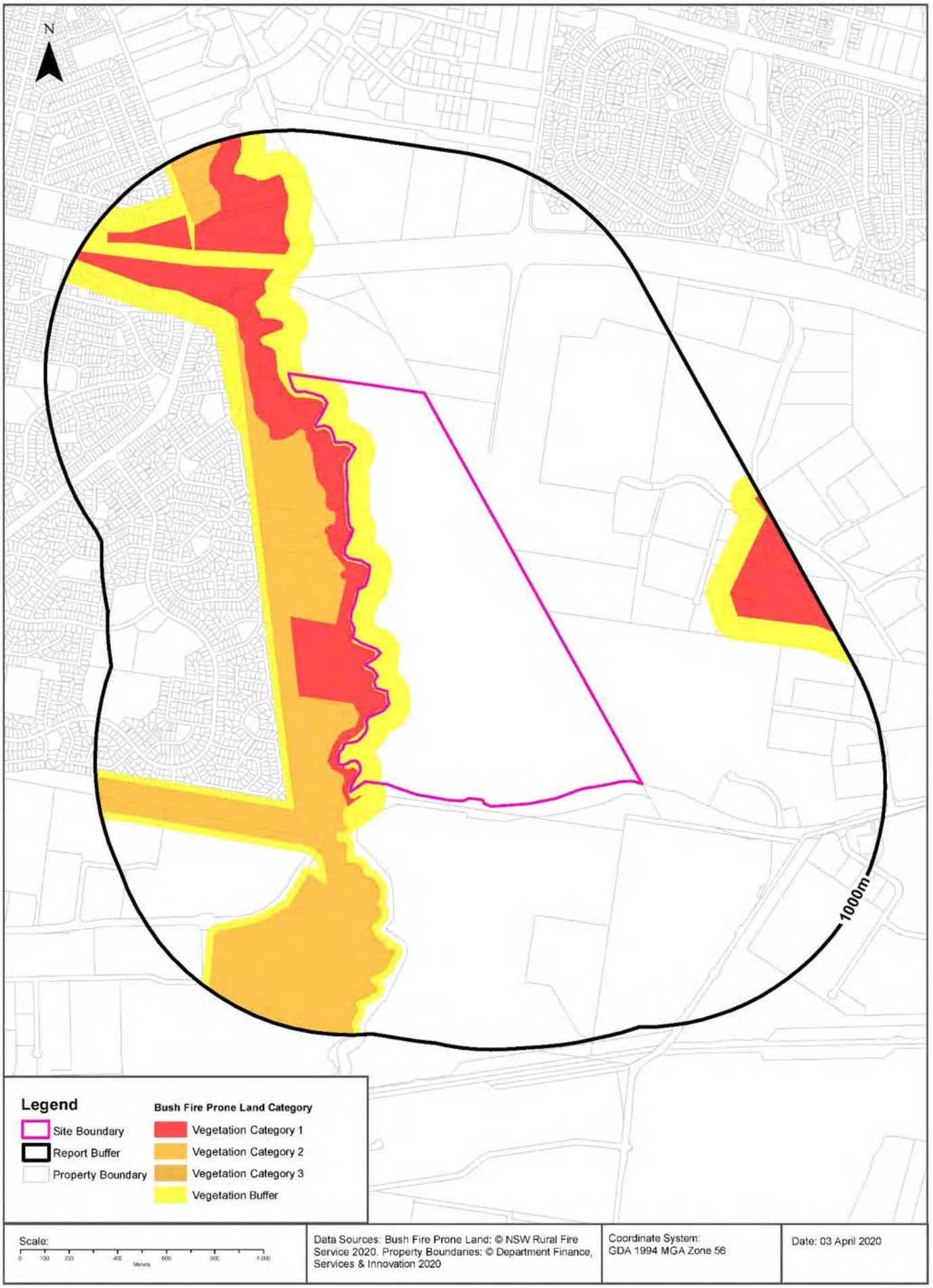
# Natural Hazards - Bush Fire Prone Land

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Natural Hazards

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

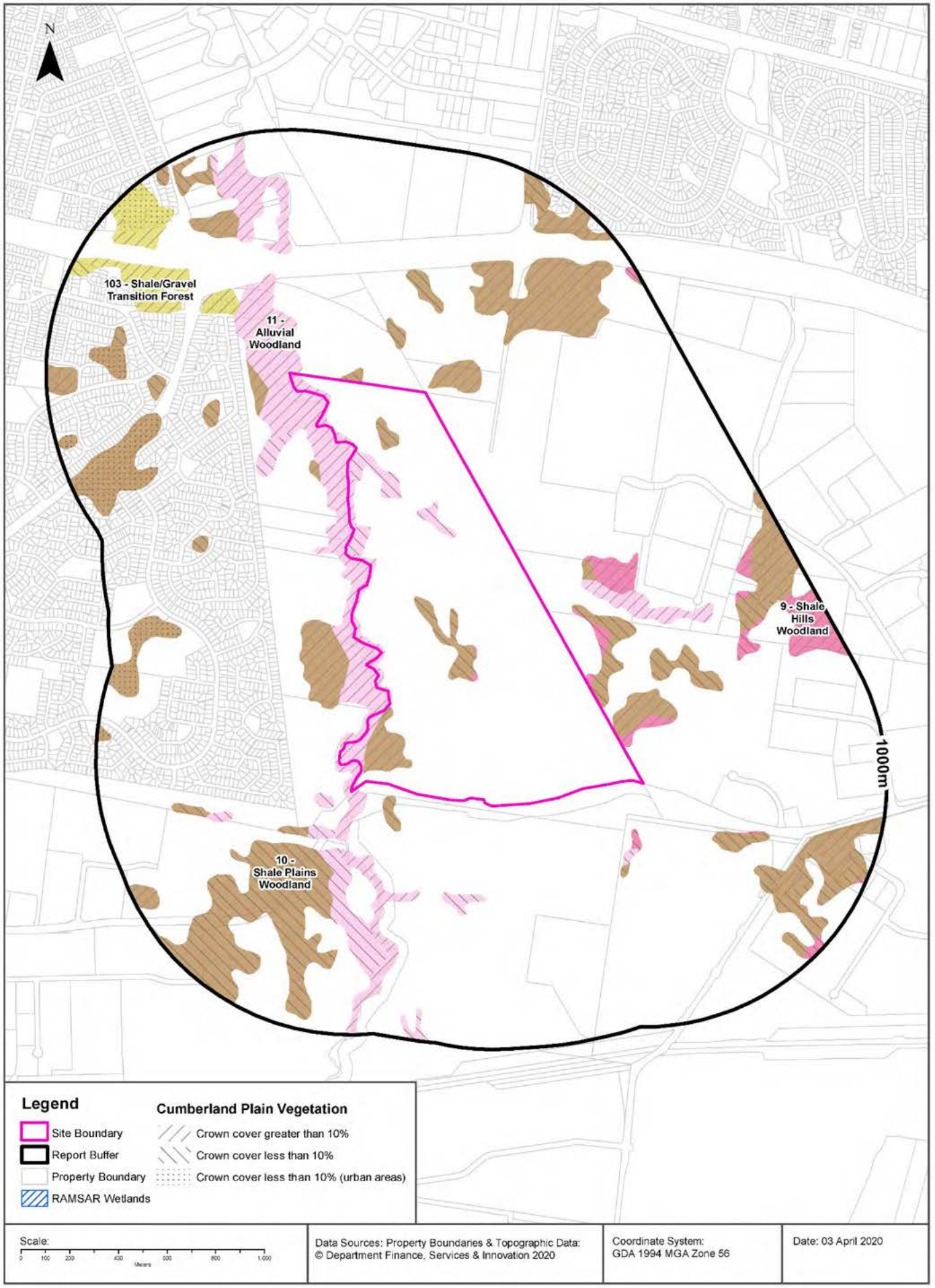
## Bush Fire Prone Land

What are the nearest Bush Fire Prone Land Categories that exist within the dataset buffer?

| Bush Fire Prone Land Category | Distance | Direction |
|---|---|---|
| Vegetation Buffer | 0m | Onsite |
| Vegetation Category 1 | 2m | North West |
| Vegetation Category 2 | 29m | South West |

# Ecological Constraints - Remnant Vegetation of the Cumberland Plain

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Ecological Constraints

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Remnant Vegetation of the Cumberland Plain

What remnant vegetation of the Cumberland Plain exists within the dataset buffer?

| Description | Crown Cover | Distance | Direction |
|---|---|---|---|
| 10 - Shale Plains Woodland | Crown cover greater than 10% | 0m | Onsite |
| 11 - Alluvial Woodland | Crown cover greater than 10% | 0m | Onsite |
| 9 - Shale Hills Woodland | Crown cover greater than 10% | 0m | Onsite |
| 10 - Shale Plains Woodland | Crown cover less than 10% | 0m | Onsite |
| 11 - Alluvial Woodland | Crown cover less than 10% | 0m | Onsite |
| 9 - Shale Hills Woodland | Crown cover less than 10% | 0m | Onsite |
| 103 - Shale/Gravel Transition Forest | Crown cover greater than 10% | 326m | North West |
| 10 - Shale Plains Woodland | Crown cover less than 10% (urban areas) | 556m | West |
| 103 - Shale/Gravel Transition Forest | Crown cover less than 10% (urban areas) | 798m | North West |
| 103 - Shale/Gravel Transition Forest | Crown cover less than 10% | 901m | North West |



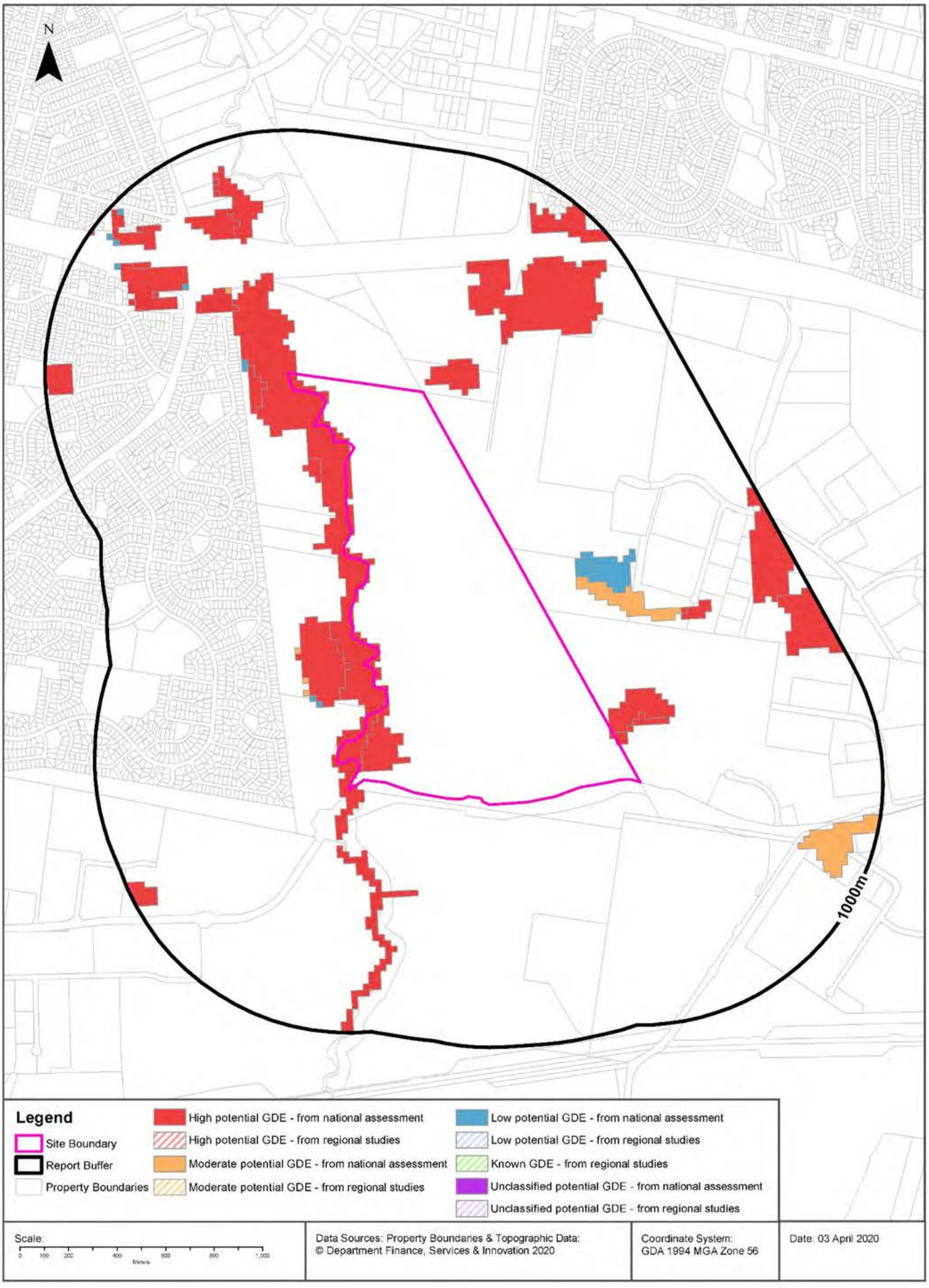
## Ramsar Wetlands

What Ramsar Wetland areas exist within the dataset buffer?

| Map Id | Ramsar Name | Wetland Name | Designation Date | Source | Distance | Direction |
|---|---|---|---|---|---|---|
| N/A | No records in buffer | | | | | |

# Ecological Constraints - Groundwater Dependent Ecosystems Atlas

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Ecological Constraints

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

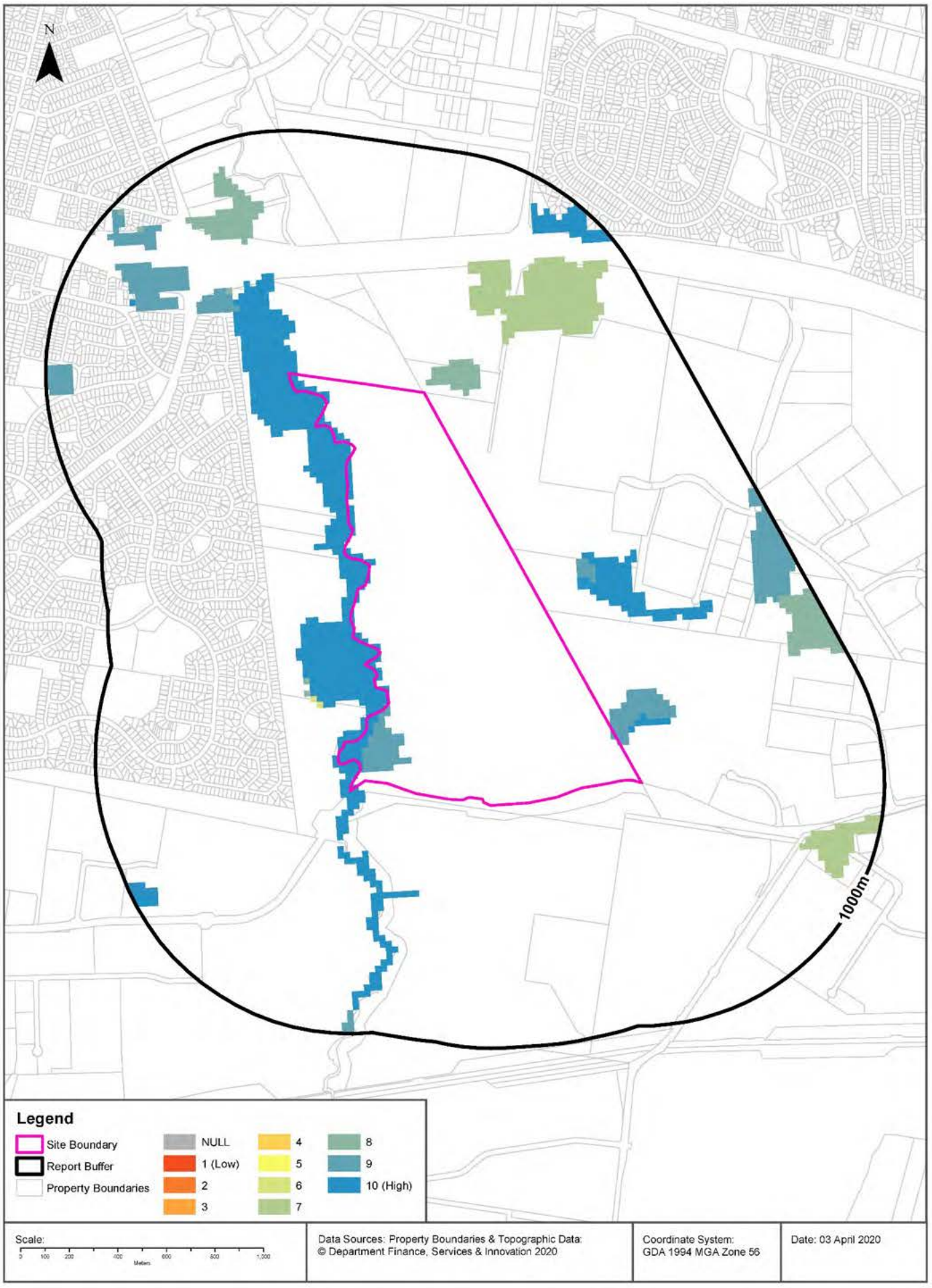
## Groundwater Dependent Ecosystems Atlas

| Type | GDE Potential | Geomorphology | Ecosystem Type | Aquifer Geology | Distance |
|---|---|---|---|---|---|
| Terrestrial | High potential GDE - from national assessment | Undulating to low hilly country, mainly on shale. | Vegetation | Consolidated sedimentary | 0m |
| Terrestrial | High potential GDE - from national assessment | Undulating to low hilly country, mainly on shale. | Vegetation | Unconsolidated sedimentary | 0m |
| Terrestrial | Moderate potential GDE - from national assessment | Undulating to low hilly country, mainly on shale. | Vegetation | Consolidated sedimentary | 157m |
| Terrestrial | Low potential GDE - from national assessment | Undulating to low hilly country, mainly on shale. | Vegetation | Unconsolidated sedimentary | 163m |

Groundwater Dependent Ecosystems Atlas Data Source: The Bureau of Meteorology

# Ecological Constraints - Inflow Dependent Ecosystems Likelihood

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**



# Ecological Constraints

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## Inflow Dependent Ecosystems Likelihood

| Type | IDE Likelihood | Geomorphology | Ecosystem Type | Aquifer Geology | Distance |
|---|---|---|---|---|---|
| Terrestrial | 9 | Undulating to low hilly country, mainly on shale. | Vegetation | Consolidated sedimentary | 0m |
| Terrestrial | 10 | Undulating to low hilly country, mainly on shale. | Vegetation | Unconsolidated sedimentary | 0m |
| Terrestrial | 8 | Undulating to low hilly country, mainly on shale. | Vegetation | Consolidated sedimentary | 28m |
| Terrestrial | 6 | Undulating to low hilly country, mainly on shale. | Vegetation | Unconsolidated sedimentary | 169m |
| Terrestrial | 7 | Undulating to low hilly country, mainly on shale. | Vegetation | Consolidated sedimentary | 377m |

Inflow Dependent Ecosystems Likelihood Data Source: The Bureau of Meteorology

# Ecological Constraints

**Lenore Drive, Eastern Creek, NSW 2766 (Part 1)**

## NSW BioNet Atlas

Species on the NSW BioNet Atlas that have a NSW or federal conservation status, a NSW sensitivity status, or are listed under a migratory species agreement, and are within 10km of the site?

| Kingdom | Class | Scientific | Common | NSW Conservation Status | NSW Sensitivity Class | Federal Conservation Status | Migratory Species Agreements |
|---|---|---|---|---|---|---|---|
| Animalia | Amphibia | Litoria aurea | Green and Golden Bell Frog | Endangered | Not Sensitive | Vulnerable | |
| Animalia | Aves | Anseranas semipalmata | Magpie Goose | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Anthochaera phrygia | Regent Honeyeater | Critically Endangered | Not Sensitive | Critically Endangered | |
| Animalia | Aves | Apus pacificus | Fork-tailed Swift | Not Listed | Not Sensitive | Not Listed | ROKAMBA;CAMBA; JAMBA |
| Animalia | Aves | Ardea ibis | Cattle Egret | Not Listed | Not Sensitive | Not Listed | CAMBA;JAMBA |
| Animalia | Aves | Artamus cyanopterus cyanopterus | Dusky Woodswallow | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Burhinus grallarius | Bush Stone-curlew | Endangered | Not Sensitive | Not Listed | |
| Animalia | Aves | Calidris acuminata | Sharp-tailed Sandpiper | Not Listed | Not Sensitive | Not Listed | ROKAMBA;CAMBA; JAMBA |
| Animalia | Aves | Callocephalon fimbriatum | Gang-gang Cockatoo | Vulnerable | Category 3 | Not Listed | |
| Animalia | Aves | Calyptorhynchus banksii samueli | Red-tailed Black-Cockatoo (inland subspecies) | Vulnerable | Category 2 | Not Listed | |
| Animalia | Aves | Calyptorhynchus lathami | Glossy Black-Cockatoo | Vulnerable | Category 2 | Not Listed | |
| Animalia | Aves | Certhionyx variegatus | Pied Honeyeater | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Charadrius hiaticula | Ringed Plover | Not Listed | Not Sensitive | Not Listed | ROKAMBA;CAMBA; JAMBA |
| Animalia | Aves | Chthonicola sagittata | Speckled Warbler | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Daphoenositta chrysoptera | Varied Sittella | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Ephippiorhynchus asiaticus | Black-necked Stork | Endangered | Not Sensitive | Not Listed | |
| Animalia | Aves | Gallinago hardwickii | Latham's Snipe | Not Listed | Not Sensitive | Not Listed | ROKAMBA;CAMBA; JAMBA |
| Animalia | Aves | Glossopsitta pusilla | Little Lorikeet | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Haliaeetus leucogaster | White-bellied Sea-Eagle | Vulnerable | Not Sensitive | Not Listed | CAMBA |
| Animalia | Aves | Hieraaetus morphnoides | Little Eagle | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Hirundapus caudacutus | White-throated Needletail | Not Listed | Not Sensitive | Not Listed | ROKAMBA;CAMBA; JAMBA |
| Animalia | Aves | Ixobrychus flavicollis | Black Bittern | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Lathamus discolor | Swift Parrot | Endangered | Category 3 | Critically Endangered | |
| Animalia | Aves | Lophochroa leadbeateri | Major Mitchell's Cockatoo | Vulnerable | Category 2 | Not Listed | |
| Animalia | Aves | Lophoictinia isura | Square-tailed Kite | Vulnerable | Category 3 | Not Listed | |
| Animalia | Aves | Melithreptus gularis gularis | Black-chinned Honeyeater (eastern subspecies) | Vulnerable | Not Sensitive | Not Listed | |

| Kingdom | Class | Scientific | Common | NSW Conservation Status | NSW Sensitivity Class | Federal Conservation Status | Migratory Species Agreements |
|---|---|---|---|---|---|---|---|
| Animalia | Aves | Merops ornatus | Rainbow Bee-eater | Not Listed | Not Sensitive | Not Listed | JAMBA |
| Animalia | Aves | Neophema pulchella | Turquoise Parrot | Vulnerable | Category 3 | Not Listed | |
| Animalia | Aves | Ninox connivens | Barking Owl | Vulnerable | Category 3 | Not Listed | |
| Animalia | Aves | Ninox strenua | Powerful Owl | Vulnerable | Category 3 | Not Listed | |
| Animalia | Aves | Petroica boodang | Scarlet Robin | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Petroica phoenicea | Flame Robin | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Pezoporus wallicus wallicus | Eastern Ground Parrot | Vulnerable | Category 3 | Not Listed | |
| Animalia | Aves | Pluvialis squatarola | Grey Plover | Not Listed | Not Sensitive | Not Listed | ROKAMBA;CAMBA; JAMBA |
| Animalia | Aves | Poephila cincta cincta | Black-throated Finch (southern subspecies) | Presumed Extinct | Not Sensitive | Endangered | |
| Animalia | Aves | Polytelis swainsonii | Superb Parrot | Vulnerable | Category 3 | Vulnerable | |
| Animalia | Aves | Rostratula australis | Australian Painted Snipe | Endangered | Not Sensitive | Endangered | |
| Animalia | Aves | Stagonopleura guttata | Diamond Firetail | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Stictonetta naevosa | Freckled Duck | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Todiramphus chloris | Collared Kingfisher | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Aves | Tringa nebularia | Common Greenshank | Not Listed | Not Sensitive | Not Listed | |
| Animalia | Aves | Tyto novaehollandiae | Masked Owl | Vulnerable | Category 3 | Not Listed | |
| Animalia | Gastropoda | Meridolum corneovirens | Cumberland Plain Land Snail | Endangered | Not Sensitive | Not Listed | |
| Animalia | Mammalia | Dasyurus maculatus | Spotted-tailed Quoll | Vulnerable | Not Sensitive | Endangered | |
| Animalia | Mammalia | Falsistrellus tasmaniensis | Eastern False Pipistrelle | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Mammalia | Micronomus norfolkensis | Eastern Coastal Free-tailed Bat | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Mammalia | Miniopterus australis | Little Bent-winged Bat | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Mammalia | Miniopterus orianae oceanensis | Large Bent-winged Bat | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Mammalia | Myotis macropus | Southern Myotis | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Mammalia | Phascolarctos cinereus | Koala | Vulnerable | Not Sensitive | Vulnerable | |
| Animalia | Mammalia | Pteropus poliocephalus | Grey-headed Flying-fox | Vulnerable | Not Sensitive | Vulnerable | |
| Animalia | Mammalia | Saccolaimus flaviventris | Yellow-bellied Sheathtail-bat | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Mammalia | Scoteanax rueppellii | Greater Broad-nosed Bat | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Mammalia | Vespadelus troughtoni | Eastern Cave Bat | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Reptilia | Antaresia stimsoni | Stimson's Python | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Reptilia | Aspidites ramsayi | Woma | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Reptilia | Caretta caretta | Loggerhead Turtle | Endangered | Not Sensitive | Endangered | |
| Animalia | Reptilia | Chelonia mydas | Green Turtle | Vulnerable | Not Sensitive | Vulnerable | |
| Animalia | Reptilia | Lucasium stenodactylum | Crowned Gecko | Vulnerable | Not Sensitive | Not Listed | |
| Animalia | Reptilia | Tiliqua occipitalis | Western Blue-tongued Lizard | Vulnerable | Not Sensitive | Not Listed | |

| Kingdom | Class | Scientific | Common | NSW Conservation Status | NSW Sensitivity Class | Federal Conservation Status | Migratory Species Agreements |
|---|---|---|---|---|---|---|---|
| Plantae | Flora | Acacia pubescens | Downy Wattle | Vulnerable | Not Sensitive | Vulnerable | |
| Plantae | Flora | Allocasuarina glareicola | | Endangered | Not Sensitive | Endangered | |
| Plantae | Flora | Callistemon linearifolius | Netted Bottle Brush | Vulnerable | Category 3 | Not Listed | |
| Plantae | Flora | Cynanchum elegans | White-flowered Wax Plant | Endangered | Not Sensitive | Endangered | |
| Plantae | Flora | Dillwynia tenuifolia | | Endangered Population, Vulnerable | Not Sensitive | Not Listed | |
| Plantae | Flora | Dillwynia tenuifolia | | Vulnerable | Not Sensitive | Not Listed | |
| Plantae | Flora | Eucalyptus leucoxylon subsp. pruinosa | Yellow Gum | Vulnerable | Not Sensitive | Not Listed | |
| Plantae | Flora | Eucalyptus nicholii | Narrow-leaved Black Peppermint | Vulnerable | Not Sensitive | Vulnerable | |
| Plantae | Flora | Eucalyptus scoparia | Wallangarra White Gum | Endangered | Not Sensitive | Vulnerable | |
| Plantae | Flora | Grevillea juniperina subsp. juniperina | Juniper-leaved Grevillea | Vulnerable | Not Sensitive | Not Listed | |
| Plantae | Flora | Grevillea parviflora subsp. parviflora | Small-flower Grevillea | Vulnerable | Not Sensitive | Vulnerable | |
| Plantae | Flora | Hibbertia puberula | | Endangered | Not Sensitive | Not Listed | |
| Plantae | Flora | Isotoma fluviatilis subsp. fluviatilis | | Not Listed | Not Sensitive | Extinct | |
| Plantae | Flora | Macadamia integrifolia | Macadamia Nut | Not Listed | Not Sensitive | Vulnerable | |
| Plantae | Flora | Marsdenia viridiflora subsp. viridiflora | Native Pear | Endangered Population | Not Sensitive | Not Listed | |
| Plantae | Flora | Micromyrtus minutiflora | | Endangered | Not Sensitive | Vulnerable | |
| Plantae | Flora | Persoonia nutans | Nodding Geebung | Endangered | Not Sensitive | Endangered | |
| Plantae | Flora | Pilularia novae-hollandiae | Austral Pillwort | Endangered | Category 3 | Not Listed | |
| Plantae | Flora | Pimelea curviflora var. curviflora | | Vulnerable | Not Sensitive | Vulnerable | |
| Plantae | Flora | Pimelea spicata | Spiked Rice-flower | Endangered | Not Sensitive | Endangered | |
| Plantae | Flora | Pterostylis saxicola | Sydney Plains Greenhood | Endangered | Category 2 | Endangered | |
| Plantae | Flora | Pultenaea parviflora | | Endangered | Not Sensitive | Vulnerable | |
| Plantae | Flora | Senna acclinis | Rainforest Cassia | Endangered | Not Sensitive | Not Listed | |
| Plantae | Flora | Syzygium paniculatum | Magenta Lilly Pilly | Endangered | Not Sensitive | Vulnerable | |

Data does not include NSW category 1 sensitive species.

# Location Confidences

Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading “LC” or “LocConf”. These codes lookup to the following location confidences:

| LC Code | Location Confidence |
|---|---|
| Premise match | Georeferenced to the site location / premise or part of site |
| General area or suburb match | Georeferenced with the confidence of the general/approximate area |
| Road match | Georeferenced to the road or rail |
| Road intersection | Georeferenced to the road intersection |
| Feature is a buffered point | Feature is a buffered point |
| Land adjacent to geocoded site | Land adjacent to Georeferenced Site |
| Network of features | Georeferenced to a network of features |

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# Appendix B. Site Photographs

Photograph 1 – Offsite facing north-west towards Southern Precast Site

Photograph 2 – Area east of Southern Precast Site (offsite facing south)

Photograph 3 – Area east of Southern Precast Site (offsite facing west)

Photograph 4 – Offsite facing north towards land adjacent to and east of Precast Site

Photograph 5 – Offsite facing west towards Southern Precast Site

Photograph 6 – Southern Precast Site – Gypsum board (onsite facing north)

| | | | | |
|---|---|---|---|---|
| Notes: | | Jacobs<br>IA199800_Stage_1_Contamination_Assessment_Rev0 | Site: | METROWEST PRECAST FACILITY |
| | | | Project: | STAGE 1 CONTAMINATION ASSESSMENT |
| | | | Date: | APRIL 2020 |
| | | | Drawing: | **OBSERVATION PHOTOGRAPHS** — **Appendix B** |

Photograph 7 – Southern Precast Site Southern Boundary with Lenore Drive – Fly tipped waste materials (onsite facing south)

Photograph 8 – Southern Precast Site Southern Boundary – Fill embankment and fly tipped waste (onsite facing west)

Photograph 9 – Southern Precast Site Southern Boundary – Fill embankment and fly tipped waste (onsite facing east)

Photograph 10 – Southern Precast Site Southern Boundary – Timber stockpile (onsite facing east)

Photograph 11 – Southern Precast Site Southern Boundary – Fill embankment and stockpiled C&D waste (onsite facing south-west)

Photograph 12– Southern Precast Site Southern Boundary – Fill embankment and fly tipped waste (onsite facing east)

Notes:

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| | |
|---|---|
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| Date: | APRIL 2020 |
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Photograph 13– Southern Precast Site Southern Boundary – C&D waste stockpiles (onsite facing east)

Photograph 14 – Southern Precast Site Southern Boundary – Fly tipped assorted waste stockpiles (onsite facing south)

Photograph 15– Southern Precast Site Southern Boundary – Fly tipped assorted waste stockpiles (onsite facing west)

Photograph 16 – Southern Precast Site – Access track washout and dispersive soils (onsite facing east)

Photograph 17 – Southern Precast Site – Fly tipped fibrous boarding potential asbestos containing material (onsite)

Photograph 18 – Ropes Creek - Possible blackwater effect resulting from high organic carbon (offsite facing north-west)

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| | |
|---|---|
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| Date: | APRIL 2020 |
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Photograph 19 – Environmental Protection Area adjacent to Ropes Creek – Evidence of public use of site for recreational activities (offsite facing east)

Photograph 20 – Environmental Protection Area adjacent to Ropes Creek – Fly tipped waste materials adjacent within wooded area (offsite facing west)

Photograph 21 – Environmental Protection Area adjacent to Ropes Creek – Fly tipped waste materials adjacent within wooded area (offsite facing north-east)

Photograph 22 – Environmental Protection Area adjacent to Ropes Creek – Fly tipped waste materials adjacent within wooded area (offsite facing north)

Photograph 23 – Environmental Protection Area adjacent to Ropes Creek – Fly tipped waste materials adjacent within wooded area (offsite facing north)

Photograph 24 – Environmental Protection Area adjacent to Ropes Creek – Fly tipped waste materials adjacent within wooded area (offsite facing north-east)

| | | | | | |
|---|---|---|---|---|---|
| Notes: | | Jacobs | Site: | METROWEST PRECAST FACILITY | |
| | | | Project: | STAGE 1 CONTAMINATION ASSESSMENT | |
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Photograph 25 –Fly tipped waste materials adjacent within wooded area (offsite)

Photograph 26 – Northern Precast Site – Stormwater retention pond (offsite facing east)

Photograph 27– View from main retention pond (offsite facing west)

Photograph 28– Northern Precast Site – Drainage to main stormwater retention pond (onsite facing south)

Photograph 29– Northern Precast Site – Drainage to main stormwater retention pond and Northern Precast Site (onsite facing south-west)

Photograph 30– Northern Precast Site (onsite facing west)

| | | | | |
|---|---|---|---|---|
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Photograph 31– Adjacent land use (offsite facing east)


Photograph 32– Northern Precast Site – Sewer access hole cover (onsite).

| | | | | |
|---|---|---|---|---|
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# Appendix C

## Noise and Vibration

# SYDNEY METRO WEST

## Eastern Creek Precast Facilities
## Noise and Vibration Technical Report

**Prepared for:**

Sydney Metro
Level 43, 680 George Street,
Sydney, NSW 2000

SLR Ref: 610.18331-R05
Version No: -v1.1
October 2020

# PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Tenancy 202 Submarine School, Sub Base Platypus, 120 High Street
North Sydney NSW 2060 Australia

T: +61 2 9427 8100
E: sydney@slrconsulting.com www.slrconsulting.com

# BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Sydney Metro (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

# DOCUMENT CONTROL

| Reference | Date | Prepared | Checked | Authorised |
|---|---|---|---|---|
| 610.18331-R05-v1.1 | 23 October 2020 | Jordan McMahon | Antony Williams | Antony Williams |
| 610.18331-R05-v1.0 | 16 October 2020 | Jordan McMahon | Antony Williams | Antony Williams |
| | | | | |

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# DOCUMENT REFERENCES

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## FIGURES



## APPENDICES

# Glossary and Abbreviations

| Item | Description / Definition |
|---|---|
| Attended noise monitoring | Operator attended noise monitoring which is completed to determine the various contributors to the noise environment of an area. It is usually done over a short period, such as 15-minutes. |
| CNVS | Sydney Metro *Construction Noise and Vibration Standard*. Replaces the *Sydney Metro Construction Noise and Vibration Strategy* (Sydney Metro, 2017) |
| Cumulative impacts | Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessed on its own. |
| dBA | Decibel, A-weighted |
| DEC | Department of Environment and Conservation (now EPA) |
| DECC | Department of Environment and Climate Change (now EPA) |
| DECCW | Department of Environment, Climate Change and Water (now EPA) |
| EPA | Environment Protection Authority |
| Heavy vehicles | A heavy vehicle is classified as a Class 3 vehicle (a two-axle truck) or larger, in accordance with the Austroads Vehicle Classification System. |
| HNA | Highly Noise Affected. Relates to construction noise levels of ≥75 dBA and is the point above which there may be strong community reaction to noise construction noise levels. |
| ICNG | Interim Construction Noise Guideline |
| INP | Industrial Noise Policy |
| $L_{Aeq}$ | The average noise level during a measurement period, such as the daytime or night-time |
| $L_{AFmax}$ | The maximum noise level measured during a monitoring period, using 'fast' weighting |
| mm/s | Millimetres per second |
| NATA | National Association of Testing Authorities |
| NCA | Noise Catchment Area |
| NML | Noise Management Level |
| Noise intensive equipment | Construction equipment that is particularly noisy and causes annoyance. Includes items such as rockbreakers and concrete saws |
| NPfI | Noise Policy for Industry |
| OOH | Out of Hours |
| OOHW | Out of Hours Work |
| PPV | Peak particle velocity |
| RBL | Rating Background Level. This is the background noise level measured at a particular location. The method for calculating the RBL is defined in the NSW *Noise Policy for Industry*. |
| Realistic worst-case scenarios | Realistic worst-case construction scenarios have been developed to assess the potential impacts from the proposal. These scenarios are based on the noisiest items of equipment which would likely be required to complete the works. |
| RMS | Root Mean Square |

| Item | Description / Definition |
|---|---|
| RNP | Road Noise Policy |
| SLR | SLR Consulting Australia Pty Ltd |
| Standard Construction Hours | Monday to Friday 7 am to 6 pm and Saturdays from 8 am to 1 pm |
| SWL | Sound Power Level |
| Unattended noise monitoring | Noise monitoring which is typically completed over a seven day period using unattended noise monitoring equipment. The equipment is left in a certain location to measure the existing background noise levels during the daytime, evening and night-time. |
| VDV | Vibration Dose Value |
| Worst-case impacts and noise levels | The worst-case (i.e. highest) impacts or noise levels predicted in this report |

# 1 Introduction

## 1.1 Overview of the Proposed Works

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels.

The proposal would comprise the following key features and activities:

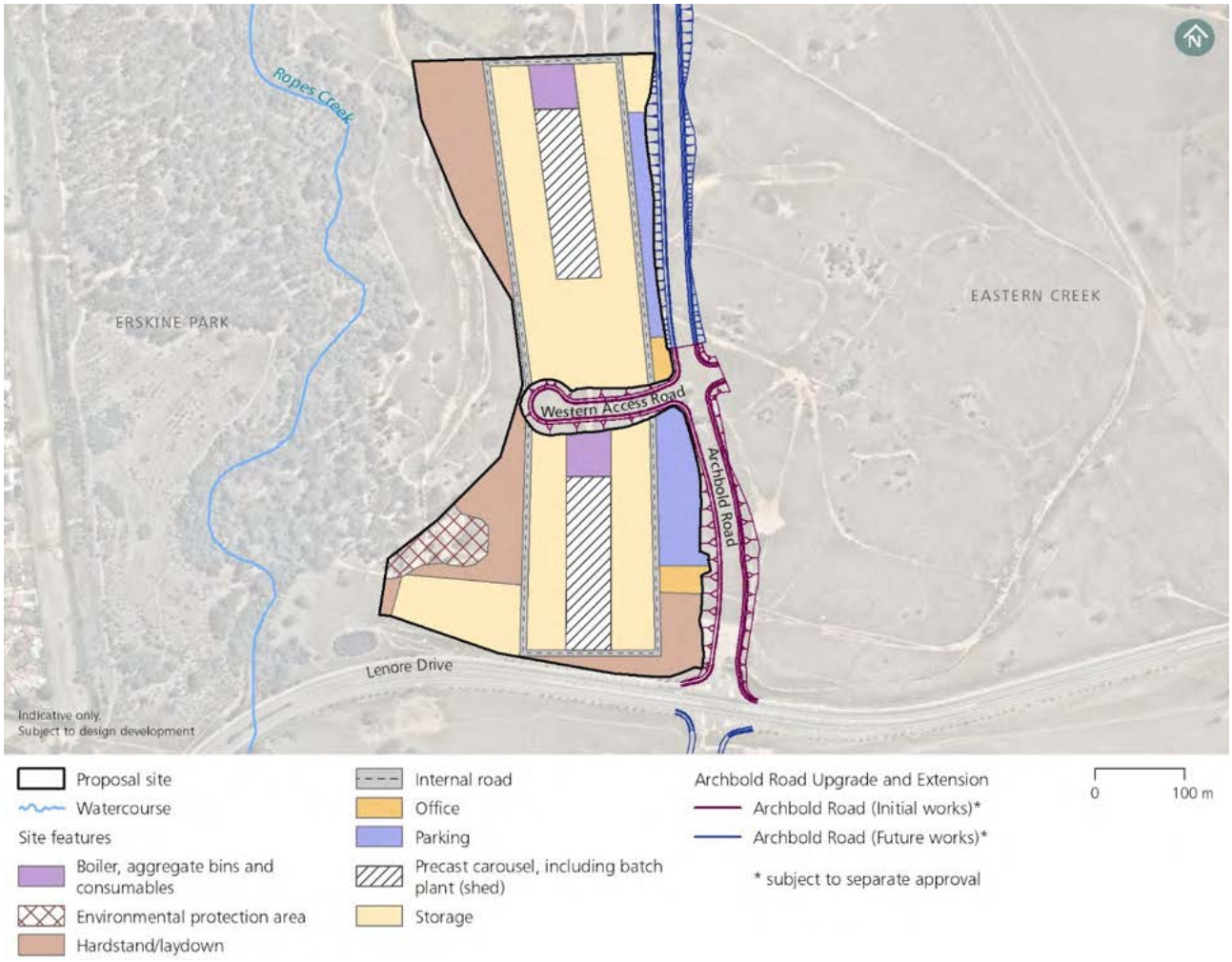
- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate and adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
  - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
  - Boiler, aggregate bins and consumables
  - Office facilities
  - On-site parking for up to 60 light vehicles
- Internal roads with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The northern and southern precast facilities would operate concurrently, 24 hours a day, seven days a week for the majority of the lifespan of the project.

The proposal would be temporary, operating for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West.

The proposed layout of the proposal is provided in **Figure 1.**

**Figure 1 Indicative Site Layout**




## 1.2 Purpose and Scope of this Report

This technical paper is one of a number of technical papers that form part of the Review of Environmental Factors. The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to noise and vibration during the construction and operation of the precast facilities.

This report includes the following:

- Describes the existing environment
- Summarises the construction and operational noise and vibration assessment of the proposal on the nearby communities and receivers
- Identifies feasible and reasonable noise and vibration mitigation and management measures to be incorporated in the detailed design and construction stage of the proposal.

## 1.3 Structure of this Report

The remainder of this report is structured as follows:

- **Section 2** details the existing noise environment
- **Section 3** provides the policy relevant to the assessment
- **Section 4** documents the assessment methodology
- **Section 5** provides an assessment of the potential noise and vibration impacts of the proposal during construction
- **Section 6** provides an assessment of the potential noise and vibration impacts during the operation of the proposal
- **Section 7** identifies mitigation and management measures.

## 1.4 Terminology

The assessment has used specific acoustic terminology and an explanation of common terms is included in **Appendix A**. A glossary is also provided at the start of this document which lists the various terms used throughout this document.

# 2 Existing Noise Environment

## 2.1 Site

The proposal is located at Eastern Creek within the Blacktown City Council local government area. The proposal would be located at Lenore Drive, Eastern Creek (the proposal site).

The 'proposal site' refers to the area that would be directly impacted by the proposal as shown in **Figure 1**. The proposal site is an undeveloped greenfield site within the broader context of surrounding established industrial areas at Eastern Creek.

Directly to the north and east, the proposal site is bounded by undeveloped land zoned for future industrial use under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (WSEA SEPP). Further to the north of the proposal site, beyond the M4 Western Motorway, is the existing Business Development Area at Minchinbury. Further to the east of the proposal site is the existing Bingo Eastern Creek Recycling Facility and the wider Eastern Creek Industrial Precinct. To the south of the proposal site there is a zoned public recreation area and an electrical substation to the south-east of the proposal site. The proposal site is bounded by Ropes Creek and riparian vegetation on the western boundary. The Erskine Park residential area extends further west (about 375 metres) from the proposal site.

Beyond the proposal site, the wider locality features a mix of land uses, including residential, commercial, public recreation and a number of industrial sites.

## 2.2 Noise Study Area

The proposal is located in Eastern Creek immediately north of Lenore Drive, around 1.5 kilometres south of M4 Motorway and three kilometres west of M7 Motorway. The existing land uses surrounding the proposal are residential receivers in Erskine Park to the west, with various commercial and industrial areas to the east and south. The nearest residential receivers are located about 375 metres to the west, with residential areas also being to the north at a distance of around 1.7 kilometres in Minchinbury.

Existing noise levels in the noise study area are generally controlled by road traffic noise from nearby motorways and arterial road, along with industrial noise from the surrounding existing commercial facilities.

All identified receivers surrounding the proposal are included in the assessment and have been grouped into Noise Catchment Areas (NCAs) to assist in summarising the potential impacts. The noise study area and NCAs are shown in **Figure 2** and described in **Table 1.**

## Figure 2 Noise Study Area

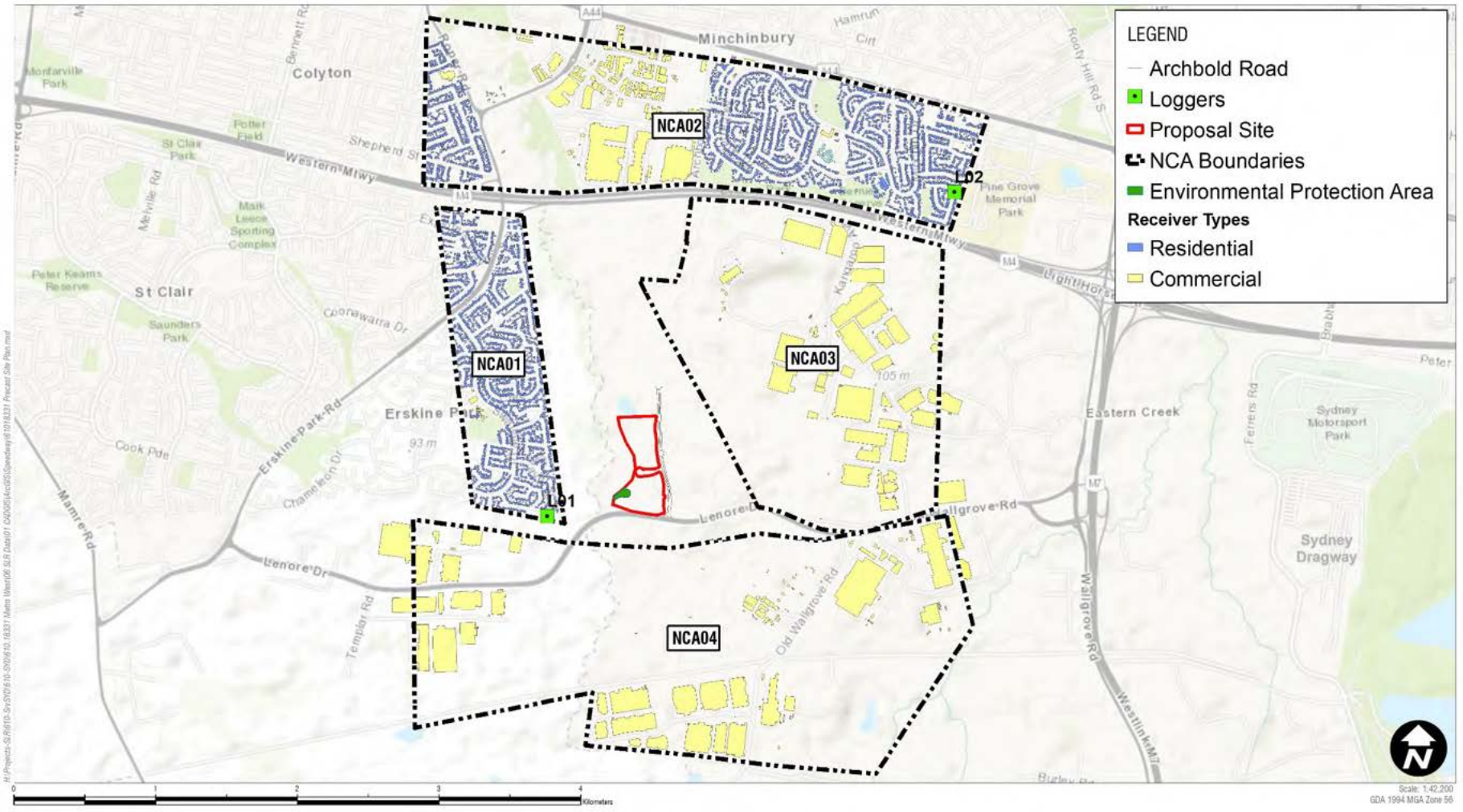


**Table 1 Noise Catchment Areas and Surrounding Land Uses**

| NCA | Description |
|---|---|
| NCA01 | West of the proposal in Erskine Park. This catchment is mostly residential with the nearest receivers being about 375 metres to the west of the proposal. A small number of commercial receivers are in this catchment at the Erskine Park Shopping Centre, which is off Shallow Drive. |
| NCA02 | North of the proposal in Minchinbury, between the M4 Motorway and Great Western Highway. This catchment consists of commercial and industrial receivers to the immediate north of the proposal, and residential receivers to the northeast and northwest. The nearest receivers in this catchment are about 1.7 kilometres away. |
| NCA03 | East of the proposal in Eastern Creek and west of M7 Motorway. This catchment is commercial and industrial. The nearest receiver is about 800 metres east of the proposal. |
| NCA04 | South of the proposal in Erskine Park (to the southwest), Eastern Creek (to the south) and Horsley Park (further south). This catchment is commercial and industrial. The nearest receivers in this catchment are about 800 metres away. |

## 2.3 Sensitive Receivers

Receivers potentially sensitive to noise and vibration have been categorised as residential buildings, 'other sensitive' land uses which includes educational institutions, child care centres, medical facilities, places of worship, outdoor recreation areas, or commercial and industrial buildings.

The noise study area (shown in **Figure 2**) includes residential buildings and 'other sensitive' land uses, such as schools, commercial and industrial buildings. No other receiver types have been identified in the noise study area.

## 2.4 Noise Surveys and Monitoring Locations

### 2.4.1 Unattended Ambient Noise Monitoring Results

Unattended ambient noise monitoring was completed in the noise study area in 2016 and 2019 as part of previous nearby projects. There have not been any significant changes to the proposal site and surrounds since this monitoring was undertaken which would influence its suitability for this assessment. The measured noise levels have been used to determine the existing noise environment and to set criteria to assess the potential impacts from the proposal.

The ambient noise monitoring locations were selected with reference to the procedures outline in the NSW EPA *Noise Policy for Industry* (NPfI). The measured existing noise levels are representative of receivers in each NCA that would likely be most affected by the proposal.

The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time. All equipment carried current National Association of Testing Authorities (NATA) calibration certificates and the calibration was checked before and after each measurement.

The results of the noise monitoring have been processed with reference to the NPfI to exclude noise from extraneous events and/or data affected by adverse weather conditions, such as strong wind or rain, to establish representative existing noise levels for each NCA.

The monitoring locations are shown in **Figure 2** with the results summarised in **Table 2**. Descriptions of each monitoring location and the measured noise environment, together with graphs of the daily measured noise level, are in **Appendix B**.

**Table 2 Summary of Unattended Noise Monitoring Results**

| Location ID | Address | Noise Level (dBA)[1,2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | Background Noise (RBL) | | | Average Noise Level (LAeq) | | |
| | | Day | Evening | Night | Day | Evening | Night |
| L01 | 82 Weaver Street, Erskine Park | 37 | 37[3] (actual 40) | 37[3] (actual 39) | 47 | 46 | 45 |
| L02 | 8 Farrington St, Minchinbury | 41 | 41[3] (actual 45) | 41 | 55 | 57 | 49 |

Note 1: The RBL and $L_{Aeq}$ noise levels have been determined with reference to the procedures in the NPfI.

Note 2: Daytime is 7.00 am to 6.00 pm, evening is 6.00 pm to 10.00 pm and night-time is 10.00 pm to 7.00 am.

Note 3: RBL for evening set at no greater than the daytime, and RBL for night-time set no greater than the day or evening following conservative principles outlined in the NPfI.

The unattended noise monitoring results indicate existing daytime background noise levels in the noise study area are dominated by road traffic noise from distant major roads, including the M4 Motorway and Great Western Highway.

### 2.4.2 Attended Noise Measurements

Short-term attended noise monitoring was completed at each ambient noise monitoring location, during previous investigations. The attended measurements allow the contributions of the various noise sources at each location to be determined. Detailed observations from the attended measurements are provided in **Appendix B**.

## 2.5 Prevailing Weather Conditions

An assessment of prevailing wind conditions has been completed using data measured at Horsley Park Equestrian Centre Weather Station. The detailed weather analysis for the 12-month period from January to December 2019 is shown in **Appendix C** consistent with the requirements of NPfI Fact Sheet D. The measured prevailing weather conditions are summarised in **Table 3**.

**Table 3 Prevailing Weather Conditions**

| Weather Condition | Frequency of Occurrence | | |
|---|---|---|---|
| | Daytime (7am to 6pm) | Evening (6pm to 10pm) | Night-time (10pm to 7am) |
| Wind - Calm | Less than 30% | Less than 30% | Greater than 30% |
| Wind - 0.5 to 2 metres per second | Less than 30% | Less than 30% | Less than 30% |
| Wind - 2 to 3 metres per second | Less than 30% | Less than 30% | Less than 30% |
| Wind - 0.5 to 3 metres per second | Less than 30% | Greater than 30% | Greater than 30% |
| Atmospheric Stability F or G – Moderately or Extremely Stable | Less than 30% | Less than 30% | Greater than 30% |

As shown above, the seasonal frequency of occurrence of the prevailing winds during the daytime is less than 30 per cent, however, prevailing winds during the evening and night-time exceeds the 30 per cent threshold. Temperature inversions of Class F (moderately stable) or Class G (extremely stable) also occur for more than 30 per cent of the night-time period.

With reference to **Appendix C**, the prevailing wind direction during the evening and night-time is from the west and south-west. This is a noise-enhancing source to receiver direction for receivers north and east of the project site.

The resulting meteorological modelling conditions are discussed in **Section 4.2.3**.

# 3 Legislative and Policy Framework

This section summarises the guidelines and/or policies referred to in the assessment.

## 3.1 Relevant Guidelines Overview

The guidelines used in this assessment are listed in **Table 4**. The guidelines aim to protect the community and environment from excessive adverse noise and vibration impacts from the proposal.

**Table 4 Noise and Vibration Guidelines**

| Guideline/Policy Name | Where Guideline Used |
|---|---|
| *Interim Construction Noise Guideline* (ICNG), Department of Environment and Climate Change (DECC), 2009 | Assessment of airborne construction noise impacts on sensitive receivers |
| *Assessing Vibration: a technical guideline*, Department of Environment and Conservation (DEC), 2006 | Assessment of vibration impacts on sensitive receivers |
| *AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors* | Provides recommended design sound levels for internal areas of occupied spaces |
| *Road Noise Policy* (RNP), Department of Environment, Climate Change and Water (DECCW), 2011 | Assessment of construction traffic impacts and operational impacts of facility related traffic on public roads |
| *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2*, BSI, 1993 | Screening assessment of vibration impacts (cosmetic damage) to sensitive buildings and structures |
| *DIN 4150:Part 3-2016 Structural vibration – Effects of vibration on structures*, Deutsches Institute fur Normung, 1999 | Screening assessment of vibration impacts (cosmetic damage) to vibration sensitive heritage buildings and structures, where the structure is found to be unsound |
| *Sydney Metro Construction Noise and Vibration Standard (CNVS),* Sydney Metro, 2020 | Assessment and management protocols for construction of Sydney Metro projects. This Sydney Metro standard is based on the requirements of the ICNG and Transport for NSW *Construction Noise and Vibration Strategy*, as appropriate to Sydney Metro and is the guiding strategy for assessing and managing the potential impacts during construction of the proposal.<br>This Sydney Metro standard replaces the *Sydney Metro Construction Noise and Vibration Strategy* (Sydney Metro, 2017) |
| *Noise Policy for Industry* (NPfI), Environmental Protection Authority (EPA), 2017 | Assessment of operational industrial noise emissions from the proposal, including sleep disturbance. Ambient noise monitoring and analysis procedures |

## 3.2 Construction Airborne Noise Guidelines

The *Sydney Metro Construction Noise and Vibration Standard* (CNVS) references the NSW *Interim Construction Noise Guideline* (ICNG) for assessing and managing impacts from construction noise on projects undertaken by Sydney Metro.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers. The realistic 'worst-case' noise levels from construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impacts.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

### 3.2.1 Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 5**.

**Table 5 ICNG NMLs for Residential Receivers**

| Time of Day | NML $L_{Aeq(15minute)}$ | How to Apply |
|---|---|---|
| Standard Construction Hours:<br>Monday to Friday<br>7:00 am to 6:00 pm<br>Saturday<br>8:00 am to 1:00 pm<br>No work on Sundays or public holidays | Noise affected<br>RBL + 10 dB | The noise affected level represents the point above which there may be some community reaction to noise.<br>• Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level.<br>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly Noise Affected<br>75 dBA | The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise.<br>• Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account:<br>  • Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences.<br>If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| Outside Standard Construction Hours: | Noise affected<br>RBL + 5 dB | • A strong justification would typically be required for works outside the recommended standard hours.<br>• The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community. |

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Industrial Noise Policy* (INP). The INP has been superseded by the NSW EPA *Noise Policy for Industry* (NPfI). The RBLs have been determined in accordance with the calculation procedures outlined in the NPfI as described in **Section 2.4**.

In the ICNG, works are recommended to be completed during Standard Construction Hours. More stringent requirements are placed on works that are required to be completed outside of Standard Construction Hours (i.e. during the evening or night-time) which reflects the greater sensitivity of communities to noise impacts during these periods.

Construction of the proposal is generally expected to be completed during Standard Construction Hours.

#### 3.2.1.1 Summary of Residential NMLs

The residential NMLs for the proposal have been determined using the results from the unattended ambient noise monitoring (see **Section 2.4**) and are shown in **Table 6**.

**Table 6 Residential Receiver Construction NMLs**

| NCA | Representative Background Monitoring Location | NML ($L_{Aeq(15minute)}$ – dBA) | | | | Sleep Disturbance Screening Criteria (52 dBA or RBL +15 dB whichever is higher) |
|---|---|---|---|---|---|---|
| | | Standard Construction (RBL +10 dB) | Out of Hours (RBL +5 dB) | | | |
| | | Daytime[1] | Daytime[1] | Evening[1] | Night-time[1] | |
| NCA01 | L01 | 47 | 42 | 42 | 42 | 52 |
| NCA02 | L02 | 51 | 46 | 46 | 46 | 56 |
| NCA03 | N/A | N/A | N/A | N/A | N/A | N/A |
| NCA04 | N/A | N/A | N/A | N/A | N/A | N/A |

Note 1: Daytime out of hours is 7 am to 8 am and 1 pm to 6 pm on Saturday, and 8 am to 6 pm on Sunday and public holidays.

The noise monitoring locations were selected on the basis of being representative of the potentially most affected residential receivers in each NCA.

### 3.2.2 Other Sensitive Land Uses and Commercial Receivers

Non-residential land uses have been identified in the noise study area. These include 'other sensitive' land uses such as educational institutions and commercial/industrial properties. The ICNG NMLs for 'other sensitive' receivers are shown in **Table 7**.

**Table 7 ICNG NMLs for 'Other Sensitive' Receivers**

| Land Use | Noise Management Level $L_{Aeq(15minute)}$ (dBA) (Applied when the property is in use) | |
|---|---|---|
| | Internal | External |
| Classrooms at schools and other educational institutions | 45 | 55[1] |
| Commercial | - | 70 |
| Industrial | - | 75 |

Note 1: The criteria is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation. Hospitals are assumed to have fixed windows with 20 dB higher external levels.

## 3.3 Construction Traffic Noise Guidelines

The potential impacts from construction traffic when travelling on public roads are assessed under the NSW *Road Noise Policy* (RNP).

An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2.0 dB due to construction traffic. Where this is considered likely, further assessment is required using the RNP base criteria shown in **Table 8**.

**Table 8 RNP Criteria for Assessing Construction Traffic on Public Roads**

| Road Category | Type of Project/Land Use | Assessment Criteria (dBA) | |
|---|---|---|---|
| | | Daytime (7 am - 10 pm) | Night-time (10 pm - 7 am) |
| Freeway/ arterial/ sub-arterial roads | Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments | $L_{Aeq(15hour)}$ 60 (external) | $L_{Aeq(9hour)}$ 55 (external) |

Where the criteria are exceeded the proposal would consider the use of all feasible and reasonable mitigation and management measures to minimise the impacts.

## 3.4 Construction Vibration Guidelines

The effects of vibration from construction works can be divided into three categories:

- Those in which the occupants of buildings are disturbed (**human comfort**). People can sometimes perceive vibration impacts when vibration generating construction works are located close to occupied buildings. Vibration from construction works tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV) shown in **Table 9**.
- Those where building contents may be affected (**building contents**). People perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.
- Those where the integrity of the building may be compromised (**structural or cosmetic damage**). If vibration from construction works is sufficiently high it can cause cosmetic damage to elements of affected buildings. Industry standard cosmetic damage vibration limits are specified in Australian Standard AS 2187-2, British Standard BS 7385 and German Standard DIN 4150, which are referenced in the Sydney Metro CNVS, which adds an additional layer of conservatism to the recommendations in the British Standard. The limits are shown in **Figure 3** and **Table 10**.

**Table 9 Human Comfort Vibration Dose Values for Intermittent Vibration**

| Building Type | Assessment Period | Vibration Dose Value[1] ($m/s^{1.75}$) | |
|---|---|---|---|
| | | Preferred | Maximum |
| Critical Working Areas (e.g. operating theatres or laboratories) | Day or night-time | 0.10 | 0.20 |
| Residential | Daytime | 0.20 | 0.40 |
| | Night-time | 0.13 | 0.26 |
| Offices, schools, educational institutions and places of worship | Day or night-time | 0.40 | 0.80 |
| Workshops | Day or night-time | 0.80 | 1.60 |

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

**Figure 3 Transient Vibration Values for Minimal Risk of Cosmetic Damage**

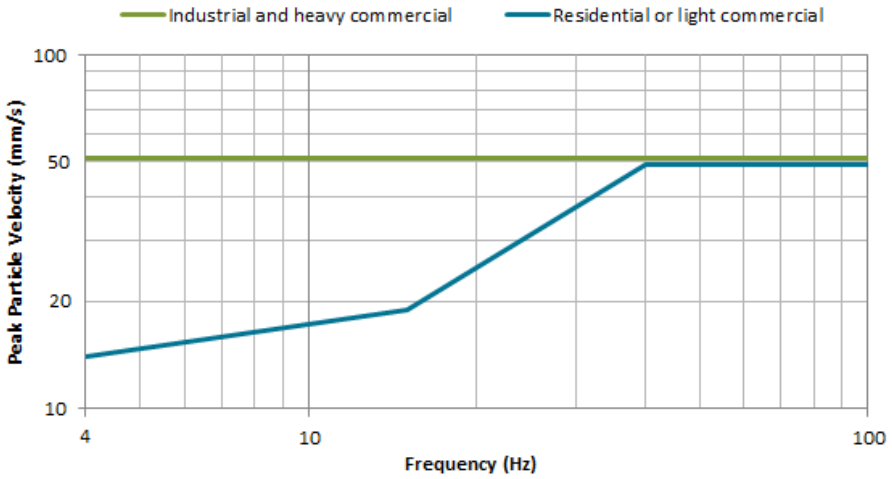



**Table 10 Transient Vibration Values for Minimal Risk of Cosmetic Damage**

| Type of Building | Peak Particle Velocity[1] |
|---|---|
| Reinforced or framed structures. Industrial and heavy commercial buildings | 25 mm/s |
| Unreinforced or light framed structures. Residential or light commercial type buildings | 7.5 mm/s |

Note 1: Cosmetic damage vibration limits are conservatively recommended to be reduced by 50 percent to account for dynamic loading caused by continuous vibration dynamic magnification due to resonance.

### 3.4.1 Heritage Buildings and Structures

The Sydney Metro CNVS states that heritage buildings and structures should be assessed according to the cosmetic damage screening criteria in **Table 10** and should not be assumed to be more sensitive to vibration unless found to be structurally unsound.

Where heritage buildings and structures are found to be structurally unsound, a more conservative cosmetic damage objective of 2.5 mm/s Peak Particle Velocity (PPV) (from DIN 4150) would be considered.

No heritage buildings or structures have been identified within or in proximity of the proposal site.

## 3.5 Industrial Operational Noise Guidelines

### 3.5.1 Noise Policy for Industry

The NPfI was released in 2017 and sets out the NSW Environment Protection Authority (EPA)'s requirements for the assessment and management of noise from industry in NSW.

#### Trigger Levels

The NPfI describes 'trigger levels' which inform the noise level at which feasible and reasonable noise management measures should be considered. Two forms of noise objectives are provided – one to account for 'intrusive' noise impacts and one to protect the 'amenity' of particular land uses.

- The **intrusiveness** of an industrial noise source is generally considered acceptable if the $L_{Aeq}$ noise level of the source, measured over a period of 15 minutes, does not exceed the background noise level by more than 5 dB. Intrusive noise levels are only applied to residential receivers. For other receiver types, only the amenity levels apply.
- To limit continual increases in noise levels from the use of the intrusiveness level alone, the ambient noise level within an area from all industrial sources should remain below the recommended **amenity** levels specified in the NPfI for that particular land use.

The more stringent of the intrusive and amenity trigger levels become the Project Noise Trigger Level which is used to assess the potential impacts from the proposal.

For this assessment, the area surrounding the proposal is considered to be 'suburban' which is characterised as an area that is affected by traffic noise with some limited commerce or industry.

#### Project Specific Criteria

The project specific noise trigger levels for the nearest residential and commercial receivers are shown in **Table 11**. The lower of the intrusive and amenity criteria are shown in bold.

**Table 11 Project Noise Trigger Levels – Industrial Noise**

| NCA | Receiver | Period | Recommended Amenity Noise Level $L_{Aeq}$ (dBA) | Measured Noise Level (dBA) | | Project Noise Trigger Levels $L_{Aeq(15minute)}$ (dBA) | |
|---|---|---|---|---|---|---|---|
| | | | | RBL[1] | $L_{Aeq(period)}$ | Intrusiveness | Amenity[2,3] |
| NCA01, NCA03 and NCA04 | Residential | Daytime | 55 | 37 | 47 | **42** | 58 |
| | | Evening | 45 | 37[4] | 46 | **42** | 48 |
| | | Night-time | 40 | 37[4] | 45 | **42** | 43 |
| | Commercial | When in use | 65 | - | - | - | **68** |
| NCA02 | Residential | Daytime | 55 | 41 | 55 | **46** | 58 |
| | | Evening | 45 | 41[4] | 57 | **46** | 48 |
| | | Night-time | 40 | 41 | 49 | 46 | **43** |
| | Commercial | When in use | 65 | - | - | - | **68** |

Note 1: RBL = Rating Background Level.

Note 2: The recommended amenity noise levels have been assigned as the project amenity noise level (ie not reduced by 5 dB) as other sources of industrial noise in the area are distant and unlikely to significantly affect receivers near to the project.

Note 3: The project amenity noise levels have been converted to a 15-minute level by adding 3 dB.

Note 4: The measured evening/night-time RBL was found to be higher than the daytime/evening. In these situations, the evening/night-time RBL would typically be reduced to match the daytime/evening RBL however the NPfI acknowledges this may not always be appropriate and alternate approaches may be justified. In this case, a conservative approach has been used and the RBL has been reduced.

### Sleep Disturbance

The most current method for assessing sleep disturbance is contained in the NPfI. The NPfI defines sleep disturbance criterion as 52 dBA $L_{AFmax}$ or the prevailing background level plus 15 dB, whichever is greater. The 52 dBA $L_{AFmax}$ criterion has been used for this proposal as this is the criterion which applies to the nearest residential receivers in NCA01.

## 3.6 Operational Road Traffic Noise

When traffic related to the proposed operation of the facility is on the public road network, vehicle movements are regarded as 'additional road traffic' (rather than as part of the site operations) and are assessed under the NSW *Road Noise Policy* (RNP).

The RNP requires any increase in the total traffic noise level to be limited to 2.0 dB above that of the existing road traffic noise level. The RNP criteria applicable to the proposal is provided in **Table 12**.

**Table 12 RNP Criteria for Assessing Additional Vehicles on Public Roads**

| Road Category | Type of Project/Land Use | Assessment Criteria (dBA) | |
|---|---|---|---|
| | | Daytime (7 am - 10 pm) | Night-time (10 pm - 7 am) |
| Freeway/arterial/ sub-arterial roads | Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments | $L_{Aeq(15hour)}$ 60 (external) | $L_{Aeq(9hour)}$ 55 (external) |

# 4 Assessment Methodology

This section describes the methodology used to assess the potential noise and vibration impacts from the proposal.

## 4.1 Construction Noise and Vibration Assessment

### 4.1.1 Airborne Noise Assessment

A noise model of the noise study area has been used to predict noise levels from construction of the proposal to all surrounding receivers. The model uses ISO 9613 algorithms in SoundPLAN software to predict noise levels at external building facades.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the proposal site and the surrounding noise study area.

#### Works Descriptions

Representative scenarios have been developed to assess the likely impacts from the various construction phases of the works. These scenarios are shown in **Table 13** together with a high-level description of each works activity. The location of the various work scenarios is shown in **Figure 4.**

The assessment uses 'realistic worst-case' scenarios to determine the impacts from the noisiest 15-minute period that are likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

The assessment is generally considered conservative as the calculations assume several items of construction equipment are in use at the same time within individual scenarios.

**Table 13 Construction Scenario Descriptions**

| Scenario[1] | Activity | Description |
|---|---|---|
| Site Establishment | Vegetation Clearing | Clearing the proposal site of existing vegetation, trees, soil and debris. |
| | Earthworks | Bulk earthworks including excavation, compaction and haulage of materials. |
| | Utilities | Installation of power, water, sewerage, etc. |
| Civil and Building Work | Establishment of Roads | Construction of pavements and sealing of internal access roads for the proposed precast facilities. |
| | Construction of Built Form | Construction of precast facilities and site offices. |
| Commissioning | Decommissioning and Fit out | Includes decommissioning /demobilisation of the construction area, fit-out of the shed and commissioning of operational facilities. |
| | Landscaping | Site landscaping. |

Note 1: Equipment lists for each scenario and Sound Power Level data are provided in **Appendix D**.

**Figure 4 Construction Works Locations**


## Working Hours

The works would generally be carried out during Standard Construction Hours. Standard Construction Hours are defined in the ICNG as:

- 7 am to 6 pm Monday to Friday
- 8 am to 1 pm Saturdays
- No work on Sundays or public holidays.

Other activities that may be carried out outside of the Standard Construction Hours would include:

- Work determined to comply with the relevant noise management level at the nearest sensitive receiver
- The delivery of materials outside approved hours as required by the NSW Police or other authorities for safety reasons
- Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm
- Situations where agreement is reached with affected receivers.

No other out-of-hours works are anticipated as part of the proposal. If out-of-hours works are required, Sydney Metro would follow the ICNG and Sydney Metro *Construction Noise and Vibration Standard* and obtain any necessary approvals.

#### Works Schedule

Subject to planning approval, the works are planned to start in early 2021 and be complete by the end of 2022.

### 4.1.2 Construction Vibration

The potential impacts during vibration intensive works have been assessed assuming a vibratory roller could be used anywhere within the proposal site (see **Figure 4**).

### 4.1.3 Construction Traffic Noise

During the construction period the following vehicle numbers are anticipated during Standard Construction Hours for each precast facility:

- Light vehicles: 60 vehicles (per facility) arriving in the hour before the start of shifts (6 am to 7 am for weekday shifts) and 60 vehicles (per facility) leaving in the hour after the end of shifts (6 pm to 7 pm for weekday shifts)
- Heavy vehicles: maximum of 10 heavy vehicles (per facility) per hour during standard construction hours (7 am to 6 pm).

Haulage routes would only travel east of the proposal site as per the below roads:

- Temporary haulage route (prior to the completion of Archbold Road), upgraded and extended Archbold Road (subject to separate approval), Lenore Drive, Old Wallgrove Road, Wallgrove Road and M7 Motorway.
- No haulage routes are anticipated to travel west of the proposal site.

As all construction traffic would travel east and access the M7 Motorway via existing busy arterial roads through commercial/industrial areas, no impacts from construction traffic at sensitive receivers are expected and have not been considered further.

## 4.2 Operational Industrial Noise Assessment

A three-dimensional SoundPLAN noise model of the noise study area has been used to predict operational noise levels to the surrounding receivers.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the noise study area and surrounding areas.

### 4.2.1 Operational Information

The proposal would produce and transport precast segments. Operational elements of the proposal include:

- Both the northern precast and southern precast would operate concurrently for a temporary timeframe of four to five years, subject to the program for construction for Sydney Metro West
- The proposal would have 24 hours per day, seven days per week operations
- Haulage routes would only travel to the east of the proposal site. Indicative operational vehicle movements are outlined in **Table 14**.

**Table 14 Indicative Operational Vehicle Movements (per precast facility)**

| Time of the Day | Heavy Vehicles (maximum per hour) | Light Vehicles (maximum per hour) | Light Vehicles – Staff (indicative maximum based on shift change times) |
|---|---|---|---|
| Day (7am – 6pm) | 12 | 8 | 60 (6am - 7am) |
| Evening (6pm-10pm) | 6 | 5 | 60 (5pm-6pm)<br>60 (6pm-7pm) |
| Night (10pm-7am) | 6 | 5 | 60 (5am-6am) |

Note 1: Heavy vehicles have been assumed to be evenly distributed across the worst-case hour period.

Internal access roads would be established including vehicles access and egress points on the eastern side. There would be one entrance to the proposal site, a joint site entrance for both facilities located between the northern and southern precast facilities.

The batch plant facilities would include:

- A concrete batching plant enclosed in a shed with a height of about eight metres. All openings are assumed to face east
- Site amenities including crib sheds, ablutions and offices
- Car parking areas for provision of up to 60 light vehicles at each precast facility.

### 4.2.2 Operational Scenarios

The following operational scenarios in **Table 15** have been assessed for the proposed precast facility.

**Table 15 Operational Scenarios**

| Scenario | Equipment | Operating Hours |
|---|---|---|
| Segment precast factory (internal) | Concrete mixer truck<br>Concrete pump<br>Concrete vibrator<br>Gantry crane | 24/7 |
| Segment storage | Telehandler<br>Forklift<br>Gantry crane | 24/7 |
| External equipment | Front end loader<br>Containerised boilers[1]<br>Light vehicles<br>Heavy vehicles | 24/7 |

Note 1: Assumed to not be a significant contributor to noise emissions.

The noise generated by the facility is generally not expected to contain any particularly annoying characteristics (i.e. tonal or low frequency components) and therefore NPfI modifying factor corrections have not been applied to the assessment.

### 4.2.3 Meteorological Conditions

Weather conditions with the potential to increase noise at receivers are a feature of the area (see **Section 2.5** and **Appendix C**). The NPfI requires assessment under noise-enhancing weather conditions when the frequency of occurrence of noise-enhancing conditions is measured to be greater than 30 per cent. The meteorological conditions included in the noise modelling are summarised in **Table 16**.

**Table 16 Meteorological Conditions for Noise Modelling**

| Assessable Weather Condition | Period | Air Temp. (°C) | Relative Humidity (per cent) | Wind Velocity (metres per second) | Modelled Wind Direction | Stability Category[1] |
|---|---|---|---|---|---|---|
| Standard | Daytime | 21 | 59 | 0.5 | Source > Receiver | D |
| | Evening | 20 | 67 | 0.5 | Source > Receiver | D |
| | Night-time | 17 | 75 | 0.5 | Source > Receiver | D |
| Noise-Enhancing | Evening | 20 | 67 | 3 | Source > Receiver[2] | D |
| | Night-time | 17 | 75 | 3 | Source > Receiver[2] | D |
| | Night-time | 17 | 75 | 2 | From south-west | F |

Note 1: Refer to the NPfI for definitions of these categories.

Note 2: Prevailing wind direction more than 30 per cent occurrence is from the south-west, south-south-west and west-south-west.

As described in the NPfI, where wind is identified as a significant feature, noise modelling should consider a three metres per second wind in the directions identified as significant, or alternatively use a source-to-receiver component for all receivers of three metres per second as a conservative approach.

The prevailing wind direction near the proposal site is from the southwest for more than 30 per cent of the time. A three metres per second source to receiver wind direction in the evening and night-time has therefore been conservatively applied to the assessment for all receivers. It is noted that this approach is conservative for receivers to the west of the proposal site in NCA01 as the prevailing wind direction is from the south-west.

Noise-enhancing temperature inversions as part of stability Class F have also been modelled during the night-time.

# 5 Construction Assessment

## 5.1 Construction Noise

The following overview is based on the predicted impacts at the most affected receivers and is representative of the worst-case situation where construction equipment is at the closest point to each receiver.

The assessment shows the predicted impacts based on the exceedance of the management levels, as per the categories in **Table 17**. The likely subjective response of people affected by the impacts is also shown in the table, noting that the subjective response would vary and depends on the period in which the impacts occur.

**Table 17 Exceedance Bands and Corresponding Subjective Response to Impacts**

| Exceedance of Management Level | Likely Subjective Response | Impact Colouring |
|---|---|---|
| No exceedance | No impact | |
| 1 to 10 dB | Minor to marginal | |
| 11 dB to 20 dB | Moderate | |
| >20 dB | High | |

The predicted construction airborne noise impacts are presented for the most affected receivers. Receivers which are further away from the works and/or shielded from view would have substantially lower impacts. The assessment is generally considered conservative as the calculations assume several items of construction equipment are in use at the same time within individual scenarios.

A summary of the predicted construction airborne noise levels (without additional mitigation) in each NCA for the various construction activities is shown in **Table 18** for the nearest residential and commercial receivers.

The table presents the maximum impact from the construction scenarios. This represents the likely maximum noise levels expected during construction with noise generating works.

Construction noise level contours across the proposal site are shown in **Figure 5** for the scenario which results in the highest predicted noise levels at the adjacent receivers (*Site Establishment – Earthworks*).

The noise levels presented in this report are based on a realistic worst-case assessment of each works scenario. For most construction activities, it is expected that the construction noise levels during less intensive activities would frequently be lower than predicted.

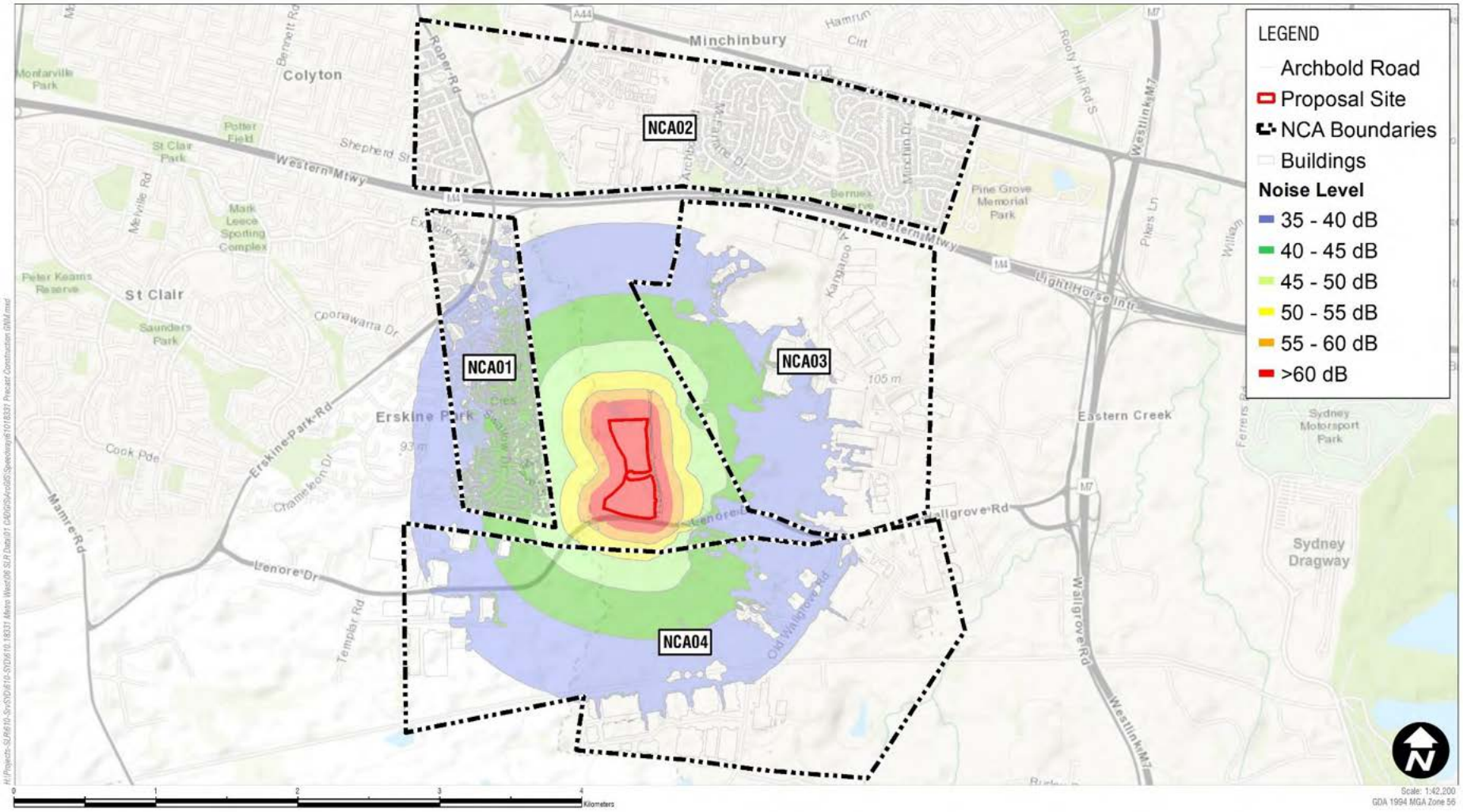
## Table 18 Predicted Worst-Case Construction Noise Impacts – Standard Construction Hours

| NCA | NML (dBA) | Predicted Worst-case $L_{Aeq(15minute)}$ Noise Level (dBA) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Site Establishment | | | Civil and Building Work | | Commissioning | |
| | | Vegetation Clearing | Earthworks | Utilities | Establishment of Roads | Construction of Built Form | Decommissioning and Fit out | Landscaping |
| **Residential – Daytime** | | | | | | | | |
| NCA01 | 47 | 47 | 50 | 34 | 46 | 45 | 42 | 31 |
| NCA02 | 51 | <30 | <30 | <30 | <30 | <30 | <30 | <30 |
| NCA03 | 47 | N/A – no residential receivers in this NCA | | | | | | |
| NCA04 | 47 | N/A – no residential receivers in this NCA | | | | | | |
| **Commercial – Daytime** | | | | | | | | |
| NCA01 | 70 | 39 | 42 | <30 | 39 | 37 | 34 | <30 |
| NCA02 | 70 | 32 | 35 | <30 | 33 | 31 | <30 | <30 |
| NCA03 | 70 | 40 | 43 | <30 | 40 | 38 | 35 | <30 |
| NCA04 | 70 | 39 | 42 | <30 | 38 | 37 | 34 | <30 |

**Legend**

No Exceedance | 1 - 10 dB above NML | 11 - 20 dB above NML | >20 dB above NML

## Figure 5 Predicted Construction Noise Level Contours – *Site Establishment – Earthworks*



The above assessment shows the construction works are anticipated to comply with the relevant criteria with the exception of a minor exceedance of the NMLs in NCA01 during the noisiest scenario which is *Site Establishment – Earthworks*. This temporary impact is only expected for a relatively short period of the works when noise generating works are occurring at the western site boundary of the proposal, which is closest to the sensitive receivers in NCA01. The worst-case predicted noise level is 50 dBA which is comparable to the existing $L_{Aeq}$ noise levels in the NCA (see **Table 2**) and would be below annoyance levels within the potentially affected buildings. As such, this exceedance is considered to be of low significance. The noise levels from all other scenarios are predicted to be compliant at all receivers.

The impacts presented above are based on all equipment working simultaneously in each assessed scenario. There would be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use.

The proposed noise mitigation measures for construction airborne noise impacts are discussed in **Section 7.1**.

## 5.2 Construction Vibration

Vibration intensive equipment is proposed to be used during construction and includes the use of a vibratory roller. This item of vibration intensive equipment could be used anywhere within the construction footprint shown in **Figure 4**.

The nearest receivers are about 375 metres from the proposal site and therefore impacts from vibration intensive works during construction of the proposal are anticipated to be negligible.

## 5.3 Cumulative Construction Impacts

The cumulative impact assessment for construction noise is provided in Chapter 8 (Environmental Impacts Assessment) of the REF.

# 6 Operational Assessment

## 6.1 Operational Noise

Operational noise emissions from the proposal have been predicted to the identified sensitive receivers in the noise study area. The following presents a summary of the predicted levels and likely impacts at the most affected receivers in each NCA, which is typically the nearest receivers.

The predicted levels represent realistic worst-case scenarios during the concurrent operation of both precast facilities, based on the assumptions detailed in **Section 4.2**. The industrial noise emissions would vary during operation, depending on delivery and production schedules, and would frequently be lower than the worst-case levels presented.

The predicted operational noise levels at the nearest receivers from industrial noise emissions are shown in **Table 19** for both standard and noise-enhancing weather conditions.

### Table 19 Industrial Noise Assessment

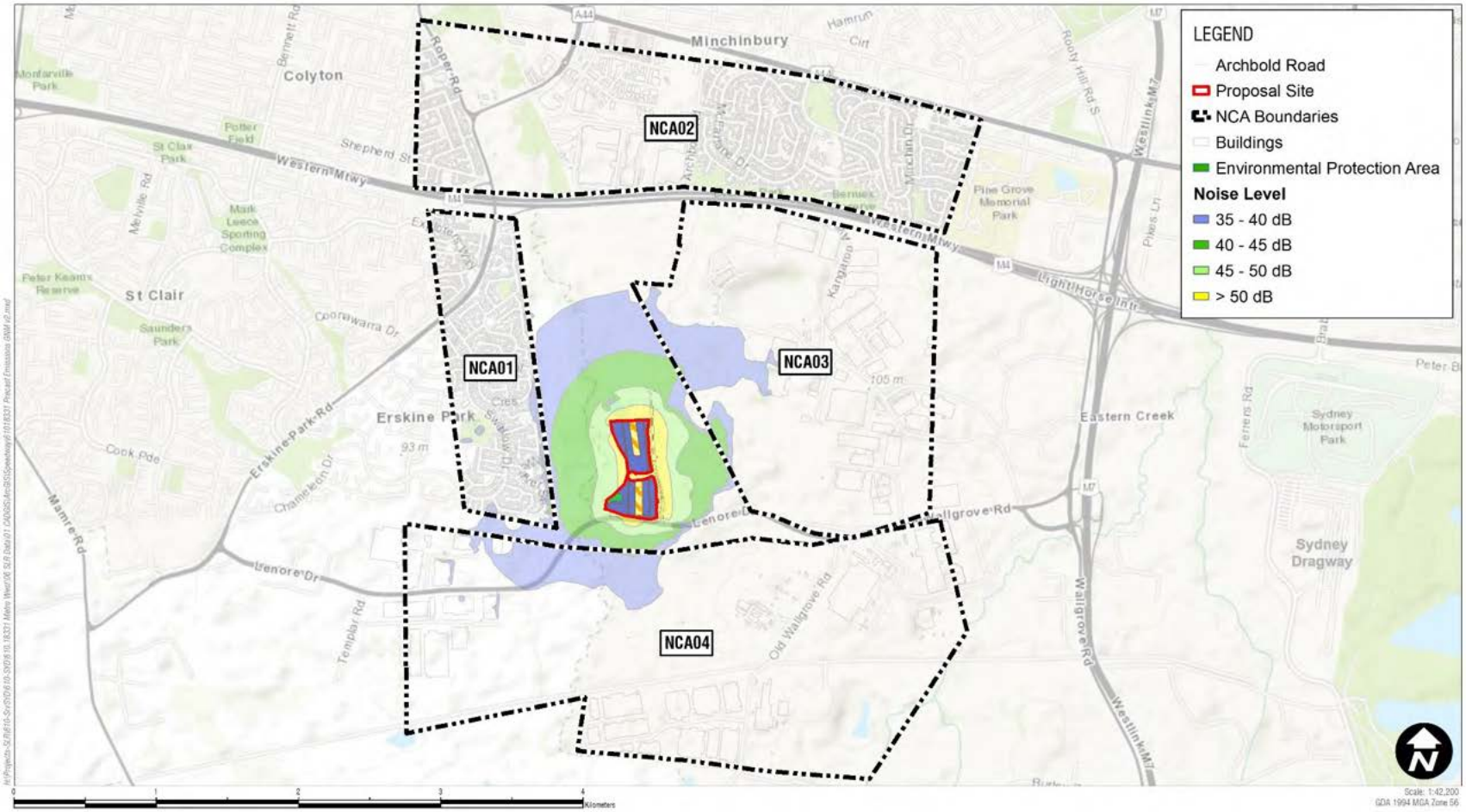
| Receiver Type | Receiver Location | Period | Noise Level $L_{Aeq(15\ minute)}$ (dBA) | | | Compliance? |
|---|---|---|---|---|---|---|
| | | | Project Trigger Level | Predicted | Exceedance | |
| **Standard Weather Conditions** | | | | | | |
| Residential | NCA01 | Daytime | 42 | 39 | - | Yes |
| | | Evening | 42 | 38 | - | Yes |
| | | Night-time | 42 | 38 | - | Yes |
| | NCA02 | Daytime | 46 | 30 | - | Yes |
| | | Evening | 46 | <30 | - | Yes |
| | | Night-time | 43 | 30 | - | Yes |
| Commercial | NCA01 | When in use | 68 | 37 | - | Yes |
| | NCA02 | When in use | 68 | 30 | - | Yes |
| | NCA03 | When in use | 68 | 37 | - | Yes |
| | NCA04 | When in use | 68 | 36 | - | Yes |
| **Noise-Enhancing Weather Conditions** | | | | | | |
| Residential | NCA01 | Daytime | N/A[1] | N/A[1] | N/A[1] | N/A[1] |
| | | Evening | 42 | 40 | - | Yes |
| | | Night-time | 42 | 42 | - | Yes |
| | NCA02 | Daytime | N/A[1] | N/A[1] | N/A[1] | N/A[1] |
| | | Evening | 46 | <30 | - | Yes |
| | | Night-time | 43 | 34 | - | Yes |
| Commercial | NCA01 | When in use | 68 | 41 | - | Yes |
| | NCA02 | When in use | 68 | 35 | - | Yes |
| | NCA03 | When in use | 68 | 41 | - | Yes |
| | NCA04 | When in use | 68 | 40 | - | Yes |

Note 1: Noise-enhancing weather conditions are not a feature of the area during the daytime.

The above assessment shows that compliance with the criteria is predicted at all receivers during facility operation under both standard and noise enhancing weather conditions.

To indicate the extent of the predicted noise levels, noise contours have been generated and are shown in **Figure 6**.

## Figure 6 Noise Contours – Predicted Operational Noise Levels (Daytime, Standard Weather)



## 6.2 Sleep Disturbance

Truck movements and precast segment loading activities are expected to result in the highest maximum noise levels from the proposal during operation. The predicted worst-case maximum noise levels at the nearest residential receivers are presented in **Table 20**.

**Table 20 Summary of Predicted Sleep Disturbance Noise Levels**

| NCA | Source | $L_{Amax}$ Noise Level (dBA) | | Compliance? |
|---|---|---|---|---|
| | | Criteria | Predicted | |
| NCA01 | Truck movements | 52 | 47 | Yes |
| NCA02 | | | 35 | Yes |

The above shows that maximum noise levels from the facility are expected to comply with the sleep disturbance screening criteria and therefore further consideration of maximum noise levels is not required.

## 6.3 Operational Road Traffic Noise

Traffic would access the site from Lenore Drive via a temporary haulage route and, once complete, the upgraded and extended Archbold Road, and generally travel east to access the M7 Motorway via existing busy arterial roads through commercial/industrial areas. As such, no impacts from traffic at sensitive receivers are expected.

# 7 Mitigation and Management Measures

## 7.1 Construction Management

The ICNG acknowledges that due to the nature of construction works it is inevitable that there would be impacts where construction is near sensitive receivers. Where exceedances of the management levels are predicted, the following mitigation and management measures would be applied, where feasible and reasonable.

### 7.1.1 Standard Mitigation Measures

The Sydney Metro CNVS contains a number of 'standard mitigation measures' for mitigating and managing construction impacts on Sydney Metro projects/proposals. The measures are shown in **Appendix E** and would be applied to the works where feasible and reasonable.

Although the Sydney Metro *Construction Noise and Vibration Standard* is typically applied to the construction phase of projects, it is proposed to also use this standard for the operational phase of the precast facilities considering their role in supporting construction of Sydney Metro West and their use by the tunnelling contractors.

### 7.1.2 Additional Noise Mitigation Measures

The proposed construction works are predicted to result in only a minor exceedance for the noisiest scenario at the nearest receivers to the west. The predicted levels of construction noise would be similar to the existing ambient levels of noise in the catchment and are not expected to result in any adverse impact. All other works are expected to result in noise levels that are below the NMLs.

As the works would generally be completed during Standard Construction Hours it is not considered necessary to consider any 'additional mitigation measures' (outlined in the Sydney Metro CNVS) for this proposal.

### 7.1.3 Proposal Specific Mitigation

The proposal-specific mitigation measures which would be implemented where feasible and reasonable to minimise noise and vibration impact from the proposal are listed in **Table 21**.

**Table 21 Proposal Specific Noise Mitigation Measures**

| Item | Mitigation Measure |
|---|---|
| Notification | Receivers that would potentially be affected by noise and/or vibration from the works would be appropriately notified before the relevant works start. |
| Monitoring | Noise monitoring at the most affected receiver(s) would be undertaken at the start of the works to check the levels are as predicted and to confirm that the standard mitigation measures are adequate. |

## 7.2 Operational Management

Operational noise levels from the facility are expected to comply with the noise goals during standard and noise-enhancing weather conditions meaning there is no requirement to consider operational mitigation measures.

# 8 Conclusion

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels.

The existing land use surrounding the proposal site is a mix of residential and commercial receivers, with the nearest residential receivers being situated about 375 metres to the west of the proposal.

## 8.1 Construction

The proposed construction activities would generally be completed during Standard Construction Hours. The potential construction noise and vibration impacts have been predicted to the nearest receivers.

The impacts are predicted to be compliant with the Noise Management Levels during all works, except for a minor exceedance during the worst-case noise scenario, which is expected to be during *Site Establishment – Earthworks*. All other construction works are predicted to comply with the management levels.

The main potential source of construction vibration would be from vibratory rollers. The separation distance between the nearest works location and the nearest potentially affected receivers is sufficient for vibration levels to be compliant with both the human comfort and cosmetic damage criteria.

The potential impacts would be mitigated and managed as per the strategies documented in this report.

## 8.2 Operation

The proposed operational activities would occur 24 hours per day, seven days a week for the majority of the lifespan of the project. The potential operational noise impacts have been predicted to the nearest receivers.

Operational noise levels from the facility are expected to comply with the noise goals at the surrounding receivers in all periods during both standard and noise-enhancing weather conditions.

# APPENDIX A

Acoustic Terminology

## 1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is $2 \times 10^{-5}$ Pa.

## 2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

| Sound Pressure Level (dBA) | Typical Source | Subjective Evaluation |
|---|---|---|
| 130 | Threshold of pain | Intolerable |
| 120 | Heavy rock concert | Extremely noisy |
| 110 | Grinding on steel | |
| 100 | Loud car horn at 3 m | Very noisy |
| 90 | Construction site with pneumatic hammering | |
| 80 | Kerbside of busy street | Loud |
| 70 | Loud radio or television | |
| 60 | Department store | Moderate to quiet |
| 50 | General Office | |
| 40 | Inside private office | Quiet to very quiet |
| 30 | Inside bedroom | |
| 20 | Recording studio | Almost silent |

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

## 3. Sound Power Level

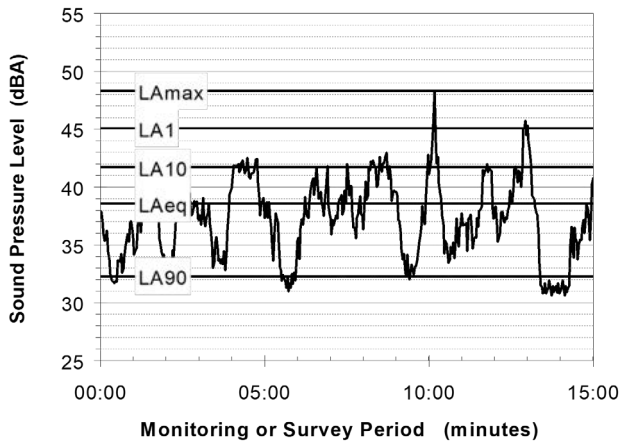
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit $10^{-12}$ W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

## 4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.




Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

## 5. Frequency Analysis

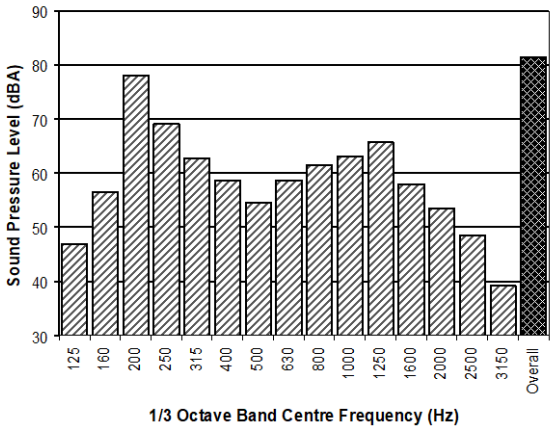
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.




## 6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

## 7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level ($10^{-9}$ m/s). Care is required in this regard, as other reference levels may be used.

## 8. Human Perception of Vibration

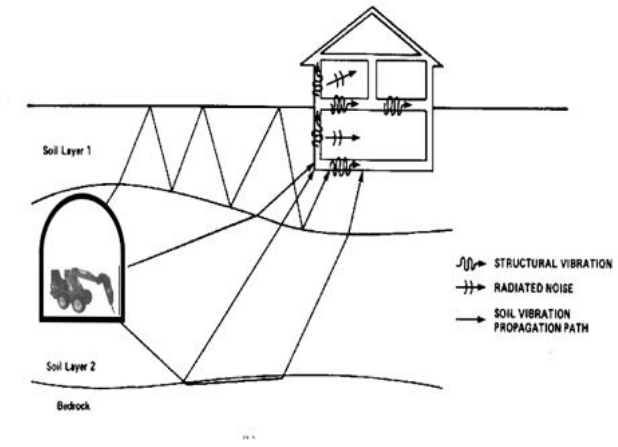
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

## 9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

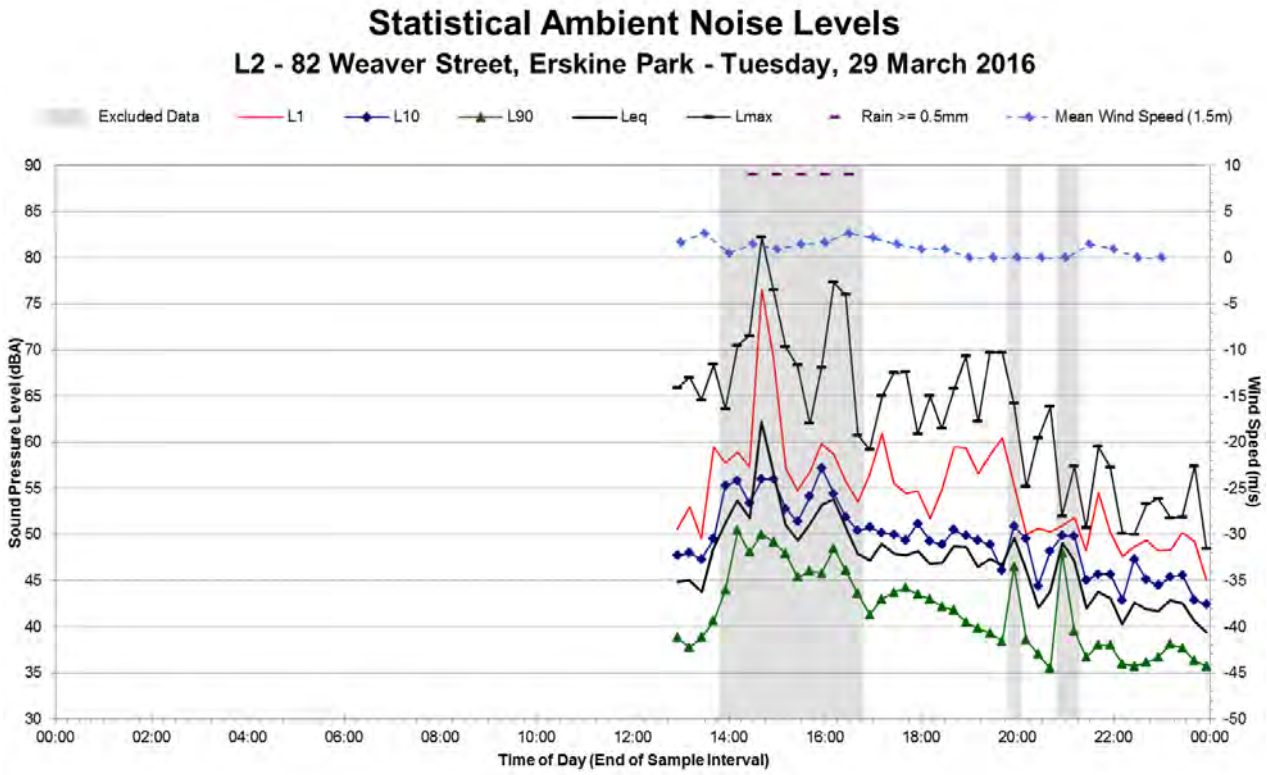
The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.

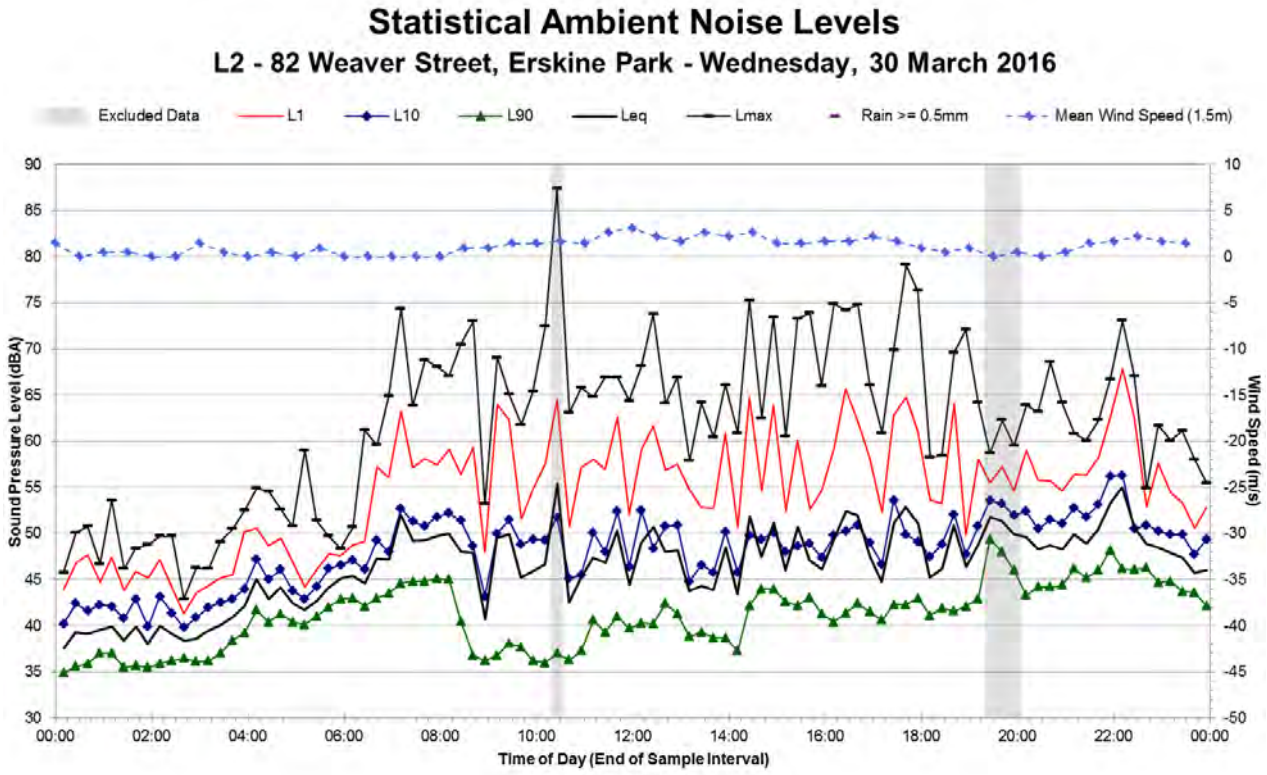


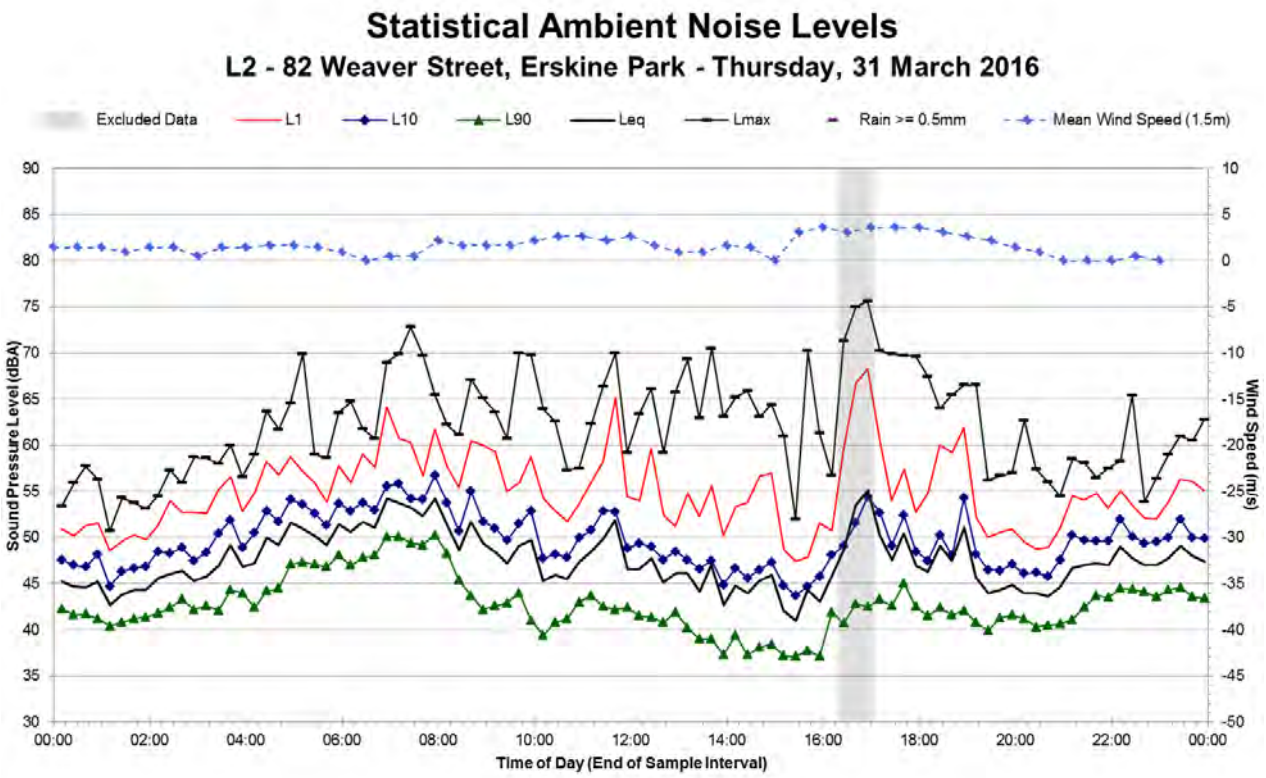

The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

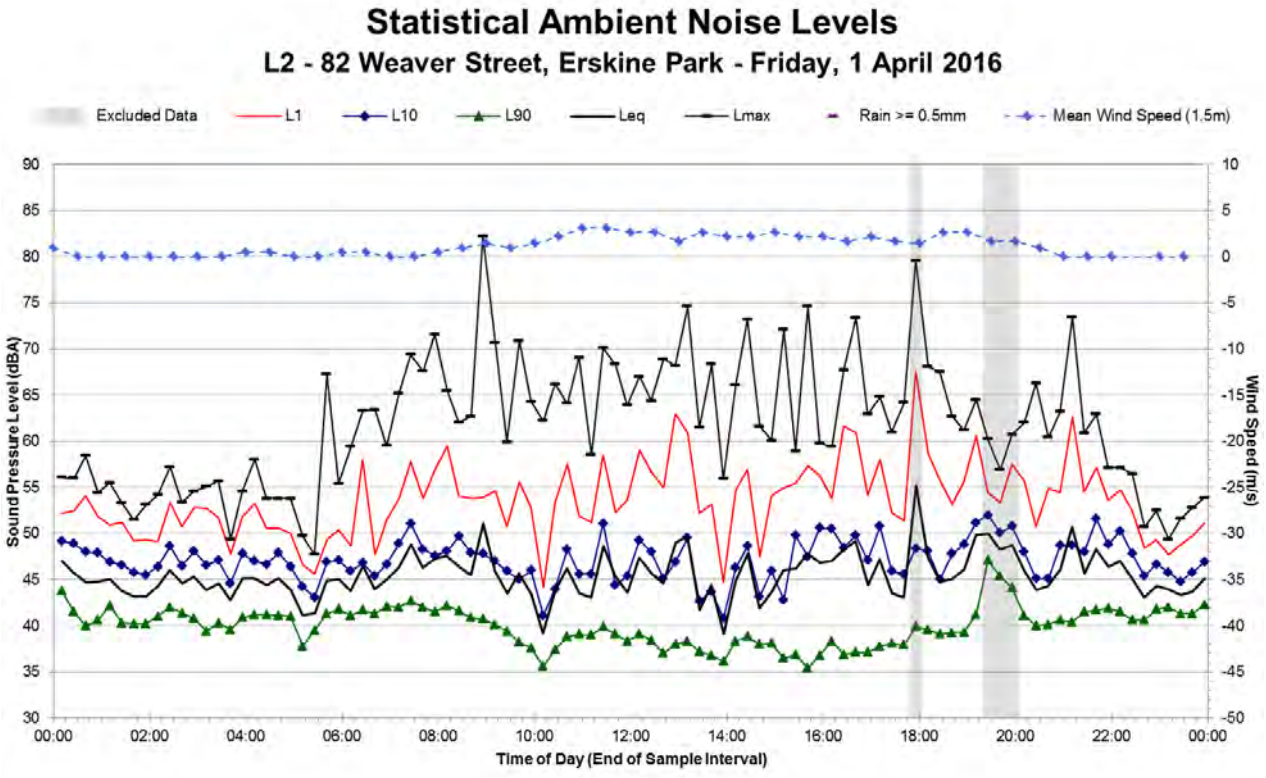
# APPENDIX B

Noise Monitoring Data


Statistical Ambient Noise Levels
L2 - 82 Weaver Street, Erskine Park - Tuesday, 29 March 2016
Excluded Data
L1
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

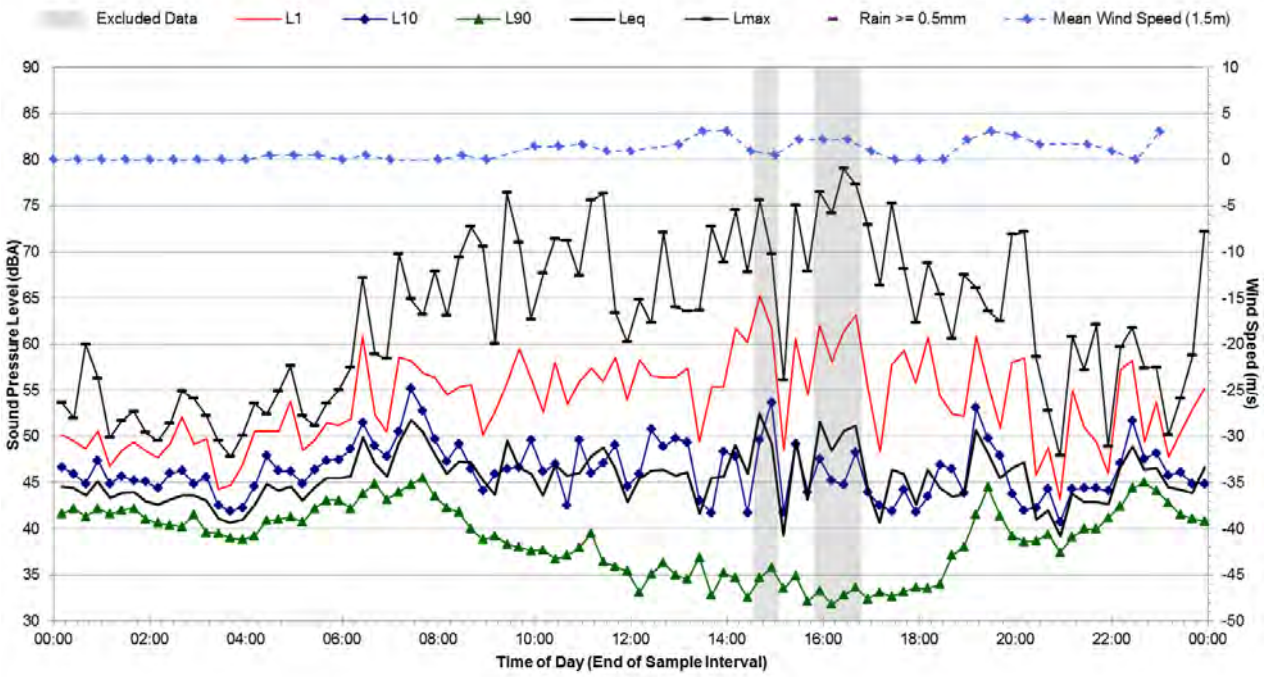

Statistical Ambient Noise Levels
L2 - 82 Weaver Street, Erskine Park - Wednesday, 30 March 2016
Excluded Data
L1
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L2 - 82 Weaver Street, Erskine Park - Thursday, 31 March 2016
Excluded Data
L1
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L2 - 82 Weaver Street, Erskine Park - Friday, 1 April 2016
Excluded Data
L1
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

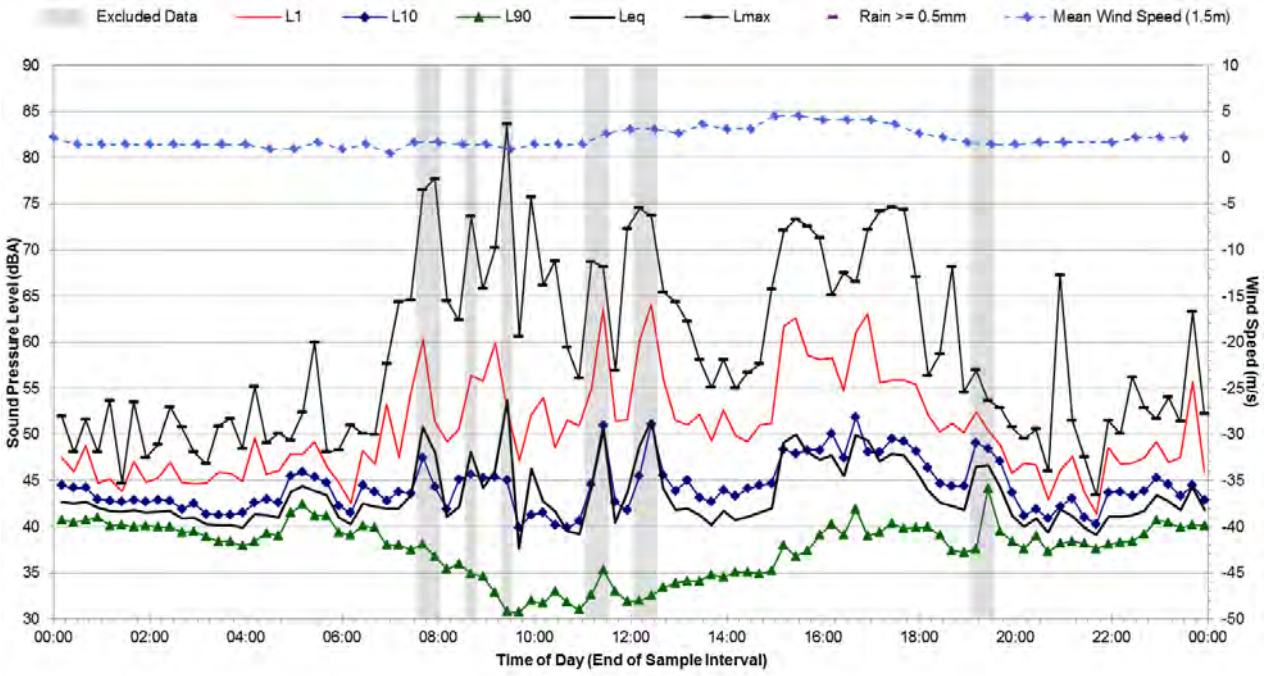
## Statistical Ambient Noise Levels

### L2 - 82 Weaver Street, Erskine Park - Saturday, 2 April 2016



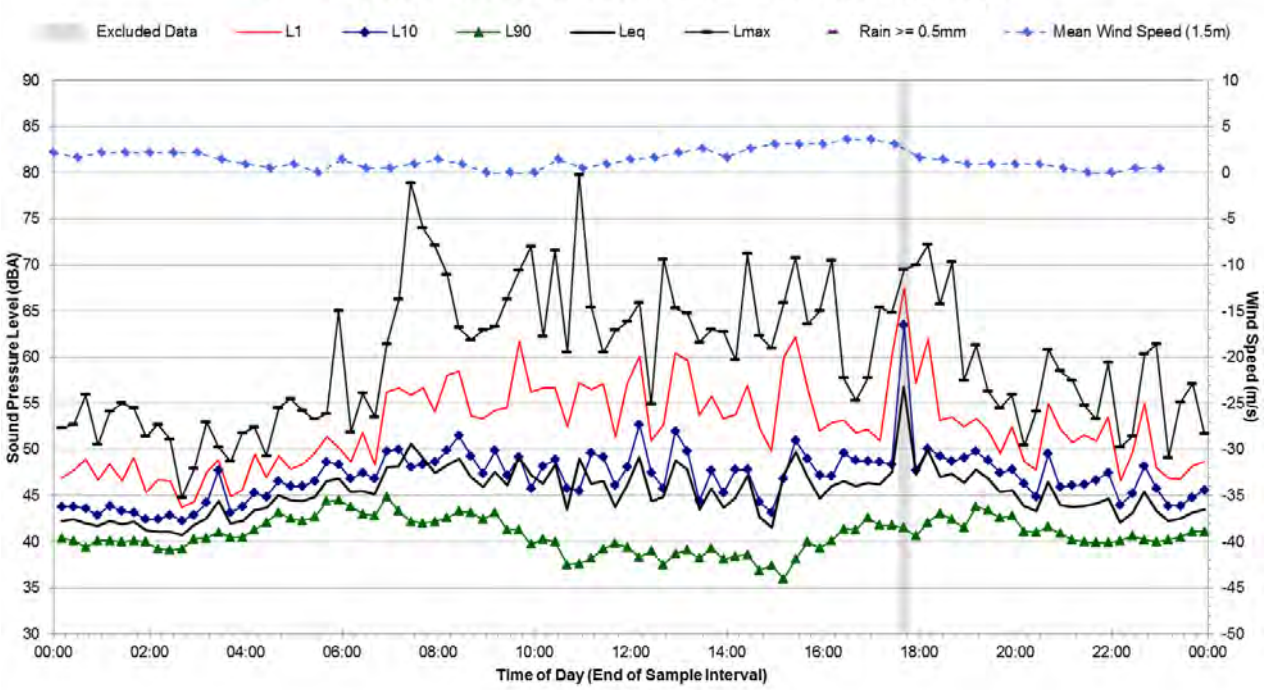

## Statistical Ambient Noise Levels

### L2 - 82 Weaver Street, Erskine Park - Sunday, 3 April 2016



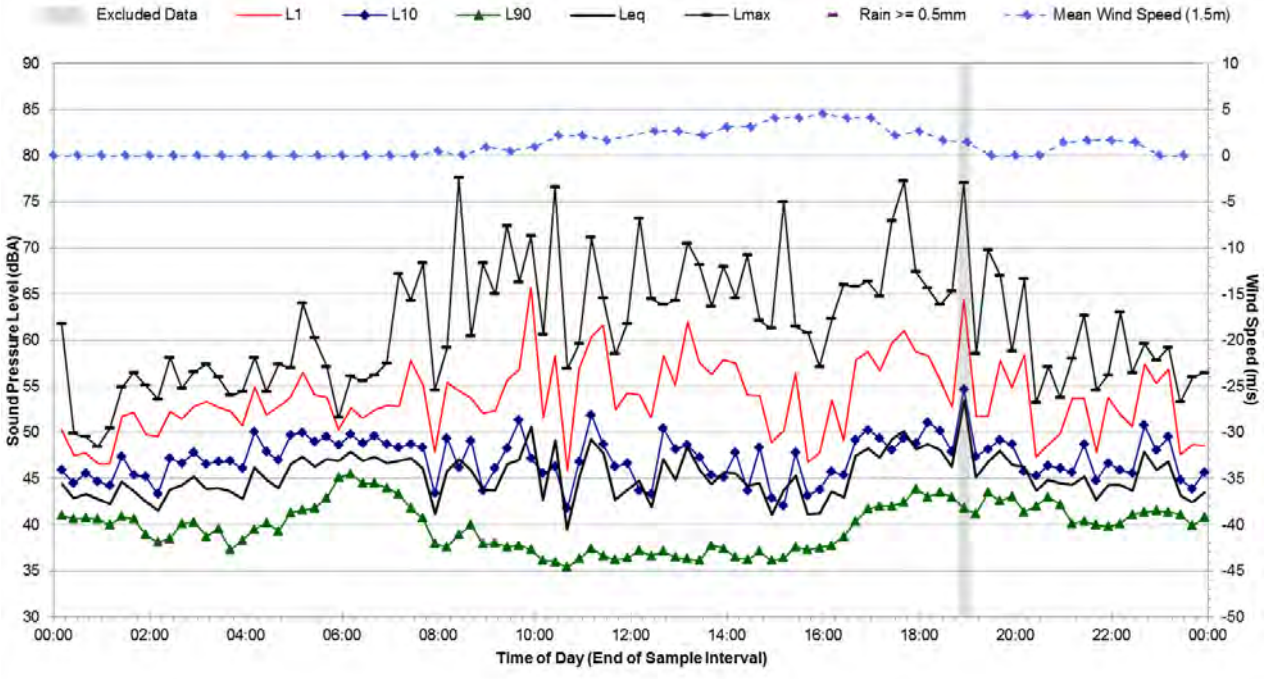
## Statistical Ambient Noise Levels

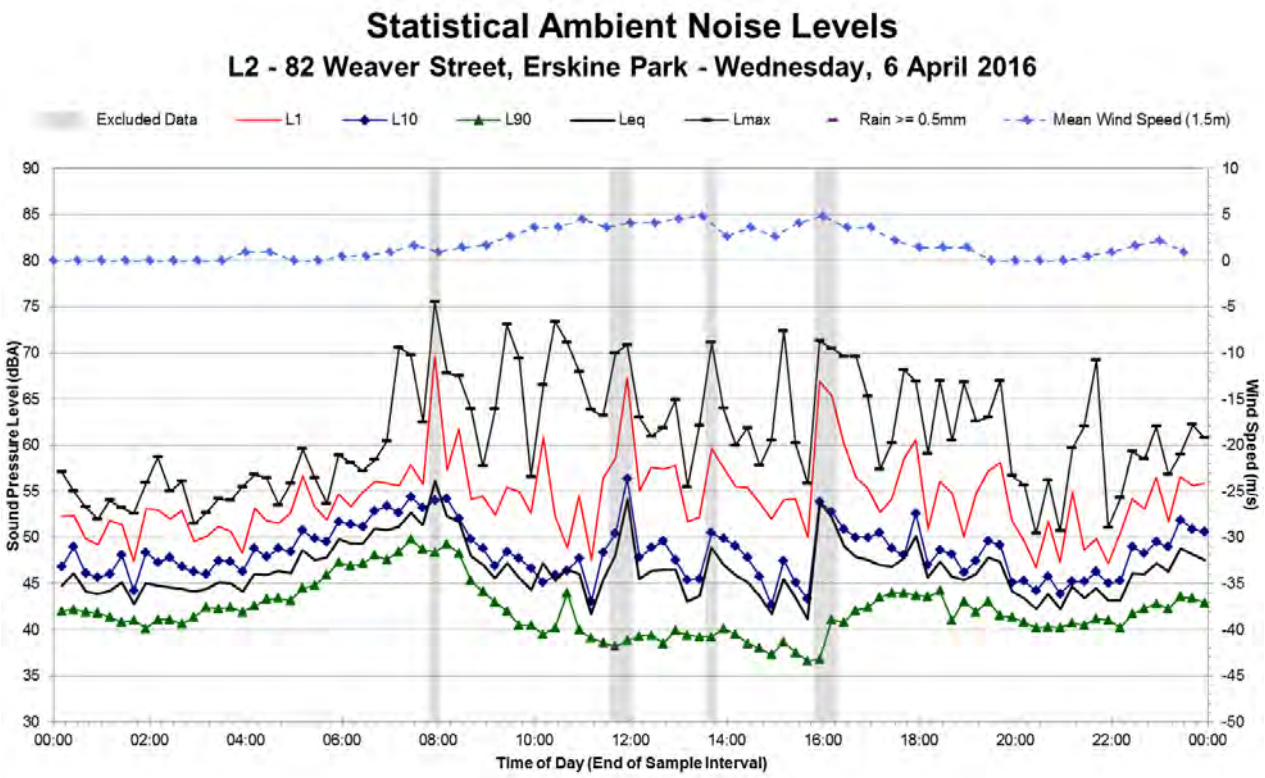
### L2 - 82 Weaver Street, Erskine Park - Monday, 4 April 2016

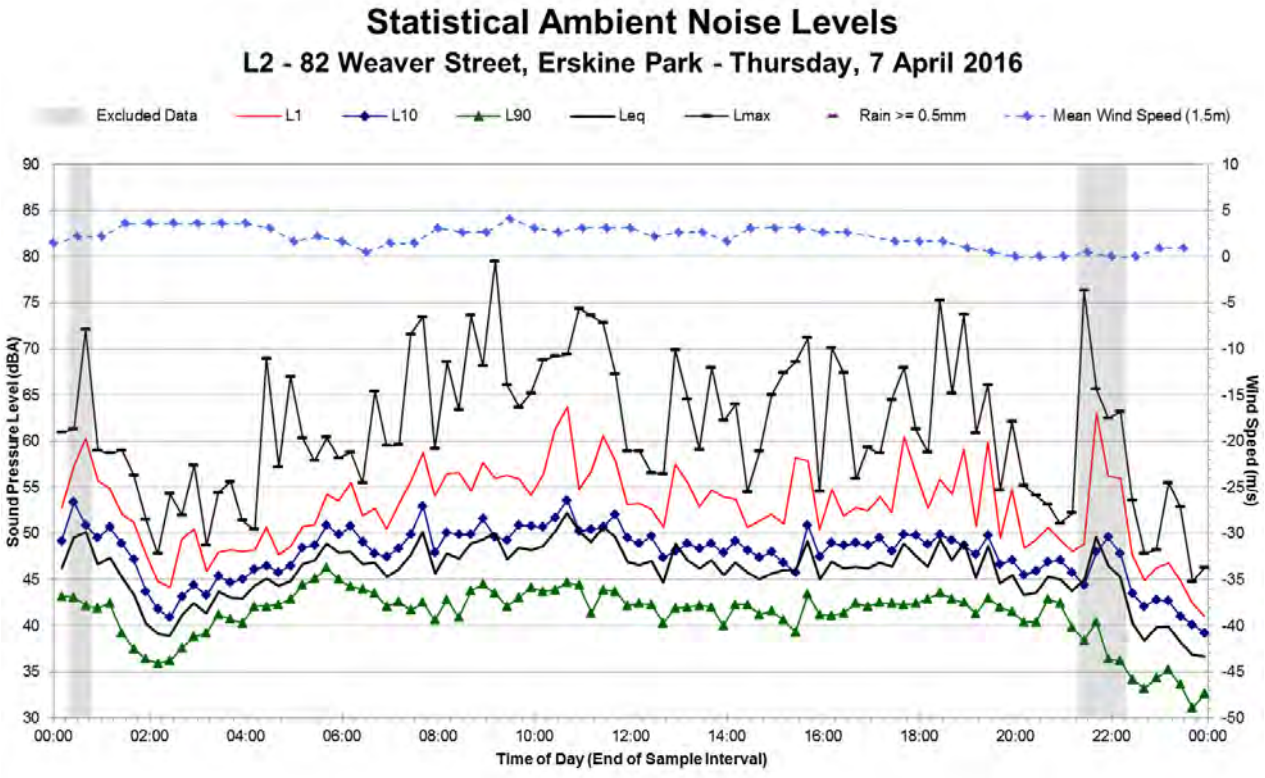


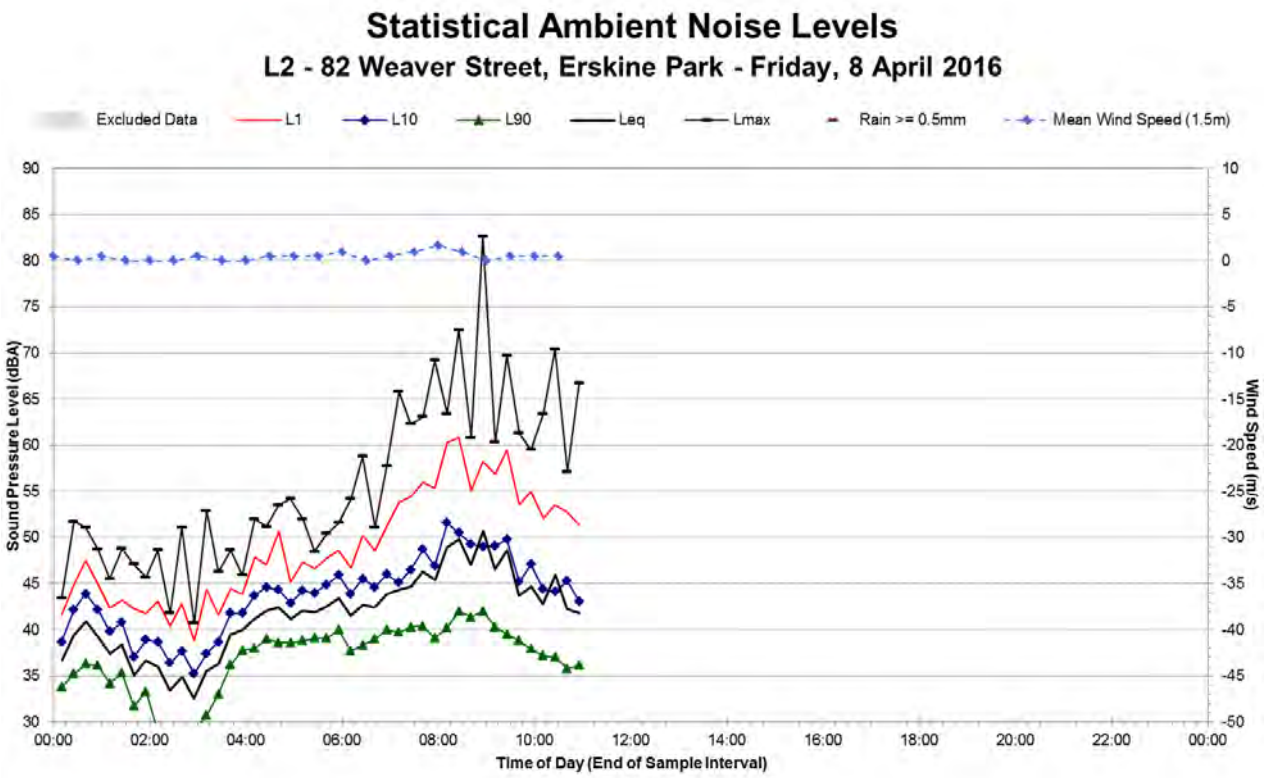

## Statistical Ambient Noise Levels

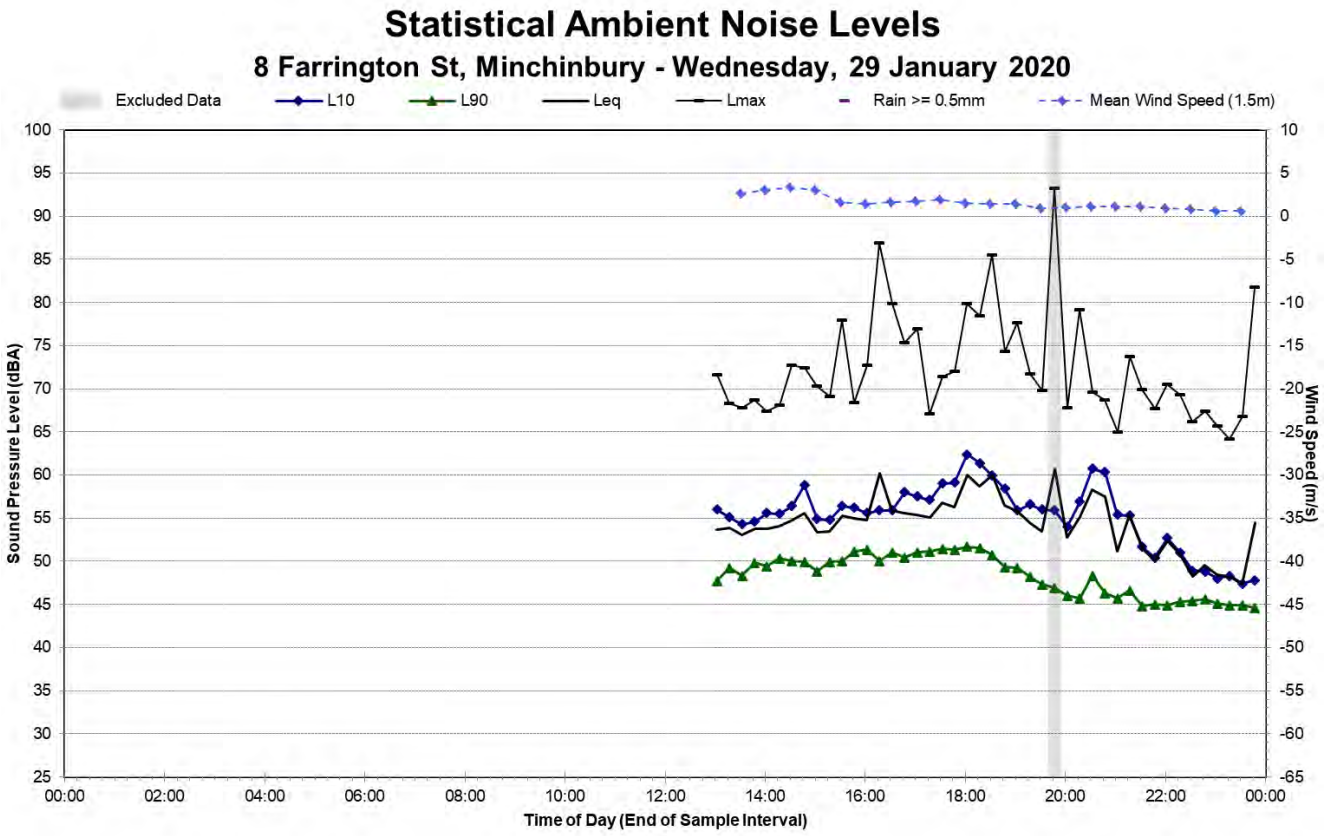
### L2 - 82 Weaver Street, Erskine Park - Tuesday, 5 April 2016

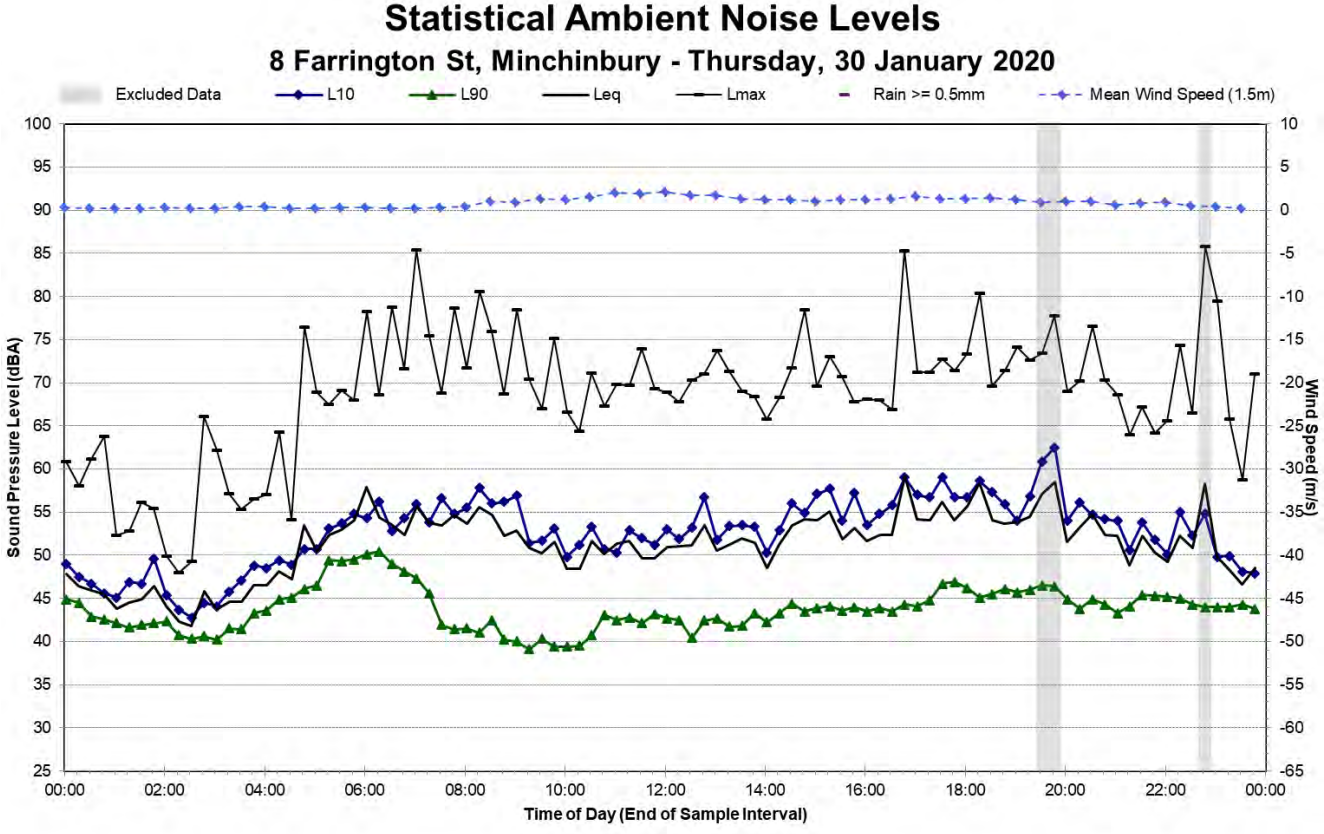


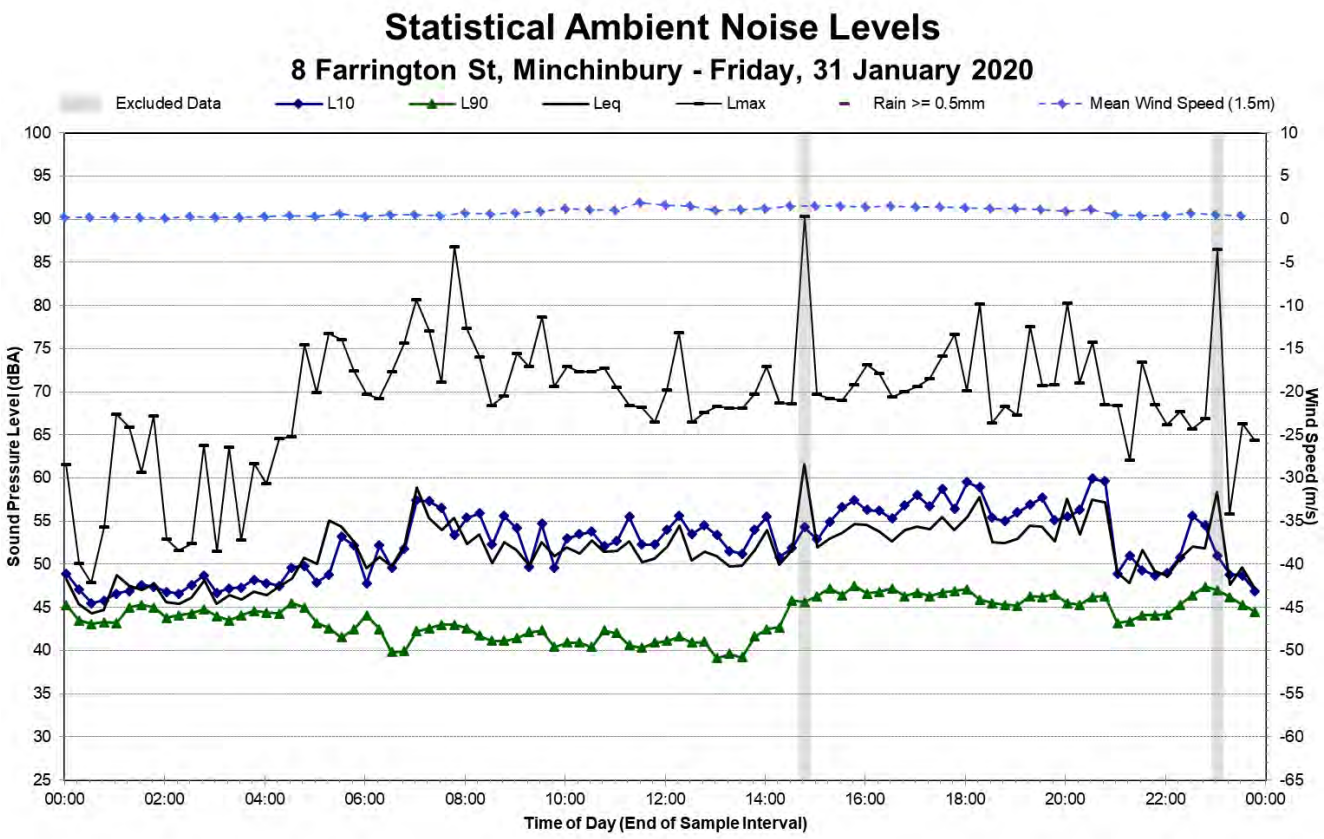

Statistical Ambient Noise Levels
L2 - 82 Weaver Street, Erskine Park - Wednesday, 6 April 2016
Excluded Data
L1
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

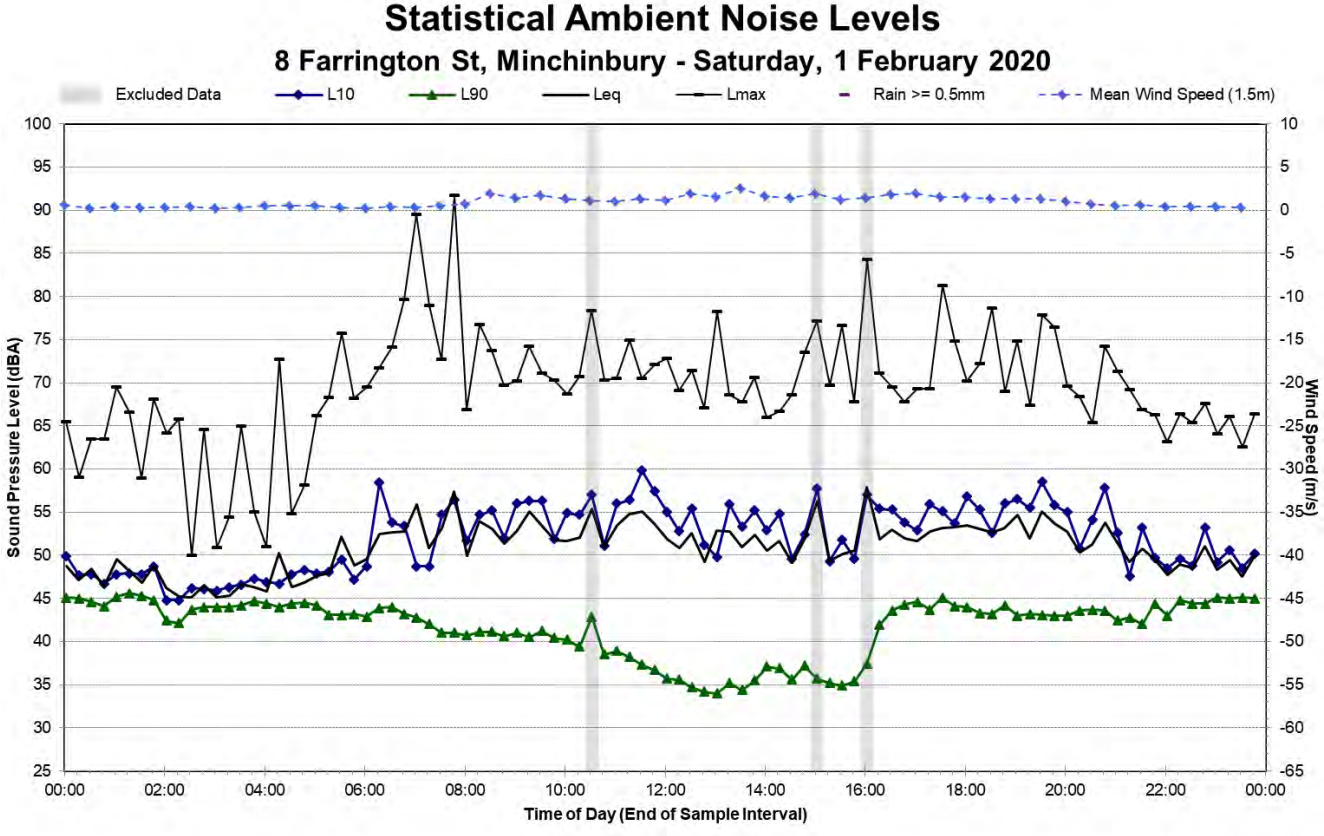

Statistical Ambient Noise Levels
L2 - 82 Weaver Street, Erskine Park - Thursday, 7 April 2016
Excluded Data
L1
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

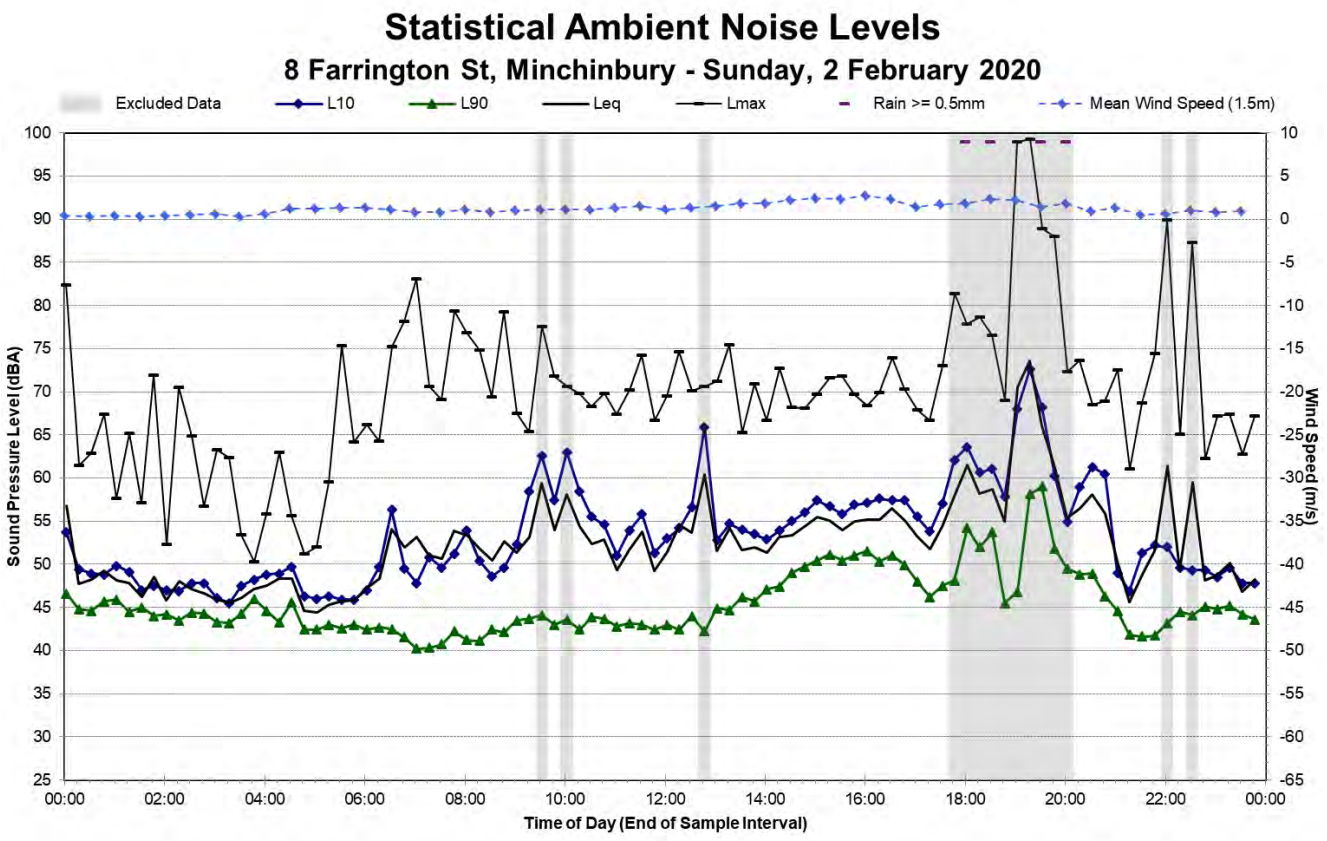

Statistical Ambient Noise Levels
L2 - 82 Weaver Street, Erskine Park - Friday, 8 April 2016
Excluded Data
L1
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
90
85
80
75
70
65
60
55
50
45
40
35
30
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

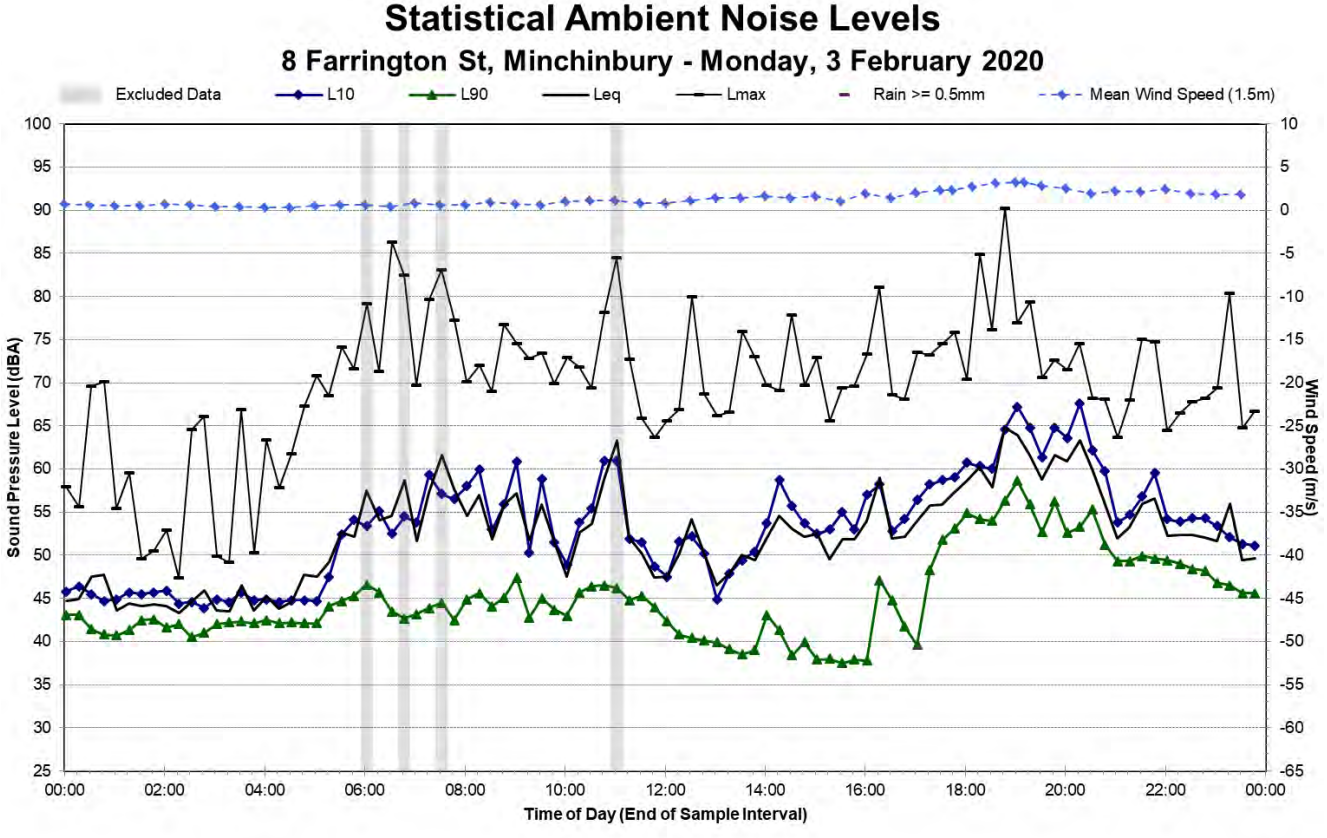

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Wednesday, 29 January 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

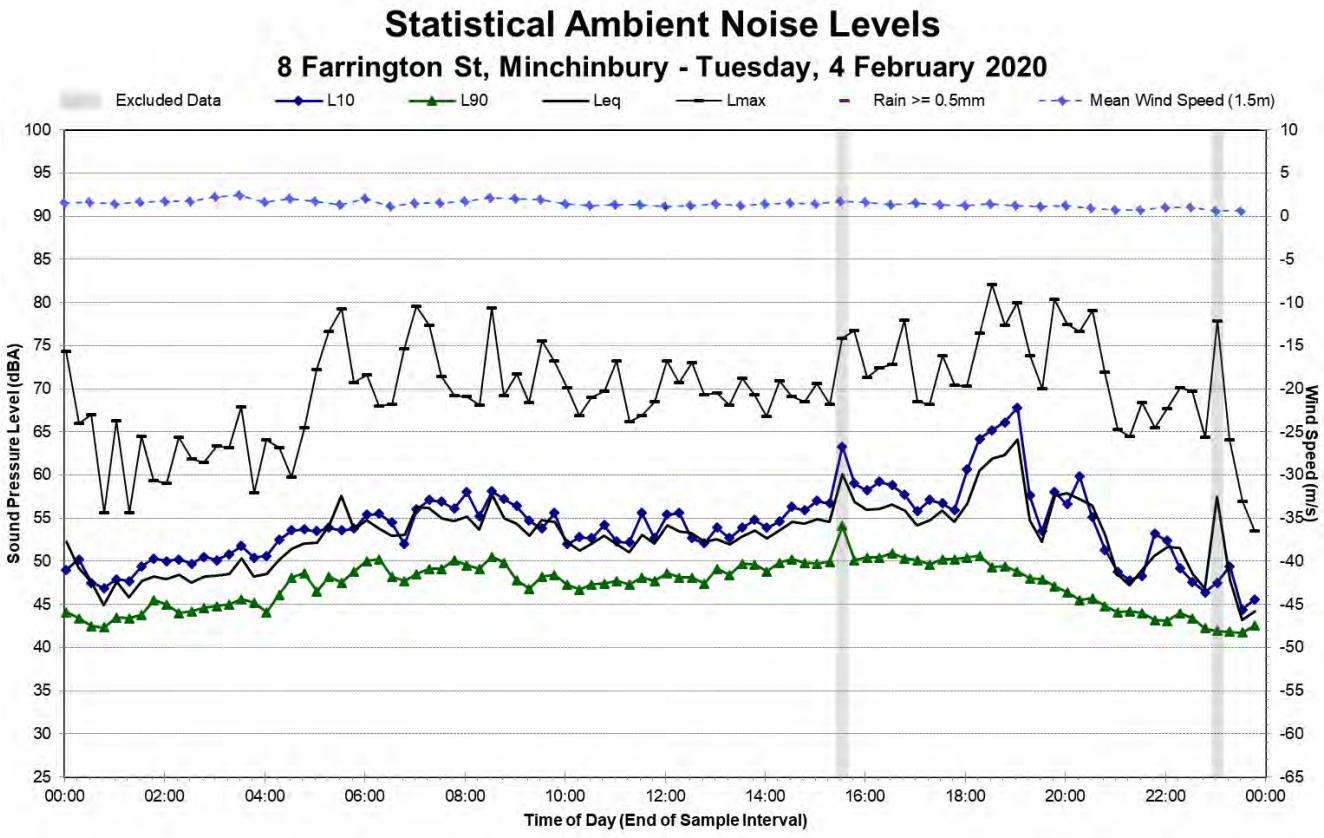

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Thursday, 30 January 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

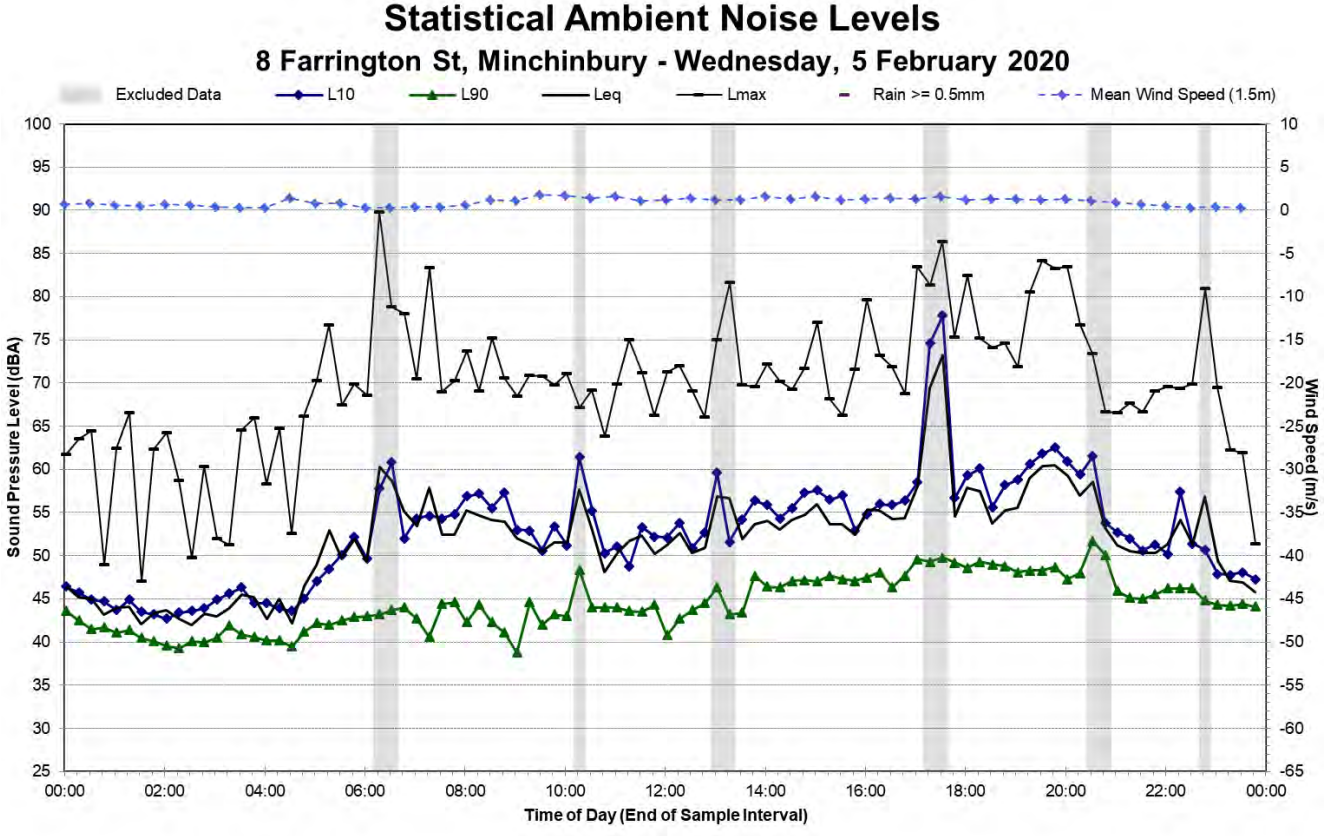

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Friday, 31 January 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

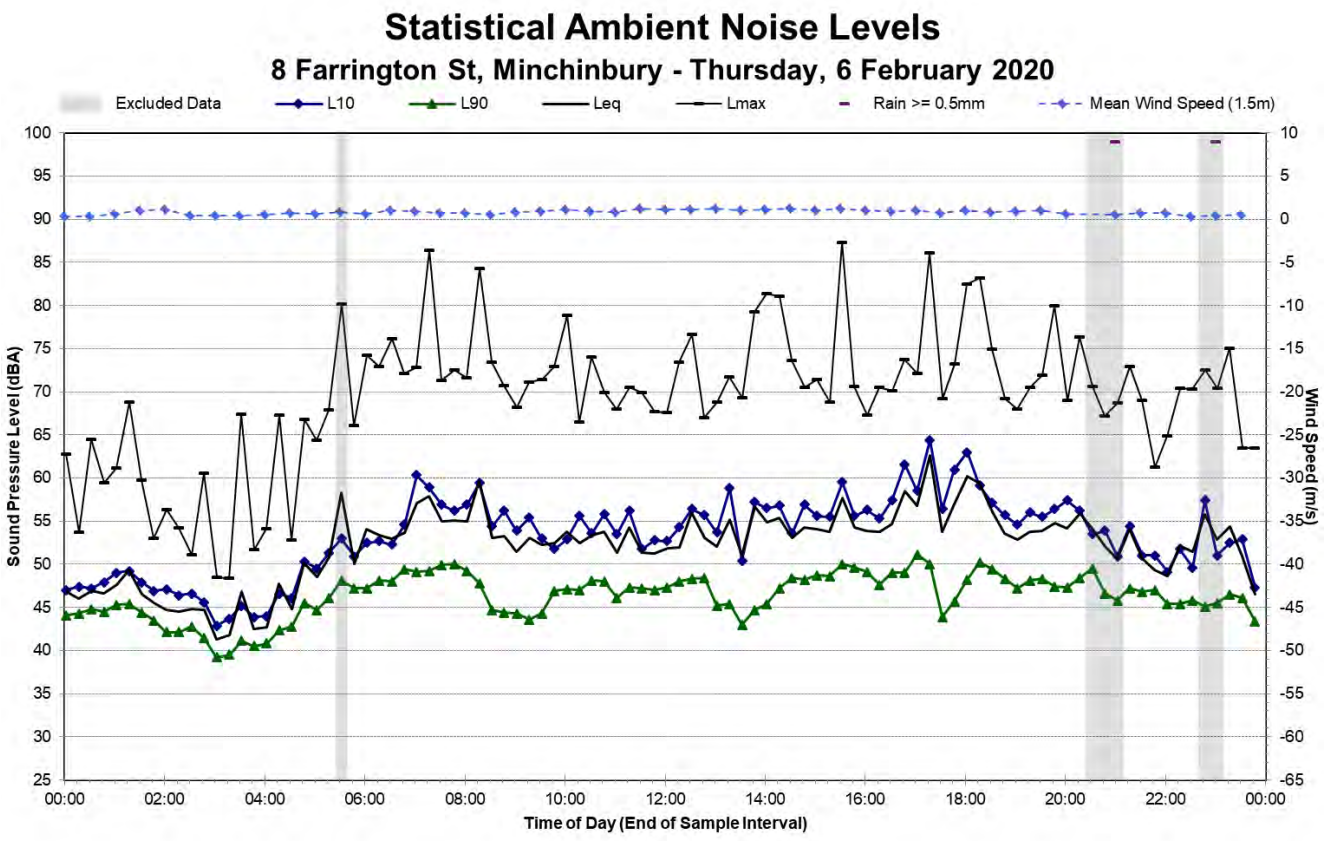

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Saturday, 1 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

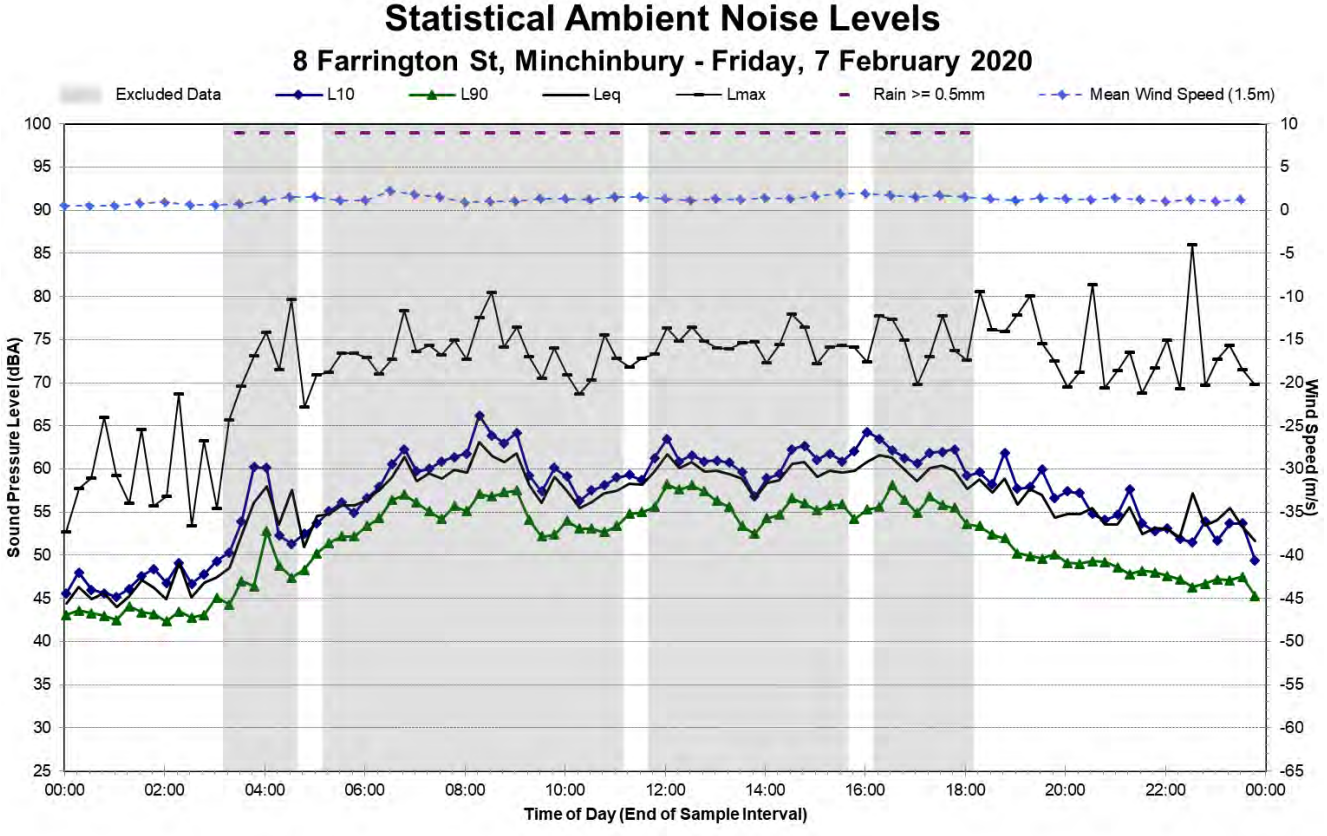

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Sunday, 2 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

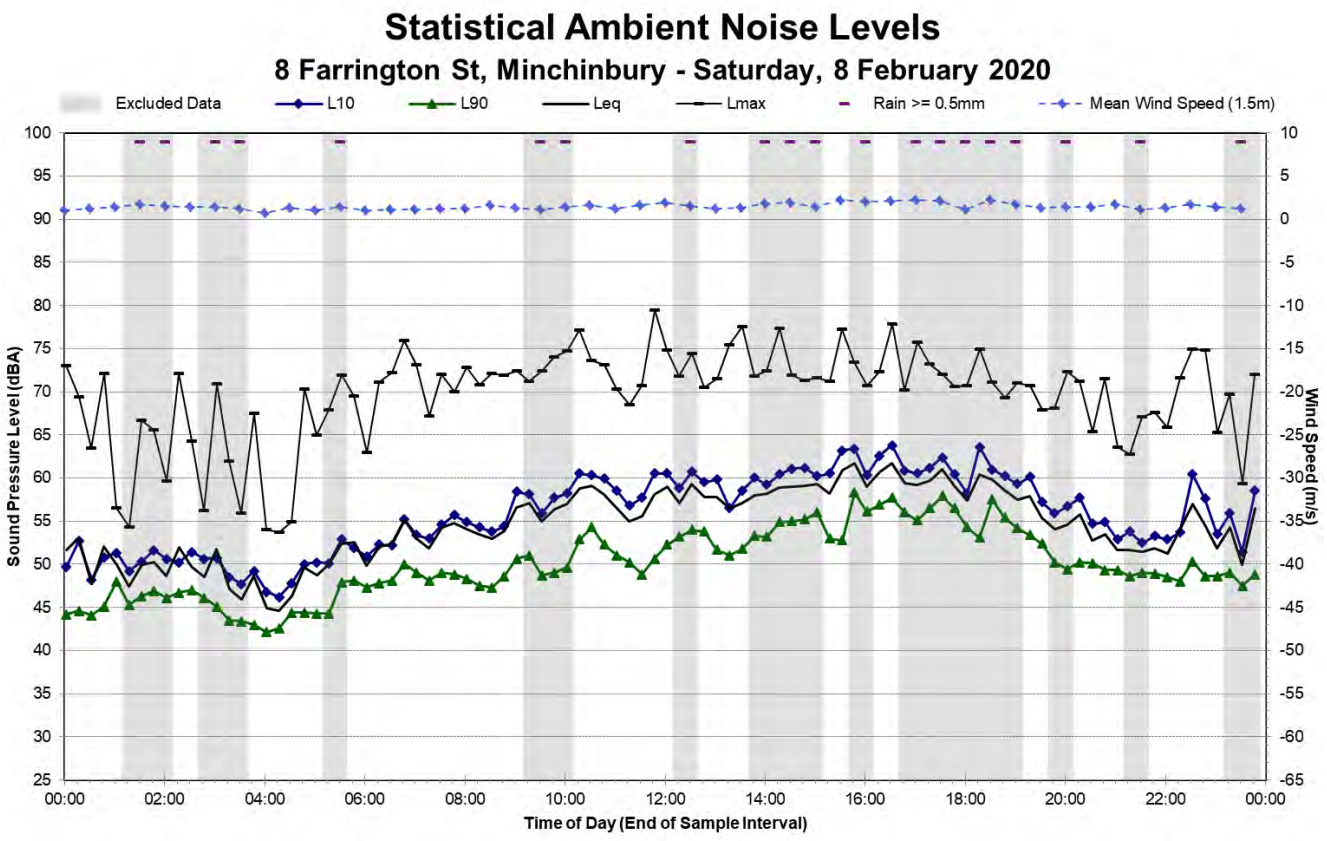

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Monday, 3 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

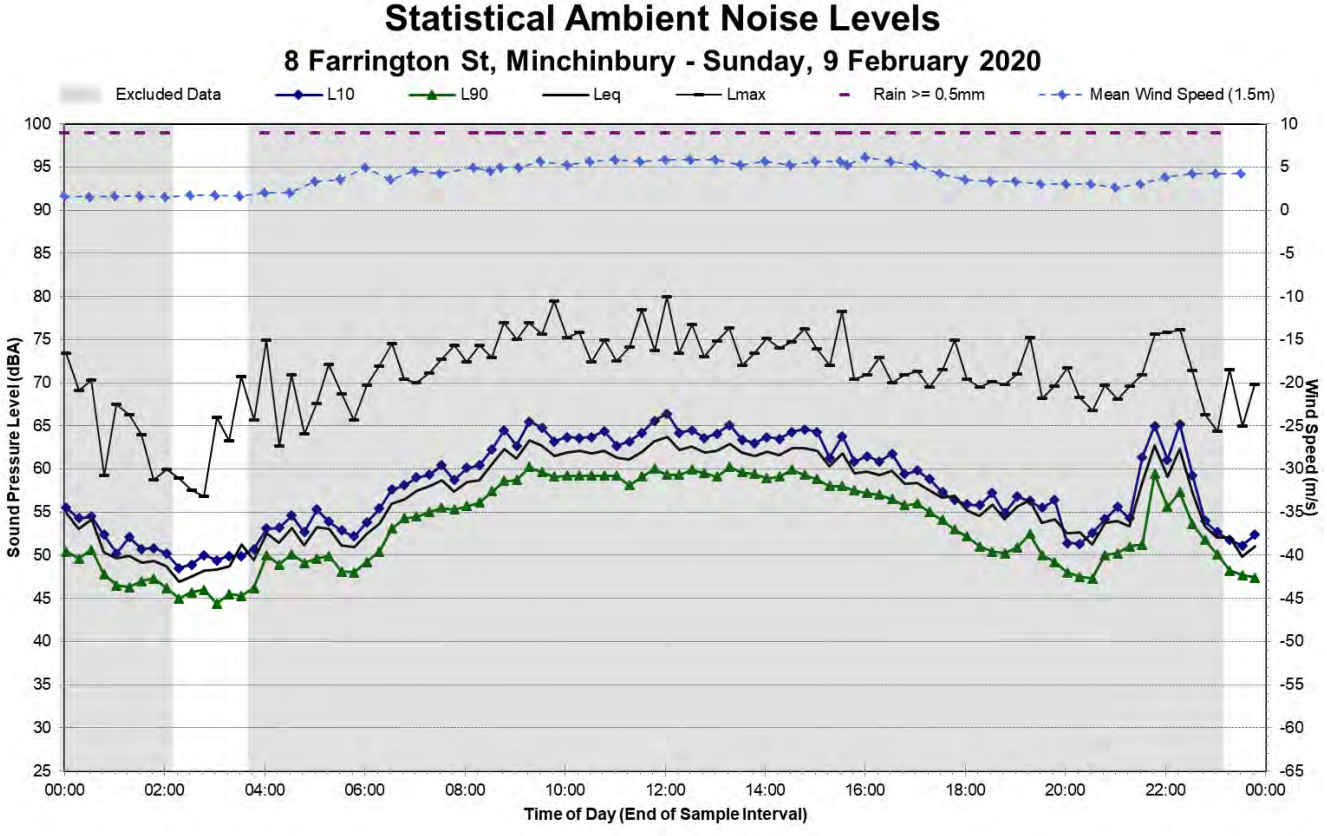

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Tuesday, 4 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

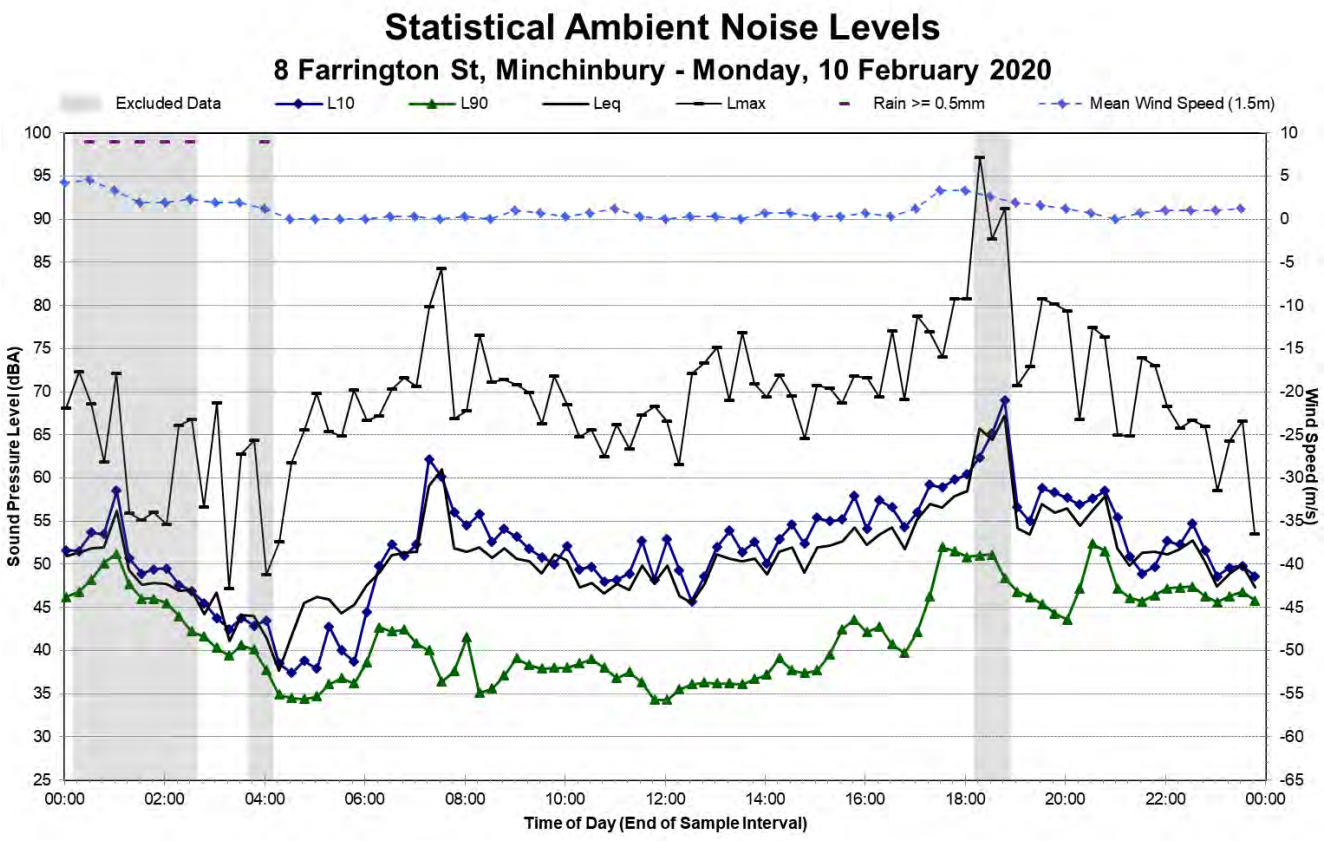

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Wednesday, 5 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

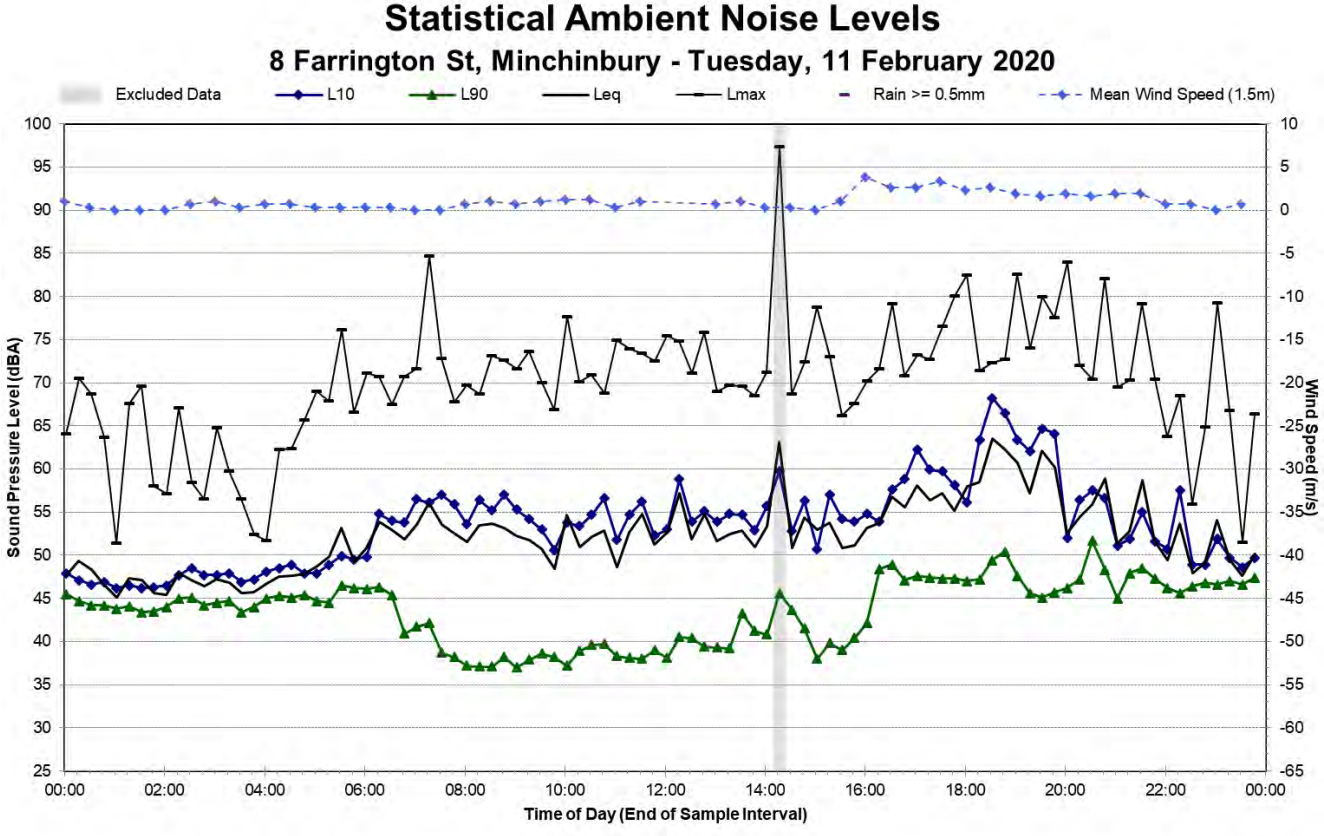

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Thursday, 6 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

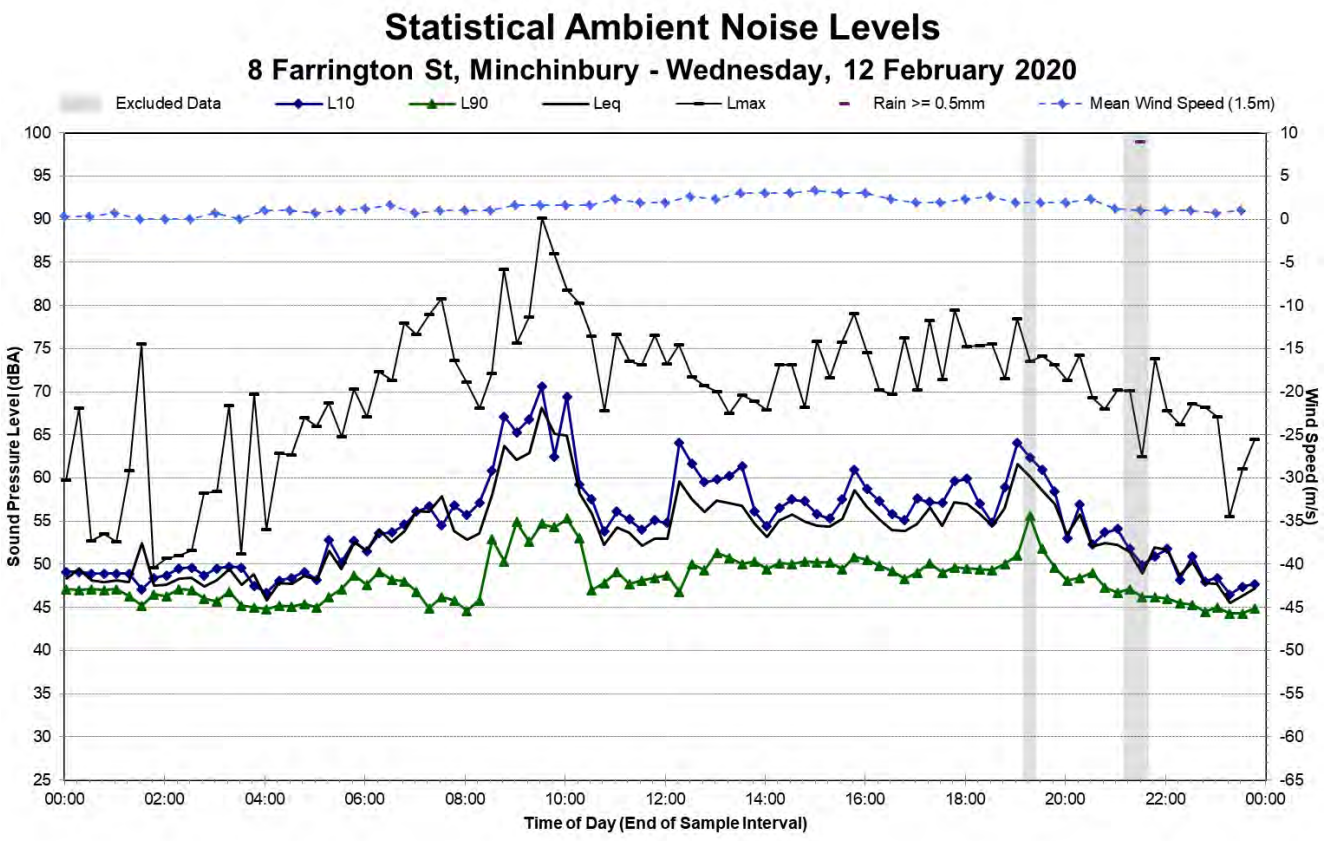

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Friday, 7 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

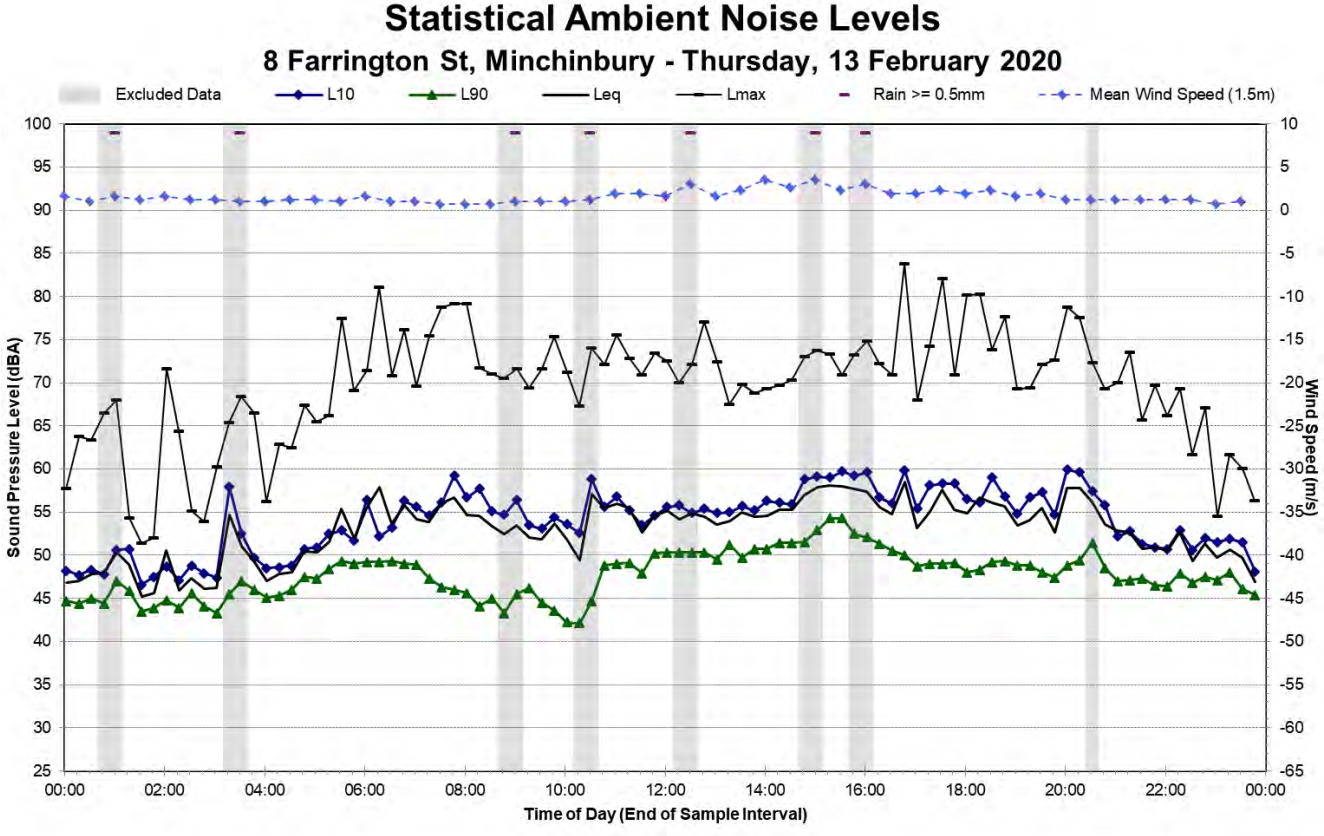

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Saturday, 8 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

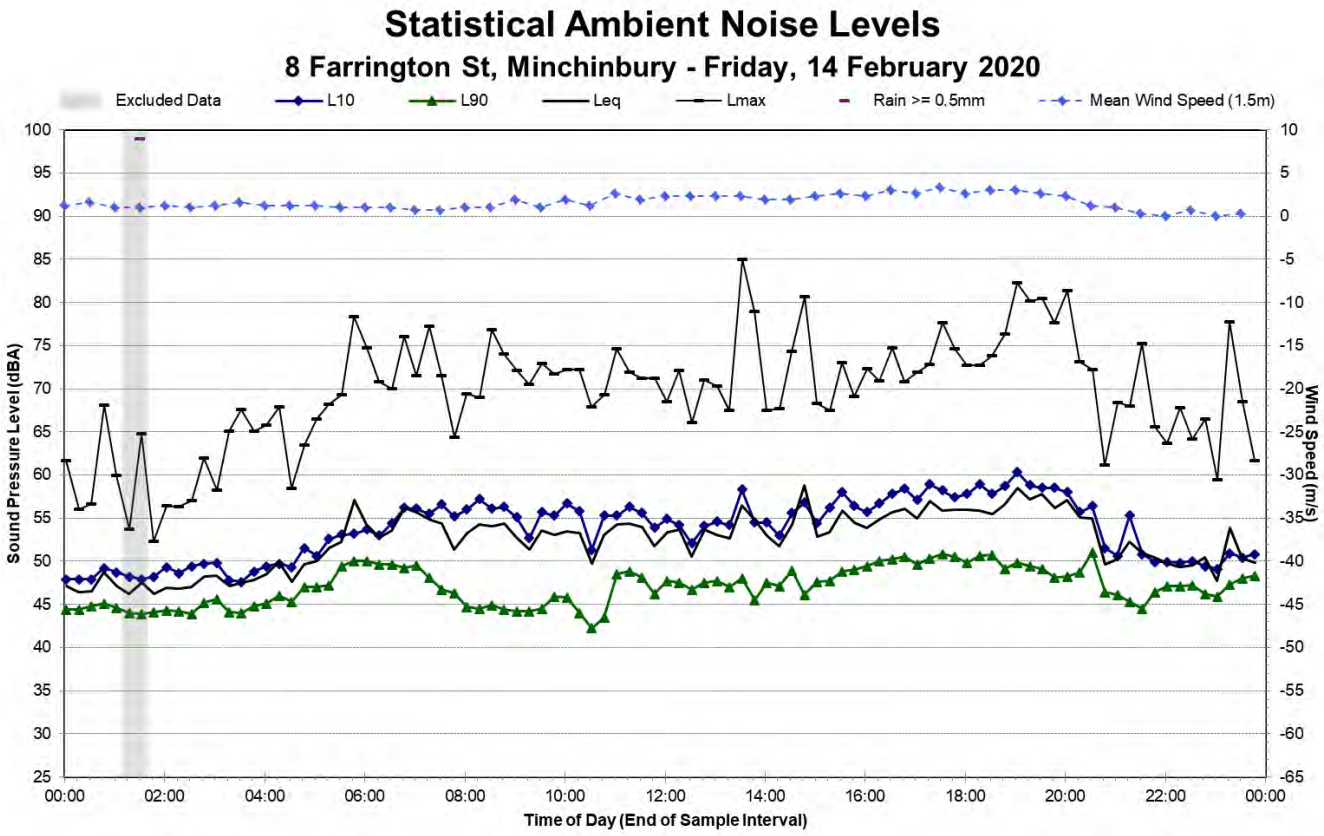

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Sunday, 9 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

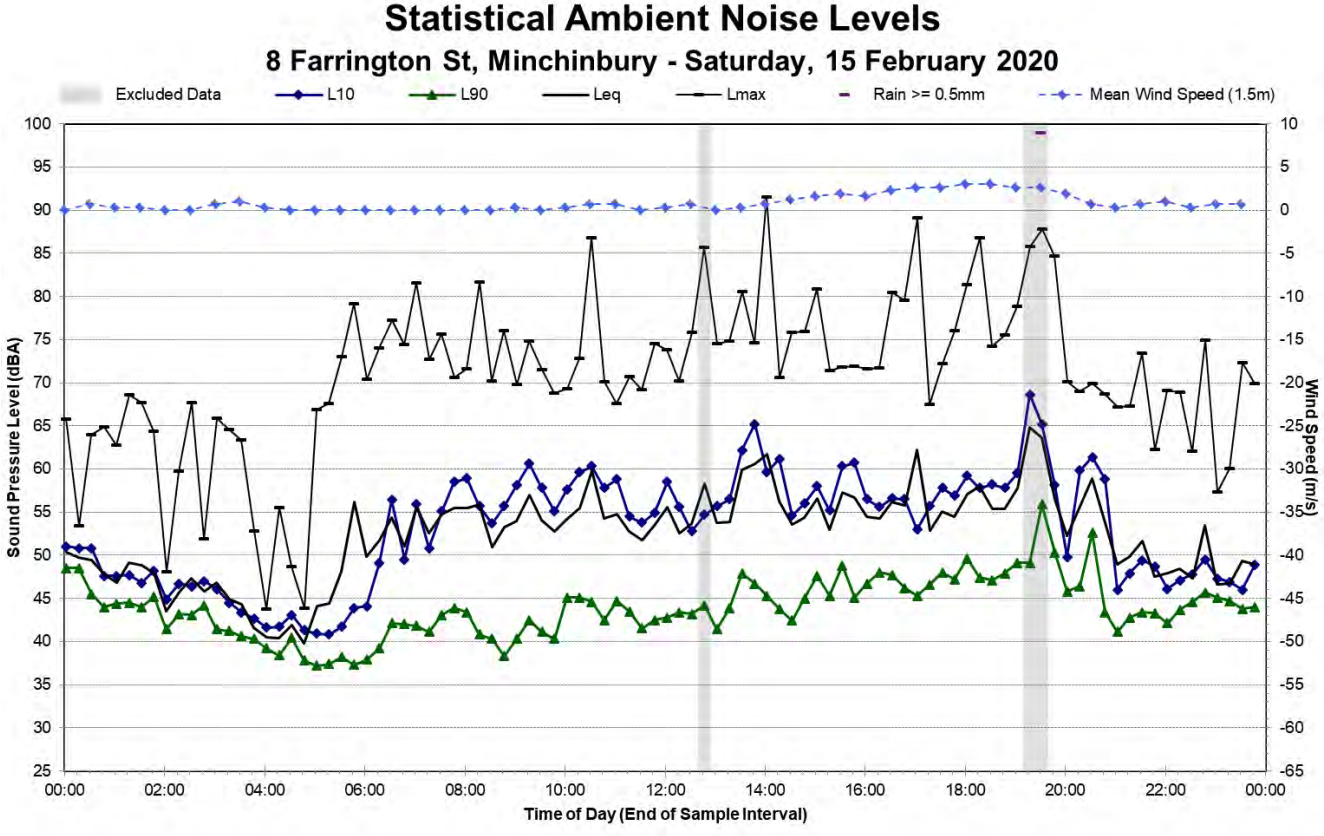

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Monday, 10 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

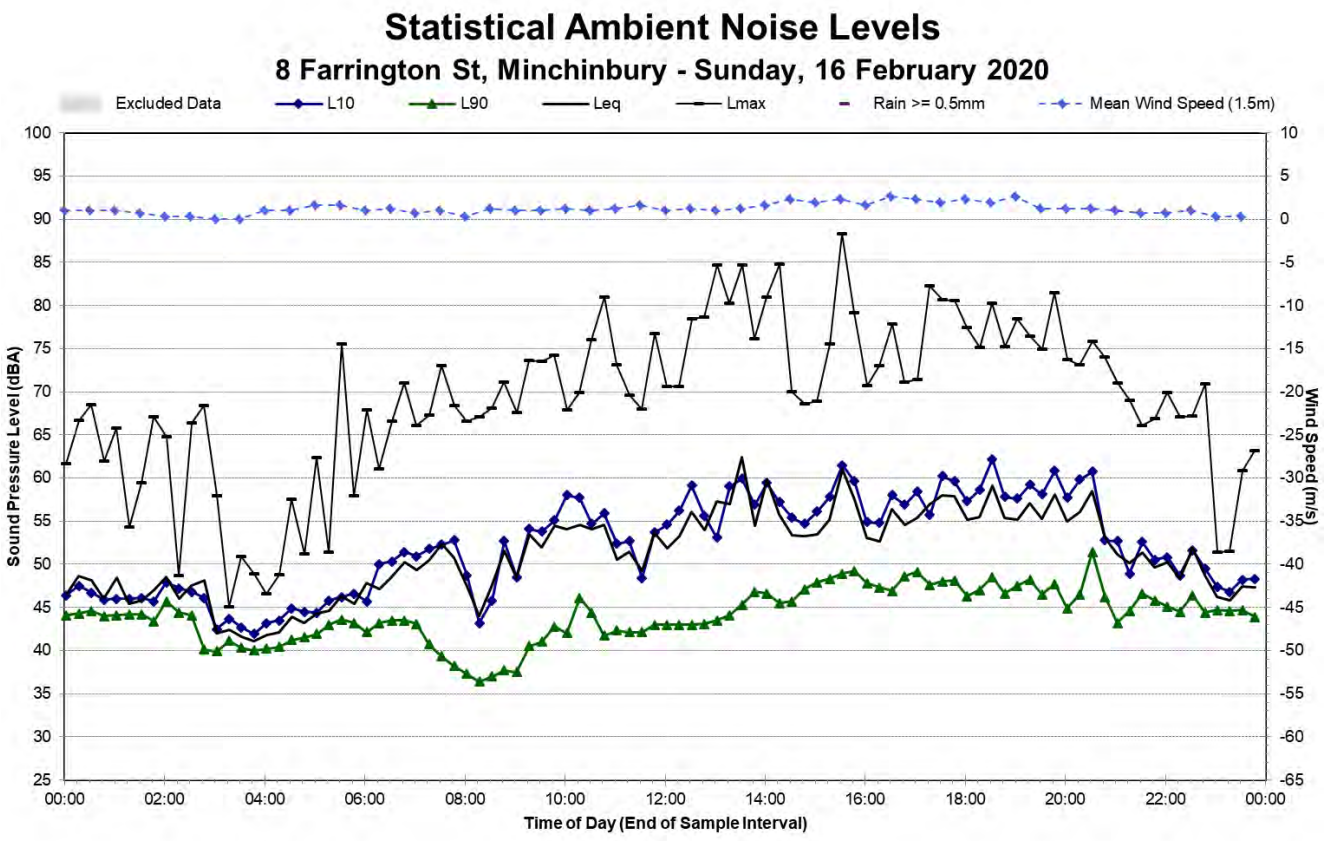

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Tuesday, 11 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

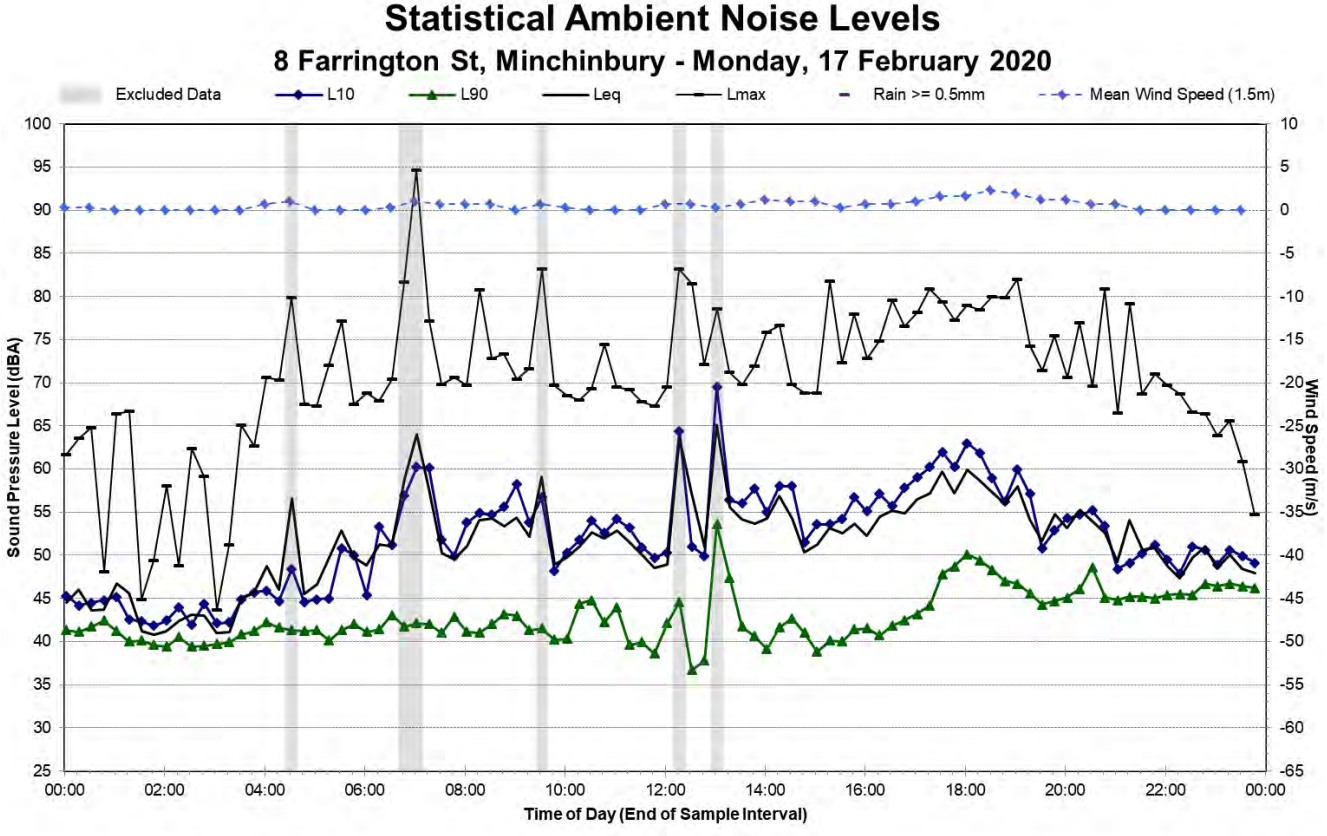

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Wednesday, 12 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

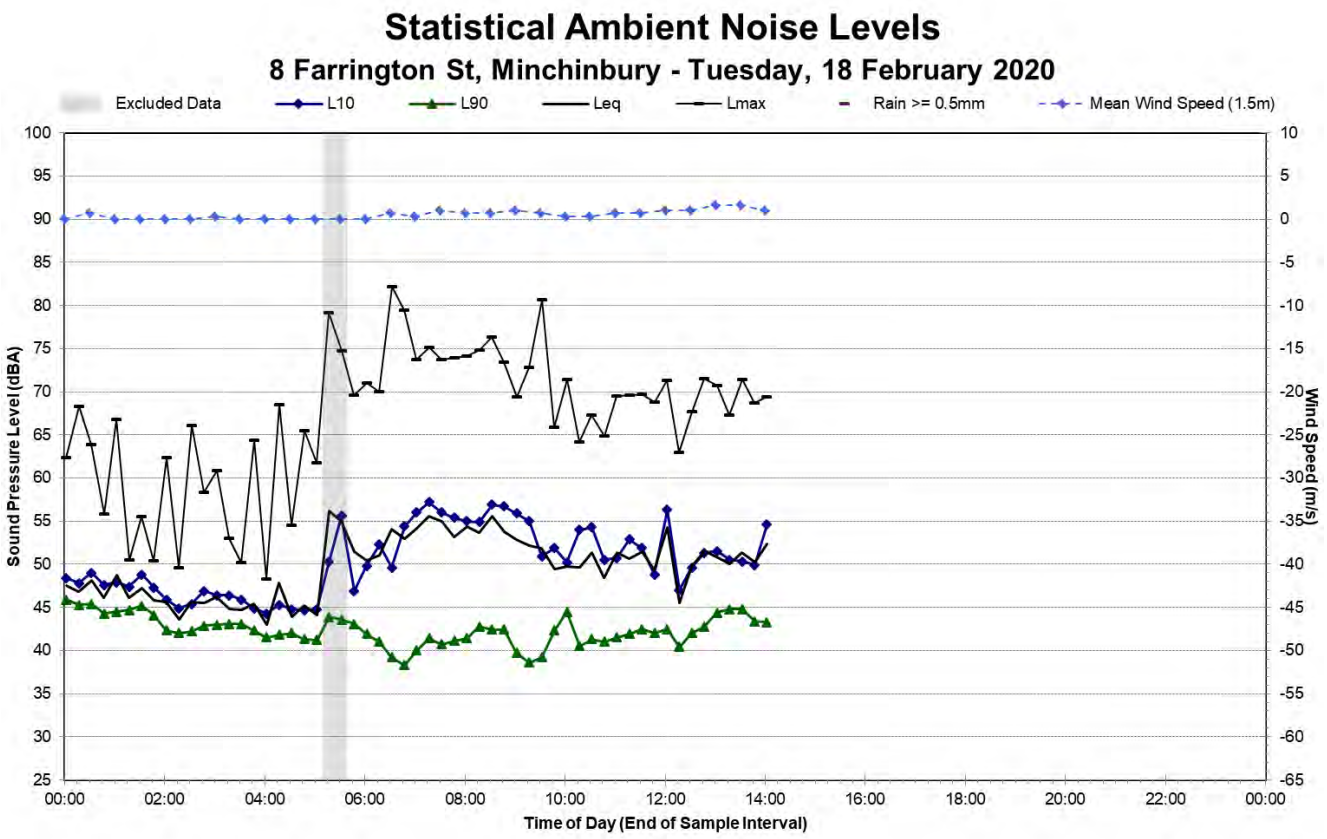

Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Thursday, 13 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Friday, 14 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Saturday, 15 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Sunday, 16 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Monday, 17 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Farrington St, Minchinbury - Tuesday, 18 February 2020
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
00:00
02:00
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# APPENDIX C

Weather Analysis Input Data

Noise-enhancing weather conditions such as wind and temperature inversions have the potential to increase noise levels from industrial or road noise sources at nearby receivers.

In order to determine the prevailing weather conditions, 12 months of weather data (January 2019 to December 2019) was obtained from the Bureau of Meteorology automatic weather station at Horsley Park. This data was analysed to determine the frequency of noise-enhancing wind and temperature inversion conditions which may affect noise levels at the site.

### Wind

Wind has the potential to increase noise at a receiver when wind is light and stable, and blows from the direction of the source of noise to the receiver. At higher wind speeds, the noise produced by the wind can obscure noise generated from industrial and transport sources.

Wind effects need to be considered where wind is a feature of the project area. The NPfI states that where wind blows from the source to the receiver at speeds up to three metres per second for more than 30 per cent of the daytime, evening or night-time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

The measured weather data was analysed to determine the frequency of occurrence of wind speeds up to three metres per second in each period. The results of the wind analysis for the daytime, evening and night-time periods are presented in **Table C-1**, **Table C-2** and **Table C-3** below. In each table, the wind direction and percentage occurrence are those dominant during each season.

**Table C-1 Seasonal Frequency of Occurrence of Wind Speed Intervals in 2019 – Daytime**

| Season | Dominant Wind Direction | Frequency of Occurrence (per cent) | | | |
|---|---|---|---|---|---|
| | | Calm | 0.5 to 2 metres per second | 2 to 3 metres per second | 0.5 to 3 metres per second |
| Annual | N | 9.6 | 13.5 | 6.5 | 20.1 |
| Summer | NNE | 9.0 | 12.2 | 8.8 | 21.0 |
| Autumn | N | 12.8 | 16.0 | 7.1 | 23.0 |
| Winter | WNW | 11.5 | 16.4 | 5.3 | 21.7 |
| Spring | N | 5.1 | 12.5 | 8.0 | 20.5 |

**Table C-2 Seasonal Frequency of Occurrence of Wind Speed Intervals in 2019 – Evening**

| Season | Dominant Wind Direction | Frequency of Occurrence (per cent) | | | |
|---|---|---|---|---|---|
| | | Calm | 0.5 to 2 metres per second | 2 to 3 metres per second | 0.5 to 3 metres per second |
| Annual | S | 16.6 | 11.0 | 8.5 | 19.5 |
| Summer | E | 6.3 | 12.6 | 14.7 | 27.3 |
| Autumn | S | 24.4 | 13.0 | 8.1 | 21.1 |
| Winter | SW, SSW, WSW | 20.4 | 16.9, 15.5, 17.1 | 16, 15.9, 13.8 | 32.9, 31.4, 30.9 |
| Spring | SE | 15.2 | 13.4 | 9.3 | 22.7 |

### Table C-3 Seasonal Frequency of Occurrence of Wind Speed Intervals in 2019 – Night-time

| Season | Dominant Wind Direction | Frequency of Occurrence (per cent) | | | |
|---|---|---|---|---|---|
| | | Calm | 0.5 to 2 metres per second | 2 to 3 metres per second | 0.5 to 3 metres per second |
| Annual | SW | 35.6 | 17.7 | 11.4 | 29.1 |
| Summer | S | 36.2 | 18.4 | 9.1 | 27.5 |
| Autumn | SW, WSW | 43.0 | 19.3, 19.5 | 12.8, 11.3 | 32.1, 30.8 |
| Winter | WSW, SW, W | 26.1 | 20.4, 18.0, 19.3 | 18.4, 18.8, 12.5 | 38.8, 36.8, 31.8 |
| Spring | SW | 37.3 | 19.0 | 8.5 | 27.5 |

The above analysis of prevailing wind conditions indicates that during the daytime periods, winds of up to 3 metres per second did not exceed the 30 per cent threshold during any season. However, the 30 per cent threshold was exceeded during the night-time period in Autumn in both the south-west and west-south-west directions, as well as during the evening and night-time period in winter, in the south-west, west and west-south-west directions.

Based on the prevailing wind analysis conducted for the 2019 weather data, wind was found to be a feature of the area during the evening and night-time periods.

### Temperature Inversions

Temperature inversions have the ability to increase noise levels by focusing sound waves towards sensitive receivers. Temperature inversions occur predominantly at night-time when the atmosphere is stable and temperatures are cooler. For a temperature inversion to be a significant characteristic of the area, the NPfI defines that it needs to occur for approximately 30 per cent of the total night-time during winter. This equates to approximately two nights per week.

The Pasquill-Gifford assignment scheme identifies seven Stability Classes – A to G – to categorise the degree of atmospheric stability, as shown below.

### Table C-4 Description of Atmospheric Stability Classes

| Atmospheric Stability Class | Category Description |
|---|---|
| A | Extremely unstable |
| B | Moderately unstable |
| C | Slightly unstable |
| D | Neutral |
| E | Slightly stable |
| F | Moderately stable |
| G | Extremely stable |

The measured weather data has been analysed to determine the frequency of each stability class and is presented below. Noise-enhancing temperature inversions are categorised as atmospheric stability Class F or Class G.

### Table C-5 Night-time Stability Class Distribution – 2019

| Stability Class | Frequency of Occurrence (per cent) | | | | |
|---|---|---|---|---|---|
| | Annual | Summer | Autumn | Winter | Spring |
| A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| B | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| C | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| D | 45.1 | 49.3 | 40.2 | 49.4 | 41.8 |
| E | 12.1 | 13.5 | 11.5 | 10.3 | 13.2 |
| F | 12.2 | 10.9 | 10.3 | 14.3 | 13.2 |
| G | 30.6 | 26.3 | 38.0 | 26.0 | 31.9 |
| F+G | 42.7 | 37.2 | 48.3 | 40.3 | 45.1 |

The above analysis indicates that temperature inversions of Class F or Class G occur more than 30 per cent of the night-time period during all four seasons.

Based on this analysis of the 2019 weather data, temperature inversions are a feature of the area during the night-time period.

# APPENDIX D

Construction Information

## Table D-1 Equipment Lists and Sound Power Levels

| Equipment | | Back Hoe (7.5 tonne JCB) | Chainsaw[1] | Concrete Mixer Truck | Concrete Pump | Concrete Vibrator | Excavator (14 tonne) | Excavator (22 tonne) | Grader | Hand Tools | Hydraulic Jack | Mobile Crane (100 tonne) | Mobile Crane (35 tonne) | Paving Machine | Roller - Vibratory (12 tonne)[1] | Truck | Welding Equipment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sound Power Level[2] | | 102 | 114 | 103 | 106 | 102 | 97 | 99 | 108 | 94 | 95 | 100 | 98 | 105 | 109 | 107 | 97 |
| **Ref** | **Scenario** | | | | | | | | | | | | | | | | |
| Site Establishment | Vegetation Clearing | | X | | | | X | | | | | | | | | X | |
| | Earthworks | X | | | | | X | X | X | | | | | | X | X | |
| | Utilities | | | | | | X | | | X | | | | | | | |
| Civil and Building Work | Establishment of Roads | | | | | | X | | | X | | | | X | X | X | |
| | Construction of Built Form | | | X | X | X | X | | | X | | X | X | | | | X |
| Commissioning | Decommissioning and Fit out | | | | | | X | X | | X | X | | | | | X | |
| | Landscaping | | | | | | | | | X | | | | | | | |

Note 1: Equipment classed as 'annoying' in the ICNG, due to being highly noise intensive, tonal and/or intermittent, and requires an additional 5 dB correction.

Note 2: Sound power level data is taken from the DEFRA Noise Database, RMS *Construction and Vibration Guideline* and TfNSW *Construction Noise and Vibration Strategy*.

# APPENDIX E

Sydney Metro CNVS Standard Mitigation Measures

## Table E-1 CNVS Summary of the Standard Mitigation and Management Measures

| Action Required | Applies To | Details |
|---|---|---|
| **Management measures** | | |
| Implementation of any project specific mitigation measures required | Airborne noise<br>Ground-borne noise and vibration | In addition to the measures set out in this table, any project specific mitigation measures identified in the environmental assessment documentation (e.g. EA, REF, submissions or representations report) or approval or licence conditions must be implemented. |
| Implement community consultation measures | Airborne noise<br>Ground-borne noise and vibration | Periodic Notification (monthly letterbox drop)1<br>Website<br>Project information and construction response telephone line<br>Email distribution list<br>Place Managers |
| Register of Noise Sensitive Receivers | Airborne noise<br>Ground-borne noise and vibration | A register of all noise and vibration sensitive receivers (NSRs) would be kept on site. The register would include the following details for<br>• Address of receiver<br>• Category of receiver (e.g. Residential, Commercial etc.)<br>• Contact name and phone number |
| Site inductions | Airborne noise<br>Ground-borne noise and vibration | All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include:<br>• All relevant project specific and standard noise and vibration mitigation measures<br>• Relevant licence and approval conditions<br>• Permissible hours of work<br>• Any limitations on high noise generating activities<br>• Location of nearest sensitive receivers<br>• Construction employee parking areas<br>• Designated loading/unloading areas and procedures<br>• Site opening/closing times (including deliveries)<br>• Environmental incident procedures |
| Behavioural practices | Airborne noise | No swearing or unnecessary shouting or loud stereos/radios; on site.<br>No dropping of materials from height; throwing of metal items; and slamming of doors.<br>No excessive revving of plant and vehicle engines<br>Controlled release of compressed air. |
| Monitoring | Airborne noise<br>Ground-borne noise and vibration | A noise monitoring program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions. |
| Attended vibration measurements | Ground-borne vibration | Attended vibration measurements are required at the commencement of vibration generating activities to confirm that vibration levels satisfy the criteria for that vibration generating activity. Where there is potential for exceedances of the criteria further vibration site law investigations would be undertaken to determine the site-specific safe working distances for that vibration generating activity. Continuous vibration monitoring with audible and visible alarms would be conducted at the nearest sensitive receivers whenever vibration generating activities need to take place inside the applicable safe-working distances. |

[1] Detailing all upcoming construction activities at least 14 days prior to commencement of relevant works

| Action Required | Applies To | Details |
|---|---|---|
| **Source controls** | | |
| Construction hours and scheduling | Airborne noise<br>Ground-borne noise and vibration | Where feasible and reasonable, construction would be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels would be scheduled during less sensitive time periods. |
| Construction respite period | Ground-borne noise and vibration<br>Airborne noise | High noise and vibration generating activities[2] may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block[3]. |
| Equipment selection | Airborne noise<br>Ground-borne noise and vibration | Use quieter and less vibration emitting construction methods where feasible and reasonable.<br>For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits. |
| Maximum noise levels | Airborne-noise | The noise levels of plant and equipment must have operating Sound Power Levels compliant with the criteria in Table 11 of the CNVS. |
| Rental plant and equipment | Airborne-noise | The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table 11 of the CNVS. |
| Plan worksites and activities to minimise noise and vibration | Airborne noise<br>Ground-borne vibration | Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. |
| Non-tonal reversing alarms | Airborne noise | Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. |
| Minimise disturbance arising from delivery of goods to construction sites | Airborne noise | Loading and unloading of materials/deliveries is to occur as far as possible from NSRs<br>Select site access points and roads as far as possible away from NSRs<br>Dedicated loading/unloading areas to be shielded if close to NSRs<br>Delivery vehicles to be fitted with straps rather than chains for unloading, wherever feasible and reasonable |
| **Path controls** | | |
| Shield stationary noise sources such as pumps, compressors, fans etc. | Airborne noise | Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding. |
| Shield sensitive receivers from noisy activities. | Airborne noise | Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant. |

[2] Includes jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling.

[3] "Continuous" includes any period during which there is less than a 60 minutes respite between ceasing and recommencing any of the work.

## ASIA PACIFIC OFFICES


**BRISBANE**

Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

**CANBERRA**

GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

**DARWIN**

Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

**GOLD COAST**

Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

**MACKAY**

21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

**MELBOURNE**

Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

**NEWCASTLE**

10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

**PERTH**

Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

**SYDNEY**

Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

**TOWNSVILLE**

12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

**WOLLONGONG**

Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 404 939 922

**AUCKLAND**

68 Beach Road
Auckland 1010
New Zealand
T: 0800 757 695

**NELSON**

6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628

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# Appendix D

## Transport and Traffic Assessment

# Sydney Metro Precast Facilities

## Transport and traffic assessment

v05 | Final

23 October 2020

**Sydney Metro Authority**

Jacobs

Memorandum

Sydney Metro West Eastern Creek Precast Facilities – Transport and traffic assessment
23 October 2020

## Contents

Jacobs

# Memorandum

Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.iacobs.com

| | | | |
|---|---|---|---|
| **Subject** | **Sydney Metro West Eastern Creek Precast Facilities – Transport and traffic assessment** | **Project Name** | Sydney Metro West Eastern Creek Precast Facilities Review of Environmental Factors |
| **From** | Clarence Li and Phillip Truong | **Project No.** | IA199800 |
| **Date** | 23 October 2020 | | |

## 1. Introduction

### 1.1 Proposal overview

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. A Review of Environmental Factors (REF) has been prepared for the proposal seeking approval under Part 5 of the *Environmental Planning and Assessment 1979* (EP&A Act).

The key components of the proposal include:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate and adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
  - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
  - Boiler, aggregate bins and consumables
  - Office facilities
  - On-site parking for up to 60 light vehicles
- Internal roads with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping

Haulage routes would only travel to the east of the proposal site. Indicative operational vehicle numbers for each precast facility site are outlined in Table 1-1.

**Table 1-1 Indicative operational vehicles (per precast facility)[1]**

| Time of day | Heavy vehicles (maximum per hour) | Light vehicles (maximum per hour) | Light vehicles – staff (indicative maximum based on shift change times) |
|---|---|---|---|
| Day (7am - 6pm) | 12 | 8 | 60 (6am - 7am) |
| Evening (6pm - 10pm) | 6 | 5 | 60 (5pm - 6pm)<br>60 (6pm - 7pm) |
| Night (10pm - 7am) | 6 | 5 | 60 (5am-6am) |

[1] Operational light and heavy vehicles are assumed to generate two movements (one movement in and one movement out of the facilities) per vehicle per hour. Staff light vehicles are assumed to generate only one movement per vehicle during staff change hours.

The northern and southern precast facilities would operate concurrently, 24 hours a day, seven days a week for the majority of the lifespan of the project.

The proposal would be temporary, operating for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West. The footprint and operational layout of the proposal is shown in Figure 1-1.

The proposal does not include the construction of the surrounding road network (upgraded and extended of Archbold Road), which would be undertaken by other parts of Transport for New South Wales (Transport for NSW) under a separate approval.

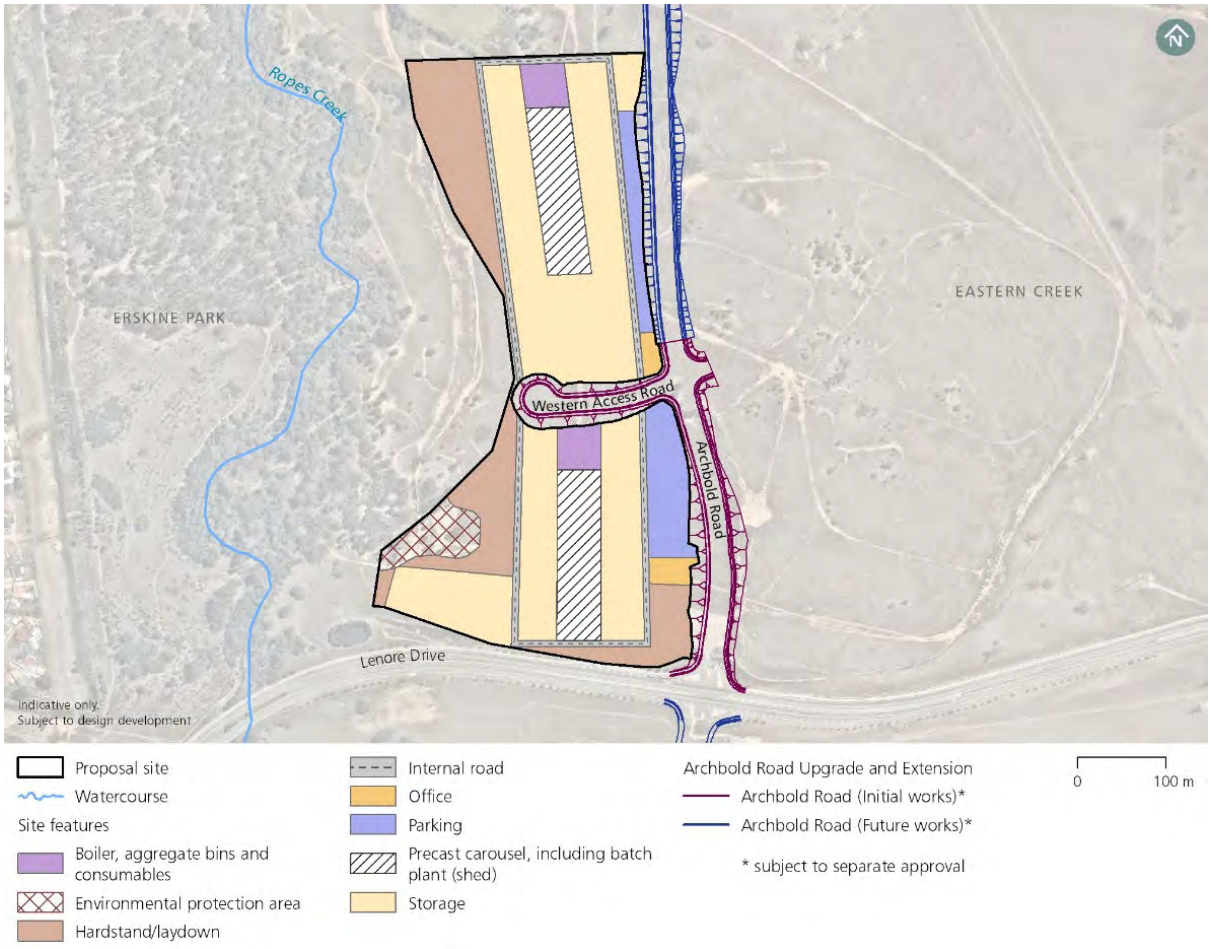


**Figure 1-1 Overview of the proposal**

## 1.2 Purpose and scope of this report

This memorandum is one of a number of technical papers that form part of the REF. The purpose of this memorandum is to identify and assess the potential impacts of the proposal in relation to transport and traffic and to identify management and mitigation measures to minimise these impacts.

## 1.3 Structure of this report

This technical memorandum is structured as follows:

- Section 2 describes the assessment methodology
- Section 3 details the existing traffic and transport environment
- Section 4 provides an assessment of the potential transport and traffic impacts of the proposal during construction
- Section 5 provides an assessment of the potential transport and traffic impacts of the proposal during operation
- Section 6 identifies proposed transport and traffic management and mitigation measures.

# 2. Assessment methodology

## 2.1 Overall assessment approach

To assess the impact of the proposal on the transport and traffic network, the following methodology has been used to identify and, where possible, quantify the following:

- Potential impacts on road network performance – assessed through the use of traffic modelling to determine the performance of the road network with and without vehicles associated with construction and operation of the proposal. Traffic counts were collected in November 2019 to inform the assessment of road network performance. There have been no recent major roadworks, upgrades or developments within the vicinity of the proposal site that would impact on the suitability on the November 2019 traffic counts for the assessment.
- Potential impacts on parking, property access, public transport, pedestrians and cyclists – assessed through an analysis of existing provisions and a comparison with provisions during construction and operation
- Cumulative impacts – the cumulative impact assessment for traffic and transport is provided in Chapter 8 (Environmental impact assessment) of the REF.

## 2.2 Traffic modelling approach

To assess the potential impacts of the proposal on road network performance, traffic modelling has been undertaken of proposed construction vehicle routes between the proposal site and the nearest arterial road inclusive of the arterial road interface.

The approach to traffic modelling undertaken for this assessment aligns with the *Traffic Modelling Guidelines* (Roads and Maritime, 2013) and includes the following broad steps:

- Development of calibrated and validated single intersection base models to align with existing operational conditions along each construction vehicle route
- Development of future year base models to align with anticipated operational conditions in the year of peak construction activity (2022) and year of peak operational activity (2026)
- Application of anticipated construction and operational traffic demands to the future year base models to enable the identification of potential impacts on road network performance.

Models were developed using the SIDRA INTERSECTION 8 traffic modelling software package. SIDRA INTERSECTION 8 is a micro-analytical tool for evaluation of intersection performance mainly in terms of capacity, level of service and a wide range of other performance measures such as delay, queue length and stops for vehicles and pedestrians, as well as fuel consumption, pollutant emissions and operating cost. SIDRA INTERSECTION 8 can be used as an aid for the design and evaluation of fixed-time / pre-timed and actuated signalised intersections, signalised pedestrian crossings, signalised single-point interchanges, roundabouts, all-way stop sign control and give-way sign control.

The traffic modelling was undertaken for the morning peak (6.00 am to 7.00 am for both construction and operation) and evening peak periods only (6.00 pm to 7.00 pm for construction and 5.00 pm to 6.00 pm for operation), which is consistent with the standard approach for this type of assessment. The peak traffic periods represent a worst-case scenario as during these periods the road network experiences the maximum background traffic demand and the available spare capacity of the road network is at its most limited.

#### 2.2.1 Performance indicators

The performance of a road network is largely dependent on the operating performance of intersections, which form capacity control points. The performance indicators that are reported for this assessment include:

- Intersection Level of Service – based on criteria outlined in Table 2-1 and defined in the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002). The average delay assessed for signalised intersections is for all movements. The average delay assessed for priority (sign-controlled) intersections is for the worst movement and is expressed in seconds per vehicle
- Maximum queue length on each approach (in metres).

**Table 2-1 Intersection Level of Service criteria**

| Level of Service | Average delay per vehicle (seconds/vehicle) | Traffic signals and roundabouts |
|---|---|---|
| A | Less than 15 | Good operation |
| B | 15 to 28 | Good with acceptable delays and spare capacity |
| C | 29 to 42 | Satisfactory |
| D | 43 to 56 | Operating near capacity |
| E | 57 to 70 | At capacity; at signals, incidents will cause delays<br>Roundabouts require other control mode |
| F | Over 70 | Extra capacity required |

*Source: Guide to Traffic Generating Developments (Roads and Traffic Authority, 2002)*

It is generally accepted that when intersection performance falls to Level of Service E during peak periods, investigations should be initiated to determine if suitable remediation can be provided. However, limited road capacity and high demand mean that Level of Service F is regularly experienced by motorists, particularly during peak periods.

## 3. Existing transport and traffic environment

### 3.1 Road network overview

Old Wallgrove Road / Lenore Drive is an east-west arterial road that provides access to local roads servicing industrial precincts at Erskine Park and Eastern Creek. Old Wallgrove Road becomes Lenore Drive west of Telopea Place. Old Wallgrove Road connects to Wallgrove Road and the M7 Motorway at its eastern end, which provide access to the wider Sydney arterial and motorway network. Wallgrove Road and the M7 Motorway run in a north-south direction and are designated as tertiary and primary freight routes, respectively. The M7 Motorway carries high volumes of freight vehicles and as a primary freight route, it provides access interstate and to strategically important ports, airports, industrial areas, freight terminals, and intermodal terminals and hubs. Wallgrove Road also carries high volumes of freight vehicles and as a tertiary freight route, it provides connections to the local road network and the lower-order elements of the State Road system.

Local roads in the vicinity of the precinct include Telopea Place, Roberts Road, Eastern Creek Drive, Southridge Street and Mini Link Road. These roads provide access to nearby industrial precincts and

the intersection of these roads with Old Wallgrove Road are signalised. Unrestricted kerbside parking is permitted on Telopea Place, Roberts Road, Eastern Creek Drive and Southridge Street.

It is assumed the upgraded and extended Archbold Road between Lenore Drive and the proposal site access would be open to traffic by mid-2022. The upgrade and extension of Archbold Road would be undertaken by other parts of Transport for NSW under a separate approval. This first stage of the planned Archbold Road upgrade and extension would provide access to the proposal site from Lenore Drive, via a new section of Archbold Road and the Western Access Road. Prior to completion of the Archbold Road extension between Lenore Drive and the proposal site access, construction traffic as part of the proposal would utilise a temporary haul road. Once complete, the proposal site would be accessed from the Western Access Road located between the northern and southern precast facilities.

The road network in the vicinity of the proposal is shown in Figure 3-1.

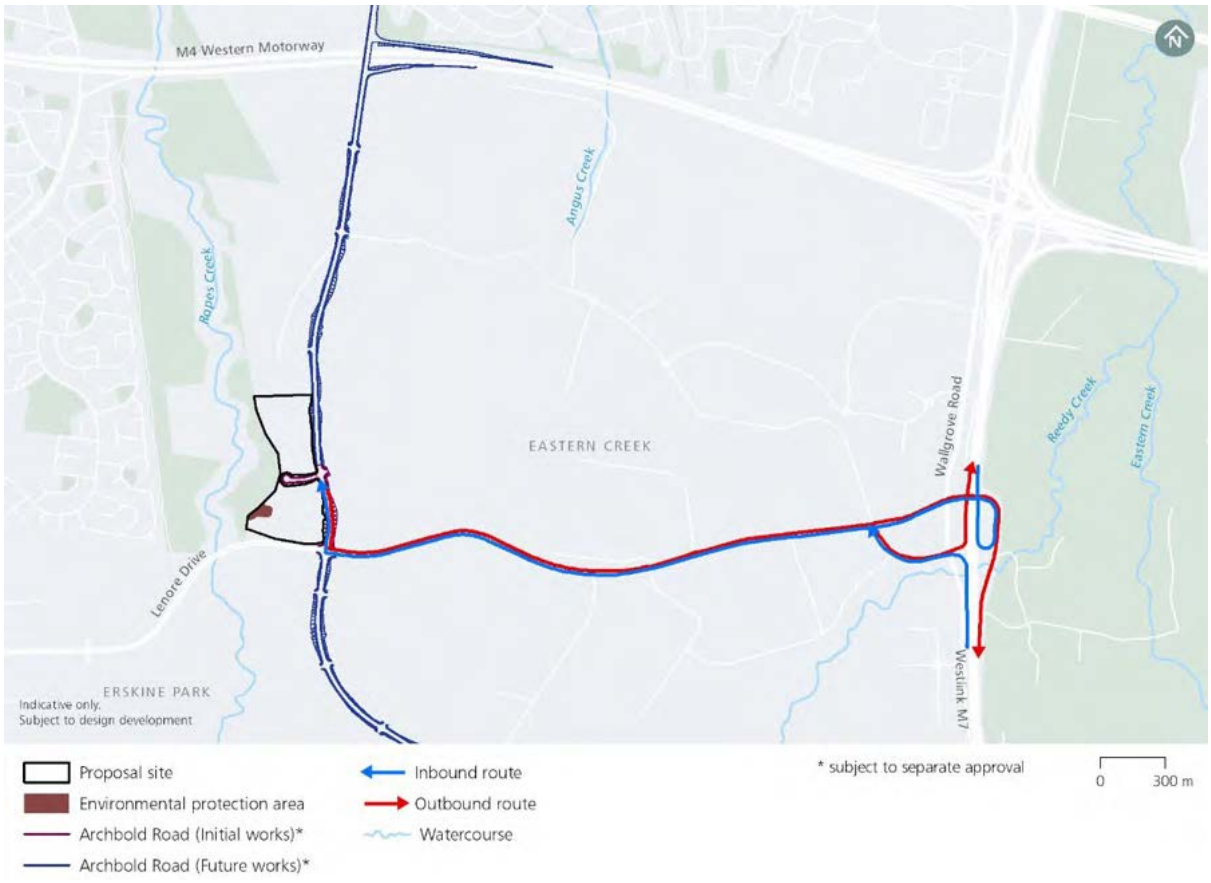


**Figure 3-1 Road network in the vicinity of the proposal**

## 3.2 Traffic volumes and patterns

The M7 Motorway is a limited-access high-speed road and carries high traffic volumes. Elsewhere on the arterial and local road network, traffic volumes are highest on Wallgrove Road, which carries over 1,000 vehicles in each direction during the peak hours. Traffic volumes are also high on Old Wallgrove Road, which carries between 690 and 1,090 vehicles per hour in each direction and exhibits a

westbound peak direction during the morning peak hour and an eastbound peak direction during the evening peak hour. Traffic volumes on all other roads near the proposal are substantially lower.

Approximate peak hour midblock volumes on key roads within the vicinity of the proposal are shown in Table 3-1. The upgraded and extended Archbold Road has not been provided as this has yet to be constructed and opened to traffic.

**Table 3-1 Existing peak hour traffic volumes by direction (2019)**

| Road | Direction | Morning peak hour volume (veh / hr) | Evening peak hour volume (veh / hr) |
|---|---|---|---|
| Old Wallgrove Road / Lenore Drive | Eastbound | 750 | 880 |
| | Westbound | 1,090 | 690 |
| Wallgrove Road | Northbound | 1,070 | 1,380 |
| | Southbound | 1,410 | 1,480 |
| Telopea Place/Old Wallgrove Road | Northbound | 230 | 510 |
| | Southbound | 40 | 30 |
| Roberts Road | Northbound | 250 | 370 |
| | Southbound | 330 | 290 |
| Eastern Creek Drive | Northbound | 120 | 60 |
| | Southbound | 90 | 80 |
| Southridge Street | Northbound | 80 | 170 |
| | Southbound | 10 | 30 |
| Mini Link Road/Quarry Road | Northbound | 320 | 350 |
| | Southbound | 0 | 10 |

*Source: SCATS count data (Transport for NSW, November 2019)*

### 3.3 Existing intersection performance

As detailed in Section 2.1, traffic modelling was completed to ascertain the existing performance of key intersections during the morning and evening peak hours in the vicinity of the proposal. The results are presented in Table 3-2, and represent the performance of the intersections in the absence of the proposal and other projects within and in the vicinity of the proposal.

Modelled intersection performance indicates that all intersections near the proposal site currently perform satisfactorily at or above Level of Service C during the morning and evening peak hours.

**Table 3-2 Modelled peak hour existing intersection performance (2019)**

| Intersection and peak hour | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
|---|---|---|---|---|---|
| **Old Wallgrove Road / Lenore Drive / Telopea Place** | | | | | |
| Morning (6 am to 7 am) | 1,720 | 30 | C | NB | 15 |
| | | | | EB | 80 |
| | | | | SB | < 5 |
| | | | | WB | 55 |
| Evening (5 pm to 6 pm) | 1,490 | 33 | C | NB | 75 |
| | | | | EB | 35 |
| | | | | SB | < 5 |
| | | | | WB | 75 |
| Evening (6 pm to 7 pm) | 950 | 30 | C | NB | 40 |
| | | | | EB | 25 |
| | | | | SB | < 5 |
| | | | | WB | 35 |
| **Old Wallgrove Road / Roberts Road** | | | | | |
| Morning (6 am to 7 am) | 1,800 | 14 | A | NB | 25 |
| | | | | EB | 35 |
| | | | | SB | - |
| | | | | WB | 110 |
| Evening (5 pm to 6 pm) | 1,600 | 20 | B | NB | 35 |
| | | | | EB | 40 |
| | | | | SB | - |
| | | | | WB | 75 |
| Evening (6 pm to 7 pm) | 1,060 | 14 | A | NB | 15 |
| | | | | EB | 20 |
| | | | | SB | - |
| | | | | WB | 30 |
| **Old Wallgrove Road / Eastern Creek Drive** | | | | | |
| Morning (6 am to 7 am) | 1,850 | 10 | A | NB | - |
| | | | | EB | 65 |
| | | | | SB | 35 |

| Intersection and peak hour | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
|---|---|---|---|---|---|
| | | | | WB | 50 |
| Evening (5 pm to 6 pm) | 1,540 | 11 | A | NB | - |
| | | | | EB | 65 |
| | | | | SB | 35 |
| | | | | WB | 30 |
| Evening (6 pm to 7 pm) | 1,040 | 11 | A | NB | - |
| | | | | EB | 50 |
| | | | | SB | 15 |
| | | | | WB | 20 |
| **Old Wallgrove Road / Southridge Street** | | | | | |
| Morning (6 am to 7 am) | 1,910 | 18 | B | NB | 15 |
| | | | | EB | 50 |
| | | | | SB | 5 |
| | | | | WB | 95 |
| Evening (5 pm to 6 pm) | 1,600 | 23 | B | NB | 20 |
| | | | | EB | 60 |
| | | | | SB | 5 |
| | | | | WB | 45 |
| Evening (6 pm to 7 pm) | 1,120 | 23 | B | NB | 15 |
| | | | | EB | 40 |
| | | | | SB | 5 |
| | | | | WB | 30 |
| **Old Wallgrove Road / Mini Link Road** | | | | | |
| Morning (6 am to 7 am) | 1,880 | 24 | B | NB | 35 |
| | | | | EB | 45 |
| | | | | SB | < 5 |
| | | | | WB | 65 |
| Evening (5 pm to 6 pm) | 1,620 | 27 | B | NB | 25 |
| | | | | EB | 55 |
| | | | | SB | < 5 |
| | | | | WB | 30 |

| Intersection and peak hour | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
|---|---|---|---|---|---|
| Evening (6 pm to 7 pm) | 1,190 | 23 | B | NB | 10 |
| | | | | EB | 30 |
| | | | | SB | < 5 |
| | | | | WB | 20 |
| **M7 Motorway southbound ramps / Wallgrove Road / Old Wallgrove Road** | | | | | |
| Morning (6 am to 7 am) | 3,100 | 34 | C | NB | 135 |
| | | | | EB | 65 |
| | | | | SB | 115 |
| | | | | WB | 50 |
| Evening (5 pm to 6 pm) | 2,910 | 27 | B | NB | 95 |
| | | | | EB | 110 |
| | | | | SB | 160 |
| | | | | WB | 25 |
| Evening (6 pm to 7 pm) | 2,010 | 33 | C | NB | 80 |
| | | | | EB | 70 |
| | | | | SB | 100 |
| | | | | WB | 15 |
| **M7 Motorway northbound ramps / Wallgrove Road / Mini Link Road** | | | | | |
| Morning (6 am to 7 am) | 2,640 | 34 | C | NB | 130 |
| | | | | EB | 60 |
| | | | | SB | 80 |
| | | | | WB | 55 |
| Evening (5 pm to 6 pm) | 3,090 | 41 | C | NB | 145 |
| | | | | EB | 70 |
| | | | | SB | 145 |
| | | | | WB | 25 |
| Evening (6 pm to 7 pm) | 1,780 | 35 | C | NB | 75 |
| | | | | EB | 40 |
| | | | | SB | 60 |
| | | | | WB | 25 |

### 3.4 Public transport network

There are no train stations located in close proximity to the proposal. Bus routes 738 and 835 are located near the proposal and are shown in Figure 3-2.

Route 738 is operated by Busways and is a loop service between Mount Druitt and Horsley Park via Wallgrove Road, Old Wallgrove Road and Roberts Road. Route 738 operates at a frequency of two buses per hour during the weekday morning and evening peak periods.

Route 835 is operated by Transit Systems and travels between Western Sydney University Kingswood and Prairiewood via Lenore Drive, Old Wallgrove Road and Wallgrove Road. Route 835 operates at a frequency of two buses per hour in each direction during the weekday morning and evening peak periods.

Bus stops are located along Old Wallgrove Road / Lenore Drive, Wallgrove Road and Roberts Road. Bus priority lanes are provided at the intersections of Old Wallgrove Road and Telopea Place, Eastern Creek Drive and Southbridge Street.

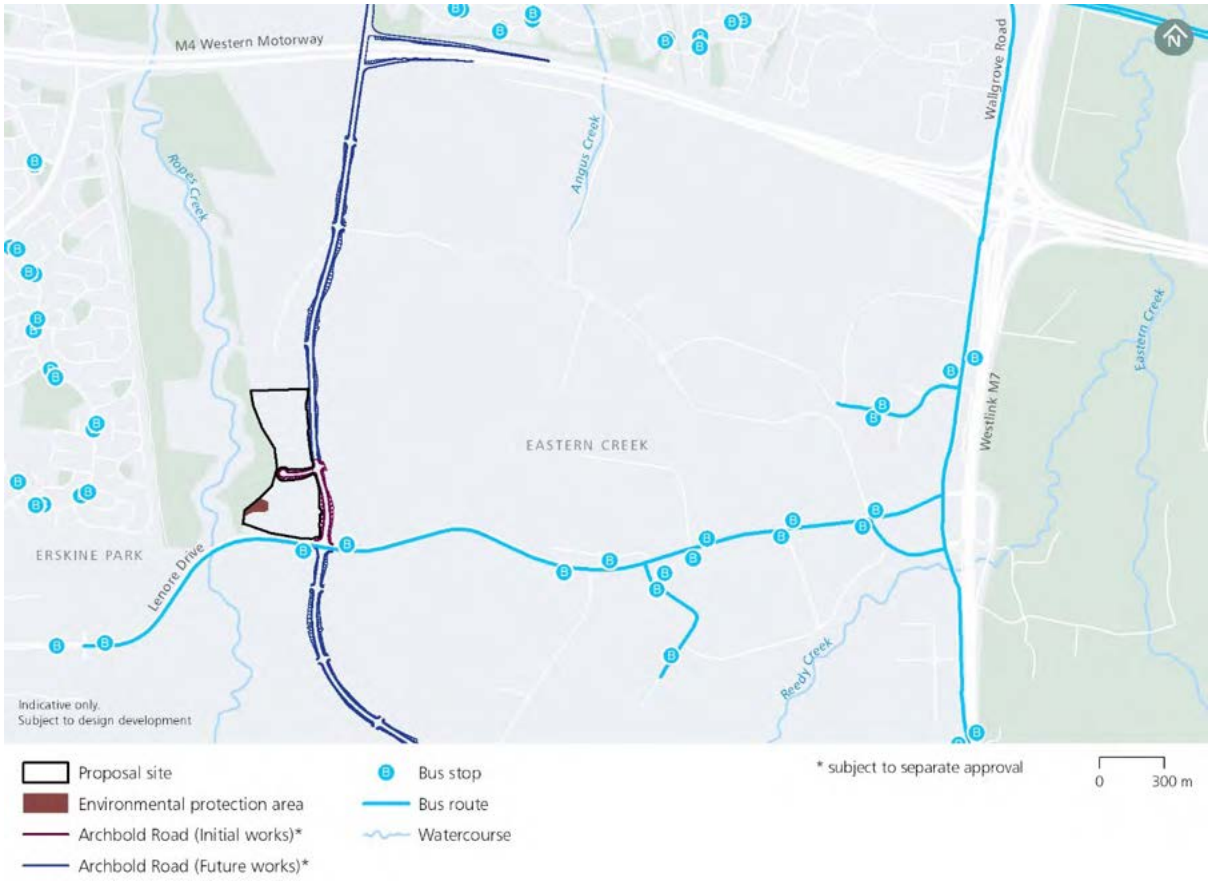


**Figure 3-2 Public transport network surrounding the proposal**

### 3.5 Active transport network

Pedestrian activity within the immediate vicinity of the proposal is low given the industrial land uses present. Footpaths are provided on both sides of Old Wallgrove Road between Telopea Place and Wallgrove Road and include a shared user path on the northern side of the road. A shared user path is provided on the northern side of Lenore Drive; footpaths are not provided on the southern side. Footpaths are not provided on Wallgrove Road, with the exception of limited sections of shared user paths that provide connectivity to Mini Link Road and the M7 Motorway shared user path.

The cycle network near the proposal is shown in Figure 3-3 and is well established with provision of a number of off-road shared user paths. Shared user paths are provided on Lenore Drive and Old Wallgrove Road and provide connections to the regional cycle network via the M7 Motorway shared user path.


**Figure 3-3 Off-road cycle network in the vicinity of the proposal**

*Source: Cycleway Finder (Transport for NSW, 2019)*

# 4. Construction

## 4.1 Key assumptions

### 4.1.1 Construction worker parking

All staff parking would be accommodated on-site and not on surrounding local streets. Provision for parking during construction would be provided within the proposal site.

### 4.1.2 Construction assessment year

Construction is proposed to commence in early 2021 and scheduled to reach completion by the end of 2022. The total duration of construction is anticipated to be around 20 months. As such, 2022 has been used as the construction assessment year.

### 4.1.3 Construction site location and access

The proposal site is bounded by Lenore Drive to the south and Ropes Creek to the west. Site access and egress to and from the construction site would be right-in, left-out via Lenore Drive and left-in, right out via the temporary haul road and, once complete, the first stage of the upgraded and

extended Archbold Road (subject to separate approval). The intersection of Lenore Drive and the upgraded and extended Archbold Road would be signalised. The Archbold Road / Lenore Drive intersection would be located approximately 1.3 kilometres west of the Old Wallgrove Road / Lenore Drive / Telopea Place intersection.

Haulage routes would only travel east of the proposal site, generally via arterial roads, as described below and shown in Figure 4-1:

- From the proposal site along the temporary haul road (and once complete, the upgraded and extended Archbold Road) to Lenore Drive
- Lenore Drive to Old Wallgrove Road
- Old Wallgrove Road to Wallgrove Road
- Old Wallgrove Road to M7 Motorway.

No haulage routes are anticipated to travel west of the proposal site.


**Figure 4-1 Proposed haulage routes**

#### 4.1.4 Construction vehicles

Construction vehicles would access and egress the proposal site generally during standard construction hours. The hours that were modelled for the construction scenario represent the

maximum number of vehicles on the road network and coincide with construction workers travelling to and from the proposal site. Modelling the maximum number of vehicles on the road network represents the worst-case scenario. The forecast number of construction vehicles to and from the proposal site at each facility would be:

- Light vehicles: 60 vehicles (per facility) arriving in the hour before the start of shifts (6 am to 7 am) and 60 vehicles (per facility) leaving in the hour after the end of shifts (6 pm to 7 pm)
- Heavy vehicles: maximum of 10 heavy vehicles (per facility) per hour during standard construction hours (7 am to 6 pm). For the purposes of the traffic assessment, heavy vehicles have been assumed to be comprised of two 12.5-metre trucks, seven 19-metre trucks and one 30-metre truck.

### 4.2 Impacts on road network performance

Intersection performance results under the '2022 without construction of proposal' (without vehicles associated with construction of the proposal) and '2022 with construction of proposal' (with vehicles associated with construction of the proposal) scenarios are summarised in Table 4-1 for the morning and evening peak hours.

Modelled intersection performance with construction traffic indicates that all intersections forming part of the construction vehicle access and egress route would perform at the same Level of Service compared to the scenario without construction traffic. Further, intersections delays would either not change or would increase by up to two seconds, which is considered a negligible impact on the road network. As a result, additional traffic generated by construction of the proposal would have a negligible or minimal impact on the operation of the surrounding road network.

Modelled intersection performance at the Old Wallgrove Road / Roberts Road, Old Wallgrove Road / Eastern Creek Drive and Old Wallgrove Road / Southridge Street intersections indicates that the Level of Service would improve very slightly with construction traffic. This is due to reallocation of signal phasing times at signalised intersections in response to additional traffic demand and is considered negligible.

**Table 4-1 Modelled peak hour intersection performance during construction**

| Intersection and peak hour | 2022 without construction of proposal | | | | | 2022 with construction of proposal | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
| **Old Wallgrove Road / Lenore Drive / Telopea Place** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,100 | 40 | C | NB | 30 | 2,220 | 40 | C | NB | 30 |
| | | | | EB | 130 | | | | EB | 130 |
| | | | | SB | < 5 | | | | SB | < 5 |
| | | | | WB | 110 | | | | WB | 110 |
| | 1,270 | 32 | C | NB | 65 | 1,390 | 33 | C | NB | 70 |

| Intersection and peak hour | 2022 without construction of proposal | | | | | 2022 with construction of proposal | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
| Evening (6 pm to 7 pm) | | | | EB | 35 | | | | EB | 55 |
| | | | | SB | < 5 | | | | SB | < 5 |
| | | | | WB | 40 | | | | WB | 40 |
| **Old Wallgrove Road / Roberts Road** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,070 | 14 | A | NB | 25 | 2,190 | 14 | A | NB | 25 |
| | | | | EB | 40 | | | | EB | 40 |
| | | | | SB | - | | | | SB | - |
| | | | | WB | 135 | | | | WB | 150 |
| Evening (6 pm to 7 pm) | 1,220 | 14 | A | NB | 15 | 1,350 | 13 | A | NB | 15 |
| | | | | EB | 30 | | | | EB | 35 |
| | | | | SB | - | | | | SB | - |
| | | | | WB | 35 | | | | WB | 40 |
| **Old Wallgrove Road / Eastern Creek Drive** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,100 | 9 | A | NB | - | 2,230 | 9 | A | NB | - |
| | | | | EB | 75 | | | | EB | 75 |
| | | | | SB | 30 | | | | SB | 30 |
| | | | | WB | 60 | | | | WB | 70 |
| Evening (6 pm to 7 pm) | 1,190 | 9 | A | NB | - | 1,310 | 8 | A | NB | - |
| | | | | EB | 50 | | | | EB | 60 |
| | | | | SB | 10 | | | | SB | 10 |
| | | | | WB | 15 | | | | WB | 15 |
| **Old Wallgrove Road / Southridge Street** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,250 | 19 | B | NB | 15 | 2,370 | 18 | B | NB | 15 |
| | | | | EB | 60 | | | | EB | 55 |
| | | | | SB | 5 | | | | SB | 5 |
| | | | | WB | 120 | | | | WB | 135 |

| Intersection and peak hour | 2022 without construction of proposal | | | | | 2022 with construction of proposal | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
| Evening (6 pm to 7 pm) | 1,340 | 22 | B | NB | 20 | 1,460 | 22 | B | NB | 20 |
| | | | | EB | 50 | | | | EB | 60 |
| | | | | SB | 5 | | | | SB | 5 |
| | | | | WB | 35 | | | | WB | 35 |
| **Old Wallgrove Road / Mini Link Road** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,270 | 25 | B | NB | 40 | 2,400 | 25 | B | NB | 50 |
| | | | | EB | 60 | | | | EB | 60 |
| | | | | SB | < 5 | | | | SB | < 5 |
| | | | | WB | 85 | | | | WB | 90 |
| Evening (6 pm to 7 pm) | 1,510 | 24 | B | NB | 10 | 1,640 | 25 | B | NB | 10 |
| | | | | EB | 40 | | | | EB | 45 |
| | | | | SB | < 5 | | | | SB | < 5 |
| | | | | WB | 25 | | | | WB | 25 |
| **M7 Motorway southbound ramps / Wallgrove Road / Old Wallgrove Road** | | | | | | | | | | |
| Morning (6 am to 7 am) | 3,430 | 37 | C | NB | 150 | 3,490 | 37 | C | NB | 150 |
| | | | | EB | 80 | | | | EB | 80 |
| | | | | SB | 130 | | | | SB | 130 |
| | | | | WB | 80 | | | | WB | 95 |
| Evening (6 pm to 7 pm) | 2,290 | 34 | C | NB | 90 | 2,350 | 35 | C | NB | 90 |
| | | | | EB | 85 | | | | EB | 85 |
| | | | | SB | 115 | | | | SB | 125 |
| | | | | WB | 24 | | | | WB | 20 |
| **M7 Motorway northbound ramps / Wallgrove Road / Mini Link Road** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,760 | 36 | C | NB | 140 | 2,820 | 38 | C | NB | 145 |
| | | | | EB | 70 | | | | EB | 75 |
| | | | | SB | 90 | | | | SB | 95 |
| | | | | WB | 60 | | | | WB | 60 |

| Intersection and peak hour | 2022 without construction of proposal | | | | | 2022 with construction of proposal | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
| Evening (6 pm to 7 pm) | 2,170 | 39 | C | NB | 90 | 2,230 | 41 | C | NB | 95 |
| | | | | EB | 60 | | | | EB | 60 |
| | | | | SB | 80 | | | | SB | 80 |
| | | | | WB | 35 | | | | WB | 35 |

### 4.3 Impacts on parking and property access

As described in Section 4.1.1, all staff parking would be accommodated on-site and not on surrounding local streets. Therefore, there would be no impact on parking during construction of the proposal. There would also be no impact on property access during construction of the proposal.

### 4.4 Impacts on the public transport network

Wallgrove Road, Old Wallgrove Road and Lenore Drive are used by buses and also form part of the proposed construction vehicle route. Minimal impacts on buses are expected and would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network. No impacts are anticipated on the operation of bus stops.

### 4.5 Impacts on the active transport network

Prior to construction of the first stage of the upgraded and extended Archbold Road and installation of traffic signals at the Archbold Road / Lenore Drive intersection, heavy vehicles would be required to cross the shared user path on the northern side of Lenore Drive to access the site. Although pedestrian and cyclist volumes on these shared user paths are low, management and mitigation measures to minimise these impacts would be applied and are discussed further in Section 6.

It is assumed the upgraded and extended Archbold Road between Lenore Drive and the proposal site access would be open to traffic by mid-2022. Following the opening of the upgraded and extended Archbold Road, no impacts to pedestrians and cyclists are anticipated given that footpaths and shared user paths in the vicinity of the proposal would remain open during construction of the proposal. There are no safety concerns anticipated given that the Archbold Road / Lenore Drive intersection would be signalised, shared paths run along the length of the haulage route and the minimal volumes of pedestrians and cyclists.

### 4.6 Cumulative construction impacts

The cumulative impact assessment for traffic and transport is provided in Chapter 7 (Environmental Impact Assessment) of the REF.

# 5. Operation

## 5.1 Key assumptions

### 5.1.1 Operation assessment year

The proposal would be commissioned in late 2022. Both the northern and southern precast facilities would operate concurrently for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West. The year 2026 has been selected as the operation assessment year as it is the last year of anticipated operations and presents a worst-case scenario with the greatest background traffic growth. The operation assessment assumes concurrent operation of the northern and southern precast facilities.

### 5.1.2 Operation hours

The proposal would operate 24 hours per day, seven days per week with a total operational workforce of 120 staff.

### 5.1.3 Operation vehicle parking

All staff parking would be accommodated on-site and not on surrounding local streets. Provision for parking during operation would be provided within the proposal site.

### 5.1.4 Operation access

Access and egress to and from the site would be right-in, left-out via Lenore Drive and left-in, right out from the Western Access Road to the first stage of the upgraded and extended Archbold Road (subject to separate approval). The precast sites would be accessed by the Western Access Road between the northern and southern facilities (off the upgraded and extended Archbold Road). The intersection of Lenore Drive and the upgraded and extended Archbold Road would be signalised. The Archbold Road / Lenore Drive intersection would be located approximately 1.3 kilometres west of the Old Wallgrove Road / Lenore Drive / Telopea Place intersection.

Haulage routes would only travel east of the proposal site as described below and shown in Figure 4-1:

- From the proposal site along the upgraded and extended Archbold Road to Lenore Drive
- Lenore Drive to Old Wallgrove Road
- Old Wallgrove Road to Wallgrove Road
- Old Wallgrove Road to M7 Motorway.

No haulage routes are anticipated to travel west of the proposal site.

### 5.1.5 Operational vehicles

The hours that were modelled for the operation scenario represent the maximum number of vehicles on the road network and coincide with workers travelling to and from the proposal site, as well as heavy vehicle movements. Modelling the maximum number of vehicles on the road network represents the worst-case scenario. The forecast number of operation vehicles to and from the proposal site at each facility would be:

- Light vehicles: 60 vehicles (per facility) arriving in the hour before the start of shifts (6.00 am to 7.00 am for day shifts and 6.00 pm to 7.00 pm for night shifts) and 60 vehicles (per facility) leaving in the hour after the end of shifts (5.00 pm to 6.00 pm for day shifts and 5.00 am to 6.00 am for night shifts)
- Heavy vehicles: maximum of 12 heavy vehicles (per facility) per hour between 7.00 am to 6.00 pm. For the purposes of the traffic assessment, heavy vehicles have been assumed to be comprised of one 12.5-metre truck, 10 19-metre trucks and one 30-metre truck.
- Heavy vehicles: maximum of six heavy vehicles (per facility) per hour between 6.00 pm to 7.00 am. For the purposes of the traffic assessment, heavy vehicles have been assumed to be comprised of one 12.5-metre truck, four 19-metre trucks and one 30-metre truck.

#### 5.1.6 Ongoing maintenance

The proposal would be placed on a routine cleaning, inspection and maintenance schedule. Mechanical and electrical components would be tested and inspected routinely as would fire and safety equipment. Maintenance access would be via the main entry point (upgraded and extended Archbold Road). Maintenance and service vehicles would use parking facilities at each precast facility already provided for operational vehicles.

### 5.2 Impacts on road network performance

Intersection performance results under the '2026 without operation of proposal' (without vehicles associated with operation of the proposal) and '2026 with operation of proposal' (with vehicles associated with operation of the proposal) scenarios are summarised in Table 5-1 for the morning and evening peak hours.

Modelled intersection performance with operation traffic indicates that most intersections forming part of the operational vehicle access and egress route would perform at the same Level of Service compared to the scenario without operational traffic. The Old Wallgrove Road / Lenore Drive / Telopea Place intersection would experience a decrease in level of service in the morning peak hour from C to D, however this is associated with a two second increase in average delay, which is considered negligible. As a result, additional traffic generated by operation of the proposal would have a negligible or minimal impact on the operation of the surrounding road network.

Modelled intersection performance at the Old Wallgrove Road / Roberts Road and Old Wallgrove Road / Eastern Creek Drive intersections indicates that the Level of Service would improve very slightly with operation traffic. This is due to reallocation of signal phasing times at signalised intersections in response to additional traffic demand and is considered negligible.

**Table 5-1 Modelled peak hour intersection performance during operation**

| Intersection and peak hour | 2026 without operation of proposal | | | | | 2026 with operation of proposal | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
| **Old Wallgrove Road / Lenore Drive / Telopea Place** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,350 | 41 | C | NB | 40 | 2,500 | 43 | D | NB | 40 |
| | | | | EB | 165 | | | | EB | 180 |
| | | | | SB | < 5 | | | | SB | < 5 |
| | | | | WB | 85 | | | | WB | 85 |
| Evening (5 pm to 6 pm) | 2,360 | 43 | D | NB | 250 | 2,530 | 47 | D | NB | 270 |
| | | | | EB | 85 | | | | EB | 130 |
| | | | | SB | < 5 | | | | SB | < 5 |
| | | | | WB | 110 | | | | WB | 120 |
| **Old Wallgrove Road / Roberts Road** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,120 | 14 | A | NB | 25 | 2,280 | 14 | A | NB | 25 |
| | | | | EB | 40 | | | | EB | 40 |
| | | | | SB | - | | | | SB | - |
| | | | | WB | 140 | | | | WB | 160 |
| Evening (5 pm to 6 pm) | 1,760 | 20 | B | NB | 40 | 1,930 | 19 | B | NB | 40 |
| | | | | EB | 60 | | | | EB | 75 |
| | | | | SB | - | | | | SB | - |
| | | | | WB | 75 | | | | WB | 80 |
| **Old Wallgrove Road / Eastern Creek Drive** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,140 | 8 | A | NB | - | 2,290 | 8 | A | NB | - |
| | | | | EB | 70 | | | | EB | 75 |
| | | | | SB | 25 | | | | SB | 25 |
| | | | | WB | 65 | | | | WB | 75 |
| Evening (5 pm to 6 pm) | 1,690 | 11 | A | NB | - | 1,870 | 10 | A | NB | - |
| | | | | EB | 90 | | | | EB | 105 |
| | | | | SB | 25 | | | | SB | 25 |
| | | | | WB | 30 | | | | WB | 30 |

| Intersection and peak hour | 2026 without operation of proposal | | | | | 2026 with operation of proposal | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
| **Old Wallgrove Road / Southridge Street** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,310 | 19 | B | NB | 25 | 2,460 | 19 | B | NB | 25 |
| | | | | EB | 55 | | | | EB | 60 |
| | | | | SB | 5 | | | | SB | 5 |
| | | | | WB | 130 | | | | WB | 145 |
| Evening (5 pm to 6 pm) | 1,860 | 24 | B | NB | 30 | 2,030 | 24 | B | NB | 30 |
| | | | | EB | 80 | | | | EB | 95 |
| | | | | SB | 5 | | | | SB | 5 |
| | | | | WB | 45 | | | | WB | 50 |
| **Old Wallgrove Road / Mini Link Road** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,320 | 25 | B | NB | 45 | 2,480 | 25 | B | NB | 55 |
| | | | | EB | 60 | | | | EB | 60 |
| | | | | SB | < 5 | | | | SB | < 5 |
| | | | | WB | 85 | | | | WB | 95 |
| Evening (5 pm to 6 pm) | 2,040 | 29 | C | NB | 15 | 2,210 | 30 | C | NB | 15 |
| | | | | EB | 85 | | | | EB | 100 |
| | | | | SB | < 5 | | | | SB | < 5 |
| | | | | WB | 40 | | | | WB | 45 |
| **M7 Motorway southbound ramps / Wallgrove Road / Old Wallgrove Road** | | | | | | | | | | |
| Morning (6 am to 7 am) | 3,460 | 37 | C | NB | 130 | 3,530 | 38 | C | NB | 130 |
| | | | | EB | 80 | | | | EB | 80 |
| | | | | SB | 150 | | | | SB | 155 |
| | | | | WB | 80 | | | | WB | 100 |
| Evening (5 pm to 6 pm) | 3,380 | 29 | C | NB | 85 | 3,470 | 31 | C | NB | 90 |
| | | | | EB | 115 | | | | EB | 110 |
| | | | | SB | 215 | | | | SB | 235 |
| | | | | WB | 75 | | | | WB | 75 |

| Intersection and peak hour | 2026 without operation of proposal | | | | | 2026 with operation of proposal | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | | Intersection throughput (veh / hr) | Average delay (sec / veh) | Level of Service | Maximum queue length by directional approach (m) | |
| **M7 Motorway northbound ramps / Wallgrove Road / Mini Link Road** | | | | | | | | | | |
| Morning (6 am to 7 am) | 2,860 | 35 | C | NB | 150 | 2,940 | 38 | C | NB | 160 |
| | | | | EB | 70 | | | | EB | 70 |
| | | | | SB | 85 | | | | SB | 95 |
| | | | | WB | 60 | | | | WB | 60 |
| Evening (5 pm to 6 pm) | 3,900 | 47 | D | NB | 165 | 3,990 | 49 | D | NB | 165 |
| | | | | EB | 120 | | | | EB | 140 |
| | | | | SB | 215 | | | | SB | 220 |
| | | | | WB | 35 | | | | WB | 35 |

### 5.3 Impacts on parking and property access

As described in Section 5.1.3, all staff parking would be accommodated on-site and not on surrounding local streets. Therefore, there would be no impact on parking during operation of the proposal. There would also be no impact on property access during operation of the proposal.

### 5.4 Impacts on the public transport network

Wallgrove Road, Old Wallgrove Road and Lenore Drive are used by buses and also form part of the proposed operational vehicle route. Minimal impacts to buses are expected and would be limited to a potential minor increase in travel time due to the additional operational vehicles on the road network. No impacts are anticipated on the operation of bus stops.

### 5.5 Impacts on the active transport network

No impacts to pedestrians and cyclists are anticipated given that footpaths and shared paths in the vicinity of the proposal would not be affected during operation of the proposal. There are no safety concerns anticipated given that the Archbold Road / Lenore Drive intersection would be signalised, shared paths run along the length of the haulage route and the minimal volumes of pedestrians and cyclists.

### 5.6 Cumulative operation impacts

The cumulative impact assessment for traffic and transport is provided in Chapter 7 (Environmental impact assessment) of the REF.

# 6. Management and mitigation measures

The Construction Traffic Management Framework (CTMF) for Sydney Metro West would be applied to the construction and operation of the proposal. The framework provides an overall strategy and approach for construction traffic management, an outline of the traffic management requirements and processes that would be applied, and interactions with relevant stakeholders (including working collaboratively with other stakeholders to manage cumulative impacts). It establishes the traffic management processes and acceptable criteria to be considered and followed when managing impacts to the road network. Although the CTMF is typically applied to the construction phase of projects, it is proposed to also adopt this framework for the operational phase of the precast facilities considering their role in supporting construction of Sydney Metro West and their use by the tunnelling contractors.

A summary of management and mitigation measures is included in Table 6-1.

**Table 6-1 Management and mitigation measures**

| No. | Impact | Management / mitigation measure |
|---|---|---|
| T1 | Traffic-related incidents | In the event of a traffic-related incident, coordination would be carried out with Transport Coordination and / or the Transport Management Centre's Operations Manager. |
| T2 | Emergency vehicles | Access to properties for emergency vehicles would be provided at all times. |
| T3 | Site access and egress | All trucks would enter and exit the proposal site in a forward direction, where feasible and reasonable. |
| T4 | Staff parking | All staff parking would be provided on-site and not on surrounding local streets. |
| T5 | Active transport users | The driver induction process would include safety awareness in relation to all road users, particularly pedestrians and cyclists at the proposal site access point at Archbold Road / Lenore Drive during construction. |

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# Appendix E

## Landscape and Visual Impact Assessment

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# Sydney Metro West

## Eastern Creek Precast Facilities

Landscape and visual impact assessment

October 2020

# Table of Contents

# Key terms

| Term | Definition |
|---|---|
| landscape | *'All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure.' (Transport for NSW, 2020)* |
| landscape character | The … *'combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place'. (Transport for NSW, 2020)* |
| Northern precast facility | Proposed precast facility at the north of the proposal site |
| proposal (the) | Construction of two (2) separate precast facilities, a northern and southern precast facility, each including boiler, aggregate bins and consumables, hardstand/laydown areas, offices, parking, precast carousel including batch plant, and warehouses. |
| proposal site (the) | Site located at Lenore Drive opposite Old Wallgrove Road, Eastern Creek. |
| Southern precast facility | Proposed precast facility at the south of the proposal site. |
| visual study area | Area encompassing the proposal site and immediate surrounds including the visual catchment of the proposal and areas of the landscape that provide a setting for the proposal site. |
| view | *'Any sight, prospect or field of vision as seen from a place, and may be wide or narrow, partial or full, pleasant or unattractive, distinctive or nondescript, and may include background, mid ground and/or foreground elements or features.'* (Australian Institute of Landscape Architects QLD, 2018) |
| viewpoint | *'The specific location of a view, typically used for assessment purposes.'* (Australian Institute of Landscape Architects QLD, 2018) |
| visual absorption capacity | *'The potential for a landscape or scene to absorb a particular change without a noticeable loss of valued attributes.'* (Australian Institute of Landscape Architects QLD, 2018) |

# 1. Introduction

## 1.1. Sydney Metro West Eastern Creek Precast Facilities

Sydney Metro propose to establish two precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities would manufacture precast concrete segments for lining the underground twin tunnels. A Review of Environmental Factors (REF) is to be prepared for the proposal seeking approval under Part 5 of the *Environmental Planning and Assessment 1979* (EP&A Act).

The key components of the proposal include:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate and adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
  - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
  - Boiler, aggregate bins and consumables
  - Office facilities
  - On-site parking for up to 60 light vehicles.
- Internal roads with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The northern and southern precast facilities would operate concurrently, 24 hours a day, seven days a week for the majority of the lifespan of the project. The footprint and operational layout of the proposal is shown in Figure 1-1.

## 1.2. Purpose and scope of this report

This technical paper, Technical Paper: Landscape and Visual Impact Assessment, is one of a number of technical papers that form part of the REF for the proposal. The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to landscape and visual amenity.

This report includes the following:

- A summary of the relevant legislative and policy framework
- A description of the existing landscape and visual conditions of the site and visual study area

- An assessment of impacts on the landscape
- An assessment of the daytime visual impact
- An assessment of night-time visual impact
- Identification of mitigation and management measures
- A conclusion.

## 1.3. Structure of this report

The remainder of this report is structured as follows:

- Chapter 2 provides the legislative and policy framework relevant to the proposal
- Chapter 3 documents the assessment methodology including a method for assessing the impact on the landscape, daytime views and night-time views to the proposal
- Chapter 4 details the existing environment
- Chapter 5 provides an assessment of the potential landscape and visual impacts of the proposal during construction and operation
- Chapter 6 identifies mitigation and management measures.

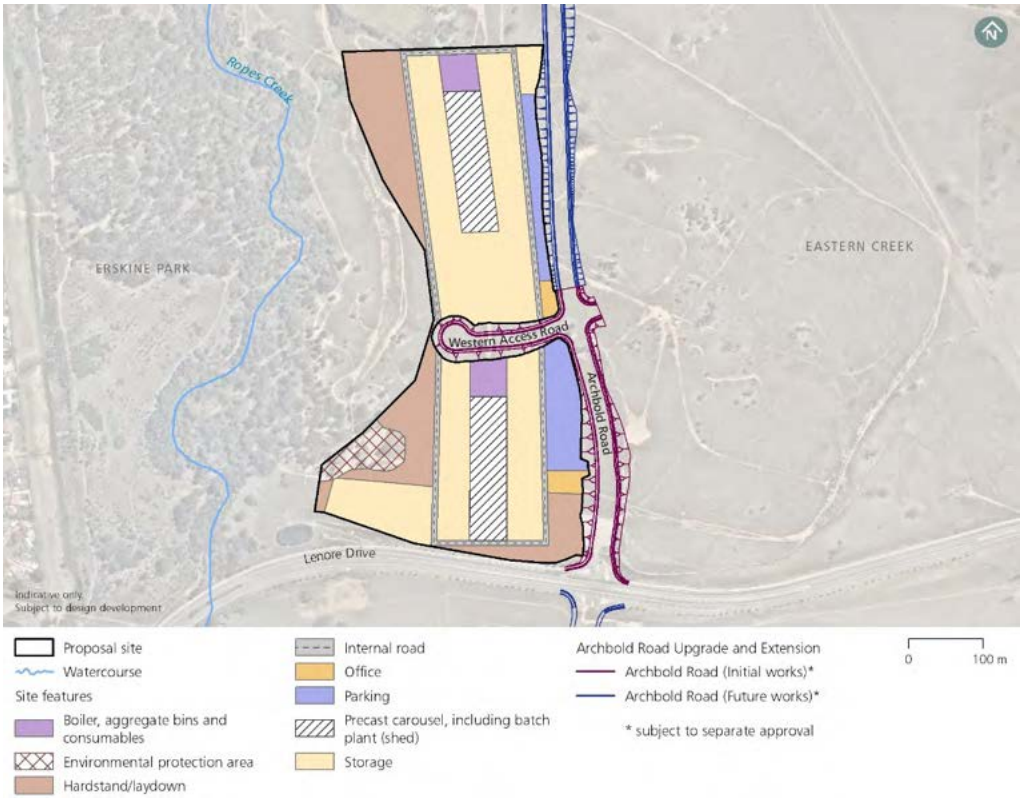


Figure 1-1 Indicative site layout

# 2. Legislative and policy framework

The following chapter provides a brief review of the State and Local Authority planning documents which provide guidance for the management of landscape character and visual amenity for the study area.

## 2.1. State legislation and planning guidance

### 2.1.1. A Metropolis of Three Cities – the Greater Sydney Region Plan, 2018

This plan sets a 40-year vision and establishes a 20-year plan to manage growth and change for Greater Sydney. It divides Greater Sydney into three regions, including the '*Western Parkland City'*, the *'Central River City'* (including Eastern Creek) and the *'Eastern Harbour City'* centred around Sydney CBD (Greater Sydney Commission, 2018a, p.6).

The role of this plan is to co-ordinate a whole-of-government approach to providing the appropriate infrastructure to support the growth of three cities. It also intends to provide a coordinated approach to district level planning.

The proposal site at Eastern Creek is located at the western edge of the '*Central River City'*, within an area identified as a *'Western Sydney Employment Area'*, between the M7 Motorway and Erskine Park (Greater Sydney Commission, 2018a, p.15).

Greater Sydney's '*green infrastructure'* including '*urban tree canopy, green ground cover, bushland, waterways, parks and open spaces'* (Greater Sydney Commission, 2018a, p.6) are identified in this plan as valued assets and several strategies in this plan relate to green infrastructure. This includes setting a target to increase tree canopy cover from the current 23 per cent to 40 per cent (Greater Sydney Commission, 2018a, Strategy 30.1, p.164). Strategy 25.1 aims to *'protect environmentally sensitive areas of waterways'* (Greater Sydney Commission, 2018a, p.151) including the South Creek Parkland Investigation area which encompasses the Ropes Creek corridor, which is located immediately to the west of the proposal site.

Objective 32 of the plan aims to connect parks, open spaces, bushland, walking and cycling paths through network of green spaces known as the Greater Sydney Green Grid. In the 'Western Parkland City vision', South Creek is identified as a 'Parkland Investigation' area and part of the green grid (Greater Sydney Commission, 2018a, p.15). The plan aims for South Creek to be a '*cool green corridor'* through the Western Parkland City which provides a *'green spine to improve amenity'* (Greater Sydney Commission, 2018a, p.17 and p.107). Ropes Creek, the M4 Motorway and the Warragamba to Prospect Water Supply Pipelines are identified as green grid opportunities (Greater Sydney Commission, 2018a, p.169).

### 2.1.2. Our Greater Sydney 2056 Central City District Plan - connecting communities, 2018

The Central City District Plan provides a 20-year plan to manage growth and provides a *'guide for implementing the Greater Sydney Region Plan, A Metropolis of Three Cities, at a district level and provides a bridge between regional and local planning*' (Greater Sydney Commission, 2018b, p.14).

The Central City District encompasses four local government areas including Blacktown, The Hills, Cumberland and Parramatta City Councils. The proposal site is located in the south western corner of the Blacktown City Council area, within the '*Western Sydney Employment Area*', adjacent to Ropes Creek, which is part of the South Creek Parkland Investigation area (Greater Sydney Commission, 2018b, p.11). Planning Priority C14 reinforces the aims identified in the Greater Sydney Region Plan, prioritising the creation of '*a Parkland City urban structure and identity, with South Creek as a defining spatial element*'. The district plan aims to create a '*cool and green parkland city*', including '*corridors of public open space and expanding the urban tree canopy*' (Greater Sydney Commission, 2018b, p.101).

Planning Priority C15 '*Protecting and improving the health and enjoyment of the District's waterways*' and aims to improve the character and '*sense of place*' of the district (Greater Sydney Commission, 2018b, p.14). In particular, objective 28 aims to protect and enhance scenic and cultural landscapes including urban bushland, parkland areas and waterways such as South Creek and its tributaries (including Ropes Creek), which contribute to the '*identity and international profile of Greater Sydney*' (Greater Sydney Commission, 2018b, p105).

Green infrastructure is planned to be increased through the delivery of green grid connections such as the '*Ropes Creek Corridor'* which aims to improve the environmental quality and enhance access to open space and recreation, including provision of walking and cycling trails (Planning Priority C16, Greater Sydney Commission, 2018b, p.108-109).

### 2.1.3. State Environmental Planning Policy (Western Sydney Employment Area) 2009 (WSEA SEPP)

The aim of this Policy is to put in place planning controls that will enable the Western Sydney Employment Area to rezone and develop the land for '*employment or environmental conservation purposes*' (NSW State Government, 2009, cl.3.2.c). A key priority is to ensure that development occurs in an '*environmentally sensitive'* manner, conserving and rehabilitating areas that have a '*high biodiversity or heritage or cultural value*' (NSW State Government, 2009, cl.3.2.f).

The proposal site is zoned IN1 General Industrial and located in the Ropes Creek Precinct (no.6). A Draft DCP has been exhibited for the Ropes Creek Precinct that includes specific objectives and development controls for this area (refer to section 2.2.1 of this technical paper).

Figure 2-1 shows the location of the WSEA SEPP land zoning for and surrounding the proposal site.

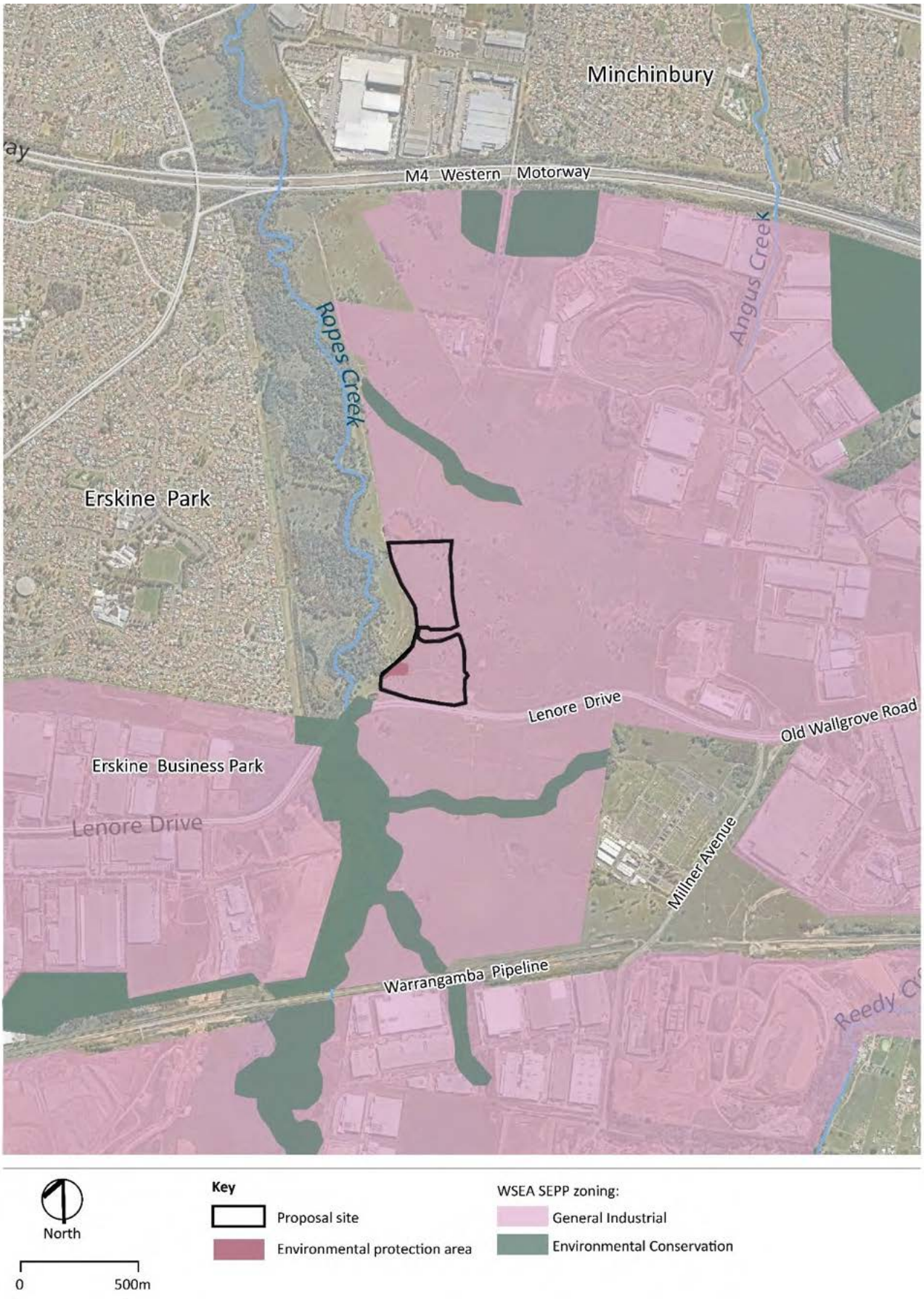


Figure 2-1 WSEA SEPP land zoning

## 2.2. Local Government planning guidance

The proposal site is located within the western part of Blacktown City Council local government area, with the boundary of Penrith City Council local government area located to the west of the proposal site along Ropes Creek. While the proposal site is exempt from the requirements of the planning documents of both the Blacktown and Penrith City Councils, they provide some useful context to the current and intended land uses of the surrounding area and therefore have been considered for the purposes of this assessment.

The following documents apply to the areas surrounding the proposal site:

- *Blacktown Local Strategic Planning Statement* (Blacktown City Council, 2020)
- *Blacktown Local Environmental Plan 2015 (*Blacktown City Council, 2015a*)*
- *Blacktown Development Control Plan 2015 (*Blacktown City Council, 2015a*)*
- *Draft Ropes Creek Development Control Plan 2016* (NSW Department of Planning & Environment, 2016)
- *Penrith Local Strategic Planning Statement* (Penrith City Council, 2020)
- *Penrith Local Environmental Plan 2010* (Penrith City Council, 2010)
- *Penrith Development Control Plan 2014* (Penrith City Council, 2014)
- *Penrith Scenic & Cultural Landscapes Study* (Penrith City Council, 2019b)

### 2.2.1. Blacktown City Council planning guidance

#### *Blacktown Local Strategic Planning Statement, 2020*

The purpose of the *Blacktown Local Strategic Planning Statement* (LSPS) is to provide a vision and strategic direction for Blacktown over the next 20 years. The LSPS recognises the role of Blacktown City as critical part of Western Sydney and seeks to achieve a future which is sustainable, liveable and productive.

The LSPS divides the Blacktown local government area into four districts, each serviced by a strategic centre, with its own economic, social and environmental characteristics. The proposal site is located in the southwestern corner of the '*Mount Druitt'* precinct which is identified as an '*employment area*' in the LSPS. The Mount Druitt precinct will provide logistics, distribution and warehousing development with connections to Sydney's arterial roads and motorway network (Blacktown City Council, 2020, p.20-21).

Blacktown City Council also places importance on the protection of '*scenic and cultural landscapes*' and is committed to an increase in '*urban tree canopy cover*' to manage urban heat through landscaping (p.70-72). It identifies the Ropes Creek corridor (west of the proposal site) as a potential green grid investigation area (p.64).

### *Blacktown Local Environmental Plan 2015*

The proposal site is located entirely within the WSEA SEPP area and therefore the provisions of the *Blacktown Local Environmental Plan 2015* (LEP) do not apply to the proposal however the LEP has been considered for guidance. The LEP generally aims *'to encourage development opportunities for business and industry so as to deliver local and regional employment growth'* (Blacktown City Council, 2015a, cl. 1.2.2d). The land to the immediate west of the proposal site is zoned Public Recreation (RE1), and land further west associated with Ropes Creek is zoned Environmental Conservation (E2) (Refer to Figure 2-2 which shows the combined Blacktown and Penrith land use zoning surrounding the proposal site).

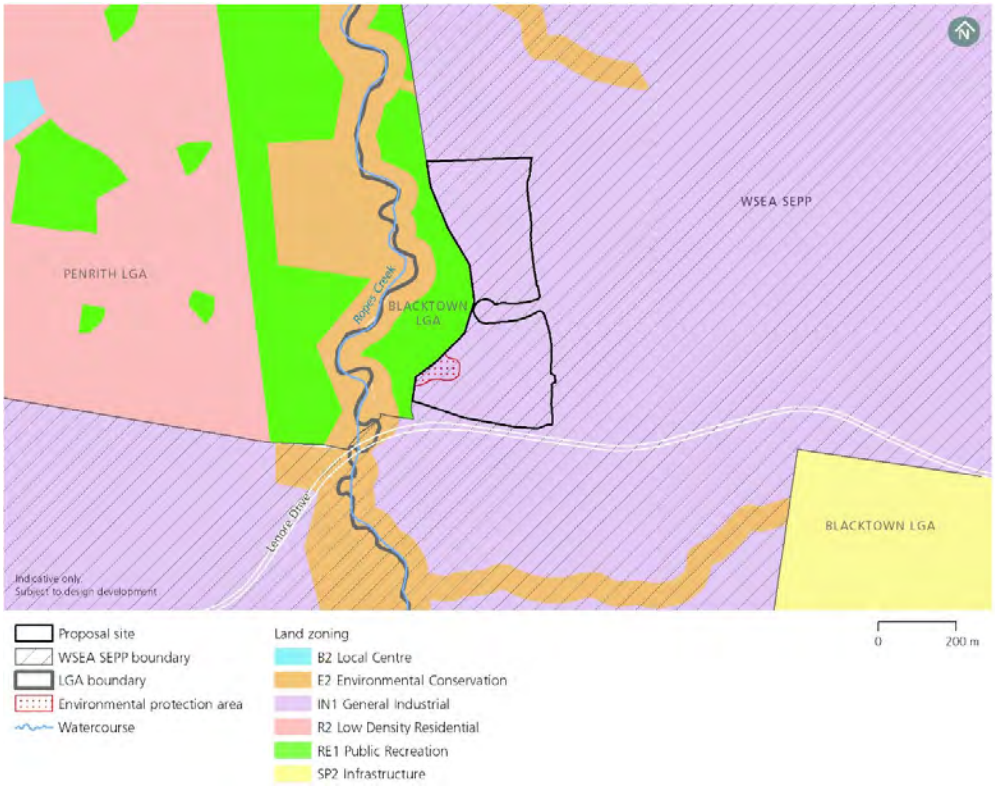


Figure 2-2 Combined Penrith and Blacktown LGA area land zoning

### *Blacktown Development Control Plan 2015*

The proposal site is located entirely within the WSEA SEPP and as such the *Blacktown Development Control Plan 2015* (DCP) is not applicable to the proposal site. However, the DCP includes more detailed provisions to guide development, ensuring that development contributes to the quality of the natural and built environments and positively responds to the character of the surrounding area.

Several design guidelines contained within the DCP are relevant, including: use of *'landscaping and other beautification works on the site's street frontages',* ensuring buildings *'present an acceptable scale and bulk when viewed from the street',* and consideration of the *'appearance of the development from elevated residential areas'*, for example through '*use of non-reflective building materials or the use of materials which blend with the landscape*' (Blacktown City Council, 2015a, PART E, s.4.1-4.3).

Other relevant design guidelines that relate to the visual amenity of new development in the industrial zone include:

- '*To complement landscaping and ensure a high standard of visual and environmental quality, Council encourages high aesthetic standards for building designs*' such as '*variations in fascia treatments, roof lines and selection of building materials*'. (Blacktown City Council, 2015a, s.4.5)
- '*Open storage areas are to be effectively screened and sealed. Such areas are to be located preferably behind buildings. No storage should occur above the height of proposed screening.'* (Blacktown City Council, 2015a, s.4.6)
- *'Ensure that car parking areas are attractive through the provision of landscaping'* (Blacktown City Council, 2015a, s.4.8)

Following the adoption of this DCP a Draft DCP was released for the Ropes Creek Precinct, which includes the proposal site. If adopted, the Ropes Creek Precinct DCP would supersede the Blacktown DCP.

### *Ropes Creek Precinct draft Development Control Plan 2016*

The *Ropes Creek Precinct draft* DCP relates to lands within the Ropes Creek Precinct of the WSEA SEPP and includes the proposal site. If this draft DCP were to be adopted, the proposal would also be exempt from the requirements of the draft DCP. Despite this, the draft DCP provides an understanding of the objectives and development controls that Blacktown City Council have developed to guide the future development in the wider Ropes Creek Precinct.

The draft DCP aims to '*promote high quality urban design outcomes*', ensure that *'development will not detrimentally affect the environment'* and that *'satisfactory measures are incorporated to ameliorate any impacts arising from the proposed development'* (NSW Government Department of Planning & Environment, 2016, cl.1.2).

The vision for the precinct is to '*support a range of industrial uses, potentially including transport depots and freight transport facilities, industrial retail outlets, warehouse or distribution centres and other industries*' (cl.2.1). The draft DCP encourages future built form in locations which are located to '*respond to the constraints of the site, including the tributaries and riparian land, and the transmission line easement*' (cl.2.1).

The draft DCP includes a concept plan (refer to Figure 2-3), which identifies potential development areas, vegetation protection zones, and a proposed road network.

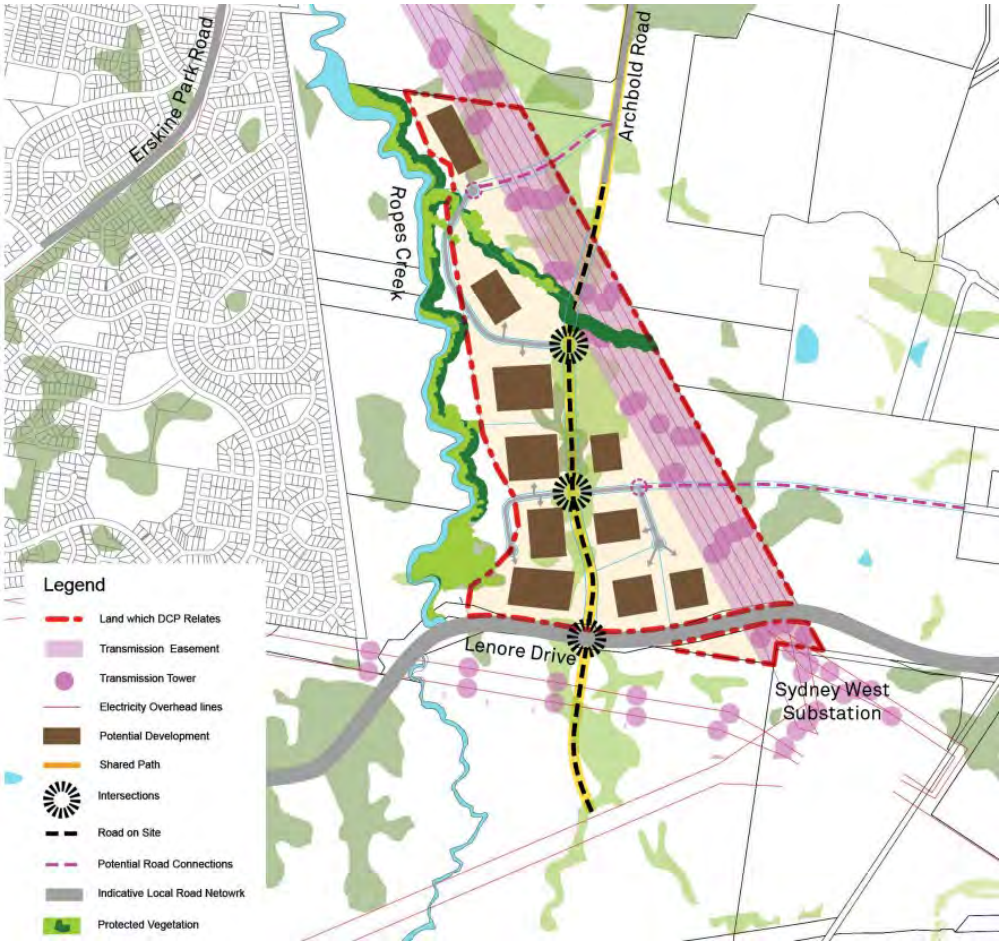


Figure 2-3 Ropes Creek Indicative Concept Plan

A range of development controls have been identified to support the concept plan. These include:

- *'Provide an internal road network that supports the role of Archbold Road as a north-south link road between Ropes Creek Precinct and the Great Western Highway' (cl.3.2)*
- *'Provide suitable separation between environmentally sensitive areas and development' (cl.3.2)*
- *'Ensure that allotments provide high quality landscape treatment within setbacks to all public roads' (cl.3.3)*
- *'Achieve the appropriate minimum building line setbacks and consistency in street frontages', including 10m from Lenore Drive and Archbold Road (cl.3.3)*
- *'Ensure that development presents an acceptable bulk and scale as viewed from adjacent sites and the public domain' and 'encourage visual interest in the design of buildings' whilst ensuring that 'any reflective materials are used with sensitivity to neighbouring development' (cl.3.3)*
- *'Development fronting Lenore Drive and Archbold Road is encouraged to provide open style fencing, which does not obstruct the view of landscaping from the street' (cl.3.3.5)*

- *'Contribute to a high quality landscape character and built form for the site' through use of hard and soft landscaping treatments, and 'retention of existing landscape elements and native vegetation' (cl.3.4)*
- *'Ensure that the alteration of ground levels does not cause a negative visual impact from more sensitive vistas' (cl.3.5)*
- *'Minimise the visual impact of development of land at higher elevations on adjacent sites or public roads at lower elevations' (cl.6.5).*

### 2.2.2. Penrith City Council planning guidance

The proposal site is located over 150 metres east of the Penrith City Council area, however, the Penrith LEP and DCP provides an understanding of the objectives and development controls that apply to the areas west of the proposal site, an area which influences the character of, and includes potential visual receptors of the proposal.

#### *Penrith Local Strategic Planning Statement, 2020*

The purpose of the *Penrith Local Strategic Planning Statement* (LSPS) is to outline Penrith's economic, social and environmental land use needs over the next 20 years. It highlights those characteristics that make the Penrith area special and outlines how growth and change will be managed into the future.

While the proposal site is located outside the Penrith local government area, the adjacent Ropes Creek corridor is partially within Penrith. This creek corridor is identified in the LSPS as a '*Significant Green Space*' (Penrith City Council, 2020, p.21). It is also part of the '*Greater Penrith to Eastern Creek Growth Area*', identified as a corridor of economic activity with the potential to capitalise on significant transport and infrastructure investment (Penrith City Council, 2020, p.31).

#### *Penrith Local Environmental Plan 2010*

A key aim of the Penrith LEP is to '*protect and enhance the environmental values*' of Penrith, including places of '*visual*' significance and to manage '*development in sensitive areas*' (Penrith City Council, 2010, cl.1.2.2). Although the proposal site is not within the Penrith LGA, Ropes Creek (adjacent to the proposal site) and land immediately west of Ropes Creek is zoned for Environmental Conservation and Public Recreation, respectively. (Refer to Figure 2-2 which shows the land use zoning surrounding the proposal site).

It also identifies Ropes Creek as having '*Land with Scenic and Landscape Values'*. The clause for the '*Protection of scenic character and landscape values'* aims to '*ensure development in these areas is located and designed to minimise its visual impact'* (cl.7.5.1b), from '*major roads and other public places'* (cl.7.5.3).

#### *Penrith Development Control Plan 2014*

There are several design principles in the *Penrith DCP 2014* DCP which provide guidance that would be relevant to Ropes Creek, which forms the boundary between Penrith and Blacktown local government areas.

The design principles that relate to the visual amenity of new development include:

- Ensuring development responds to *'the site's context, the desired scale and character of an area, and minimising impacts on key views, scenic values and where applicable, rural character'*. (Penrith City Council, 2014, PART B, s.1.2).
- Ensuring the *'building's height, bulk and scale will avoid or minimise negative impacts on an area's landscape, scenic or rural character'* (Penrith City Council, 2014, PART B, s.1.2.3b)
- To '*protect and enhance native vegetation for its scenic values and to retain the unique visual identity of the landscape'* (Penrith City Council, 2014, PART C2, 2.1B).

A number of '*key precincts*' have been identified within the Penrith LGA, which have unique characteristics or development potential that warrant development of specific controls. The proposal site is located about 200 metres from the northern area of the '*E6 Erskine Business Park*' precinct. Several design objectives for this precinct relate to the visual amenity, including to minimise the '*impact of development on views from adjoining residential areas'* and '*ensure a scale of buildings which minimises the impact of development on adjoining residential areas'* (Penrith City Council, 2014, PART E6, 6.3.1). It also identifies Ropes Creek as a '*Biodiversity Conservation Area'* and requires a 10 metre setback of development from this area (Penrith City Council, 2014, PART E6, s. 6.3.3).

*Penrith Scenic and Cultural Landscapes Study*

The purpose of this document is to identify, protect and manage Penrith's scenic and cultural landscapes. Eight broad landscape character units were identified in the Penrith local government area, based on characteristics such as landform, land use and vegetation cover. The proposal site is adjacent to the '*Central Urban Area*', which includes Ropes Creek. The Ropes Creek corridor is identified as a '*valued green corridor'* that breaks up the urban area (Penrith City Council, 2019b, p.12). Views of Ropes Creek corridor, including from the Main Western Rail Line, M4 and Great Western Highway, are identified as an important element of the '*Central Urban Area'* (Penrith City Council, 2019b, p.33).

There are no '*highly visually sensitive landscapes'* or '*significant landscapes*' near the site (Penrith City Council, 2019b, p.43), nor are there any '*major viewpoint locations'*, '*important regional vistas and view corridors'* or '*visually important tree stands'* (Penrith City Council, 2019b p.29, 34). The proposal may be visible from the M4 but would not obstruct the '*scenic and green break views'* to the Ropes Creek Corridor from this location (Penrith City Council, 2019b p.29). The proposal would, however, be visible from the '*major ridgeline*' running north-south through Erskine Park, about one kilometre west of the site (Penrith City Council, 2019b p.29). This ridge is not identified as a major viewpoint location or part of any view corridor, however, views from this location have been considered within this assessment.

# 3. Assessment methodology

## 3.1. Overall assessment approach

This assessment identifies the landscape and visual impacts of the proposal during construction and operation. The process of the assessment involved the following steps:

- Identification of the existing landscape and visual conditions of the proposal site and visual study area
- An assessment of potential landscape impact during construction and operation
- An assessment of the potential daytime visual impact during construction and operation
- An assessment of potential night-time visual impact during construction and operation
- Identification of mitigation and management measures.

These steps are described in the following sections.

## 3.2. Existing environment

The existing environment has been described in terms of the key landscape and visual features of the proposal site and visual study area. The visual study area extends to include the areas from which the proposal may be seen and any landscape features that are important to the landscape character and functioning of the proposal site.

The proposal site was visited during April and June 2020, and the existing character, landscape elements and views were recorded with photographs.

## 3.3. Landscape impact assessment

Landscape as defined by Transport for NSW (2020) is … '*All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure*.' It also defines landscape character as the … '*combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place'*.

The landscape assessment was carried out by identifying the sensitivity of the landscape, and the likely magnitude of change expected as a result of the proposal. These factors were combined to make an overall assessment of the level of impact.

### 3.3.1. Landscape sensitivity

Landscape sensitivity refers to the value placed on a landscape and the level of service it provides to the community. The sensitivity of a landscape may reflect the frequency and volume of users. It may also reflect other valued characteristics such

as tranquillity, visual relief and contribution to microclimate. The value of landscapes is often described in local and NSW Government masterplans and planning guidance documents, reflecting the importance of landscape resources to the local, regional and state-wide community.

Landscape sensitivity in this assessment is therefore considered in the broadest possible context (refer to Table 3-1), from those landscapes of national importance through to those considered to be landscapes of neighbourhood importance.

Table 3-1 lists the landscape sensitivity levels that applies to this assessment.

Table 3-1: Landscape sensitivity levels

| Landscape sensitivity | Description |
|---|---|
| National | Landscape feature protected under national legislation or international policy, e.g. the World Heritage Listed Parramatta Park. There are no nationally sensitive landscapes within this assessment. |
| State | Landscape feature that is heavily used and/or is iconic to the State, e.g. Sydney Olympic Park stadium plaza. There are no state sensitive landscapes within this assessment. |
| Regional | Landscape feature that is heavily used and valued by residents of a major portion of a city or a non-metropolitan region, e.g. Prospect Reservoir, Sydney Motorsport Park. There are no regionally sensitive landscapes within this assessment. |
| Local | Landscape feature valued and experienced by concentrations of residents and/or local recreational users. Provides a considerable service to the community, for example, it provides a place for local gathering, recreation, sport, street use by cafes and/or shade and shelter in an exposed environment. Local examples include Ropes Creek or Peppertree Reserve, Erskine Park. |
| Neighbourhood | Landscape feature valued and appreciated primarily by a small number of residents e.g. street trees in a local street. Provides a minor service to the community, for example, it provides a seat or resting place, passive recreation and/or some shade and shelter in a local street. |

### 3.3.2. Magnitude of change to the landscape

The changes to the landscape that would occur as a result of the proposal are assigned a magnitude of change level. This considers direct impacts on the landscape such as the removal of trees and tree canopy, open space and public realm areas, as well as indirect impacts, such as changes to the function of an area of open space or the public realm. The magnitude of change can result in adverse or beneficial effects.

Table 3-2 lists the magnitude of change levels that have been used in this assessment.

Table 3-2: Landscape magnitude of change levels

| Magnitude of change | Description |
|---|---|
| Considerable reduction or improvement | Substantial portion of the landscape is changed.<br>This may include substantial changes to vegetation cover (trees and canopy), landform, the area of open space, accessibility, permeability, legibility and wayfinding, comfort and amenity, activation and safety, and diversity of the public realm. |
| Noticeable reduction or improvement | A portion of the landscape is changed.<br>This may include some alteration to vegetation cover (trees and canopy), landform, the area of open space, accessibility, permeability, legibility and wayfinding, comfort and amenity, activation and safety, and diversity of the public realm. |
| No perceived reduction or improvement | Either the landscape quality is unchanged or if it is, it is largely mitigated by public realm improvements.<br>Does not alter or not noticeably alter the vegetation cover (trees and canopy), landform, the area of open space, accessibility, permeability, legibility and wayfinding, comfort and amenity, activation and safety, and diversity of the public realm. |

## 3.4. Daytime visual impact assessment

This visual impact assessment considers visual amenity as experienced by various people and aims to identify the range of views to the site which may be impacted, including views from adjacent roads, residential and industrial areas.

Views are selected to represent the existing visual conditions and range of views to the proposal site. For each representative view, the existing features and character of the view is described, and a sensitivity level assigned. The magnitude of change that would result from the proposal is then described. These factors are then combined to determine an overall level of impact.

### 3.4.1. Identification of existing visual conditions

Viewpoints were selected to represent the range of views to the proposal site. These views are from the public domain (available to the public) and from a range of locations and viewing situations. Particular attention was paid to views from places where viewers are expected to congregate such as near schools, parks and major road corridors.

### 3.4.2. Visual sensitivity

Visual sensitivity reflects the nature, quality and duration of views. Views which would be experienced for a longer duration, where there are higher numbers of potential viewers and where visual amenity is important to viewers can generally be regarded as having a higher visual sensitivity. In addition, views recognised by local, state or federal planning regulations would, by nature of their recognition in these documents, have a higher visual sensitivity.

The sensitivity of the representative viewpoints has been considered in the broadest context of possible views, from those of national importance through to those considered to have a neighbourhood visual importance (refer to Table 3-3).

Table 3-3: Visual sensitivity levels – daytime

| Visual sensitivity | Description |
|---|---|
| National | Heavily experienced view to a national icon, e.g. view to the Sydney Opera House from Circular Quay or Lady Macquarie's Chair. There are no nationally sensitive views within this assessment. |
| State | Heavily experienced view to a feature or landscape that is iconic to the State, e.g. views to Old Government House from within Parramatta Park. There are no state sensitive views within this assessment. |
| Regional | Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or an important view from an area of regional open space, e.g. view from George Maunder Lookout over Prospect Reservoir. There are no regional sensitive views within this assessment. |
| Local | High quality view experienced by concentrations of residents and/or local recreational users, local commercial areas and/or large numbers of road or rail users. Views with local visual features and/or landmarks. |
| Neighbourhood | Viewers whose interest is not specifically focused on views e.g. workers. Views where visual amenity is appreciated by a small number of isolated residents, not particularly valued by the wider community. |

### 3.4.3. Magnitude of change to views

The magnitude of change describes the extent of change that would result from the proposal and the visual compatibility of these changes within the surrounding landscape. There are some general principles which determine the ranking of magnitude of change which include factors relating to the view itself such as distance, landform, backdrop, enclosure and contrast. The characteristics of the proposal are also considered, such as scale, form, line, shape, pattern, colour or texture. The magnitude of change can result in an improvement or reduction in visual amenity.

A high magnitude of change would result if the proposal contrasts strongly and is not compatible with the existing landscape. A low magnitude of change occurs if there is minimal visual contrast and a high level of integration of form, line, shape, pattern, colour or texture between the development and the environment in which it is located.

Table 3-4lists the terminology used to describe the magnitude of change levels.

Table 3-4: Visual magnitude of change levels – daytime

| Magnitude of change | Description |
|---|---|
| Considerable reduction or improvement | A substantial part of the view is altered.<br>The proposal is not compatible and / or contrasts substantially with the surrounding landscape. |
| Noticeable reduction or improvement | A small to moderate part of the view is altered.<br>The proposal contrasts with the surrounding landscape. |
| No perceived reduction or improvement | Either the view is unchanged or if it is, the change in the view is unlikely to result in a change in the amenity of the view.<br>The proposal does not contrast with the surrounding landscape. |

## 3.5. Night-time visual impact assessment

The assessment of night-time impact has been carried out with a similar methodology to the daytime assessment. However, the assessment also draws upon the guidance contained within AS4282 *Control of the obtrusive effects of outdoor lighting* (2019) (AS4282).

AS4282 identifies four main potential effects of lighting, which are, the effects on residents, transport system users, transport signalling systems and astronomical observations. Of relevance to this assessment is the effects of lighting on the visual amenity of residents and transport system users.

AS4282 identifies environmental zones which are useful for categorising night-time landscape settings. The following assessment will use these environmental zones to describe the existing night-time visual condition and assign a sensitivity to these settings.

### 3.5.1. Night-time visual sensitivity

The environmental zone (defined in AS4282) which best describes the existing night-time visual condition of the site has been selected. These zones are typical night-time settings and reflect the predominant light level of the site and visual study area. Each environmental zone is assigned a level of sensitivity as described in Table 3-5.

Table 3-5: Environmental zone sensitivity – night-time

| | Environmental Zones (source: AS4282:2019) | |
|---|---|---|
| Sensitivity level | Description | Examples |
| Very high | A0: Intrinsically dark | UNESCO Starlight Reserve<br>IDA Dark Sky Parks<br>Major optical observatories<br>No road lighting – unless specifically required by the road controlling authority |
| High | A1: Dark | Relatively uninhabited rural areas<br>No road lighting – unless specifically required by the road controlling authority |
| Moderate | A2: Low district brightness | Sparsely inhabited rural and semi-rural areas |
| Low | A3: Medium district brightness | Suburban areas in towns and cities |
| Negligible | A4: High district brightness areas<br>TV: High district brightness | Town and city centres and other commercial areas<br>Residential areas abutting commercial areas |

### 3.5.2. Night-time visual magnitude of change

Following the sensitivity assessment, the magnitude of change that would be expected within the visual study area at night is then identified. These changes are described, as relevant, in terms of:

- *Sky glow – which is the brightening of the night sky*
- *Glare – condition of vision in which there is discomfort or a reduction in ability to see*
- *Light spill – light emitted by a lighting installation that falls outside of the design area.*

Table 3-6 lists the categories used to describe the visual magnitude of change at night.

Table 3-6: Visual magnitude of change levels – night-time

| Magnitude of change | Description |
|---|---|
| Considerable reduction or improvement | Substantial change to the level of skyglow, glare or light intrusion would be expected.<br>The lighting of the proposal would contrast substantially with the surrounding landscape at night. |
| Noticeable reduction or improvement | Alteration to the level of skyglow, glare or light intrusion would be clearly visible.<br>The lighting of the proposal would contrast with the surrounding landscape at night. |
| No perceived reduction or improvement | Either the level of skyglow, glare and light intrusion is unchanged or if it is altered, the change is generally unlikely to be perceived by viewers or compatible with the intended future use of the area. |

## 3.6. Assigning impact levels

An assessment of landscape and visual impact has been made by combining the landscape or visual sensitivity and landscape or visual magnitude of change levels for each element and assigning an impact level (refer to Table 3-7). Assessment of night-time visual impact has been made by combining the visual sensitivity of the environmental zone with the night-time visual magnitude of change for each area generally and assigning an impact level (refer to Table 3-8).

**Table 3-7: Landscape and visual impact levels – daytime**

| | | Sensitivity | | | | |
|---|---|---|---|---|---|---|
| | | National | State | Regional | Local | Neighbourhood |
| Magnitude of change | Considerable reduction | Very high adverse | Very high adverse | High adverse | Moderate adverse | Minor adverse |
| | Noticeable reduction | Very high adverse | High adverse | Moderate adverse | Minor adverse | Negligible |
| | No perceived change | Negligible | Negligible | Negligible | Negligible | Negligible |
| | Noticeable improvement | Very high beneficial | High beneficial | Moderate beneficial | Minor beneficial | Negligible |
| | Considerable improvement | Very high beneficial | Very high beneficial | High beneficial | Moderate beneficial | Minor Beneficial |

**Table 3-8: Visual impact levels - night-time**

| | | Sensitivity | | | | |
|---|---|---|---|---|---|---|
| | | Very high | High | Moderate | Low | Negligible |
| Magnitude of change | Considerable reduction | Very high adverse | Very high adverse | High adverse | Moderate adverse | Minor adverse |
| | Noticeable reduction | Very high adverse | High adverse | Moderate adverse | Minor adverse | Negligible |
| | No perceived change | Negligible | Negligible | Negligible | Negligible | Negligible |
| | Noticeable improvement | Very high beneficial | High beneficial | Moderate beneficial | Minor beneficial | Negligible |
| | Considerable improvement | Very high beneficial | Very high beneficial | High beneficial | Moderate beneficial | Minor Beneficial |

The impacts identified for construction of the proposal would be experienced temporarily and those identified for operation of the proposal would be experienced for the duration of operation.

## 3.7. Avoidance and minimisation of impacts

Measures to mitigate potential impacts have been identified, including opportunities for mitigation on and off site, both day and night.

# 4. Existing environment

## 4.1. Proposal site

The proposal site is situated to the north of Lenore Drive in Eastern Creek. The site slopes from a small ridge to the east of the proposal site, west towards Ropes Creek in the west (refer to Figure 4-1).

The proposal site has been extensively cleared of its original vegetation, which would have included eucalypt, spotted gum and ironbark species typical of the Cumberland Plain Woodland group. While it is largely undeveloped, the proposal site shows evidence of unauthorised recreational off-road driving and motorcycling, as evidenced by the extensive network of tracks. Prior to this the proposal site would have been used for agricultural purposes.

The proposal site would be accessed via the proposed upgrade and extension of Archbold Road (subject to a separate approval), that on full completion would connect Lenore Drive to the Great Western Highway in the north, at Minchinbury. This new road would be located along the eastern boundary of the proposal site and include a Western Access Road between the northern and southern precast facilities (refer to Figure 1-1).

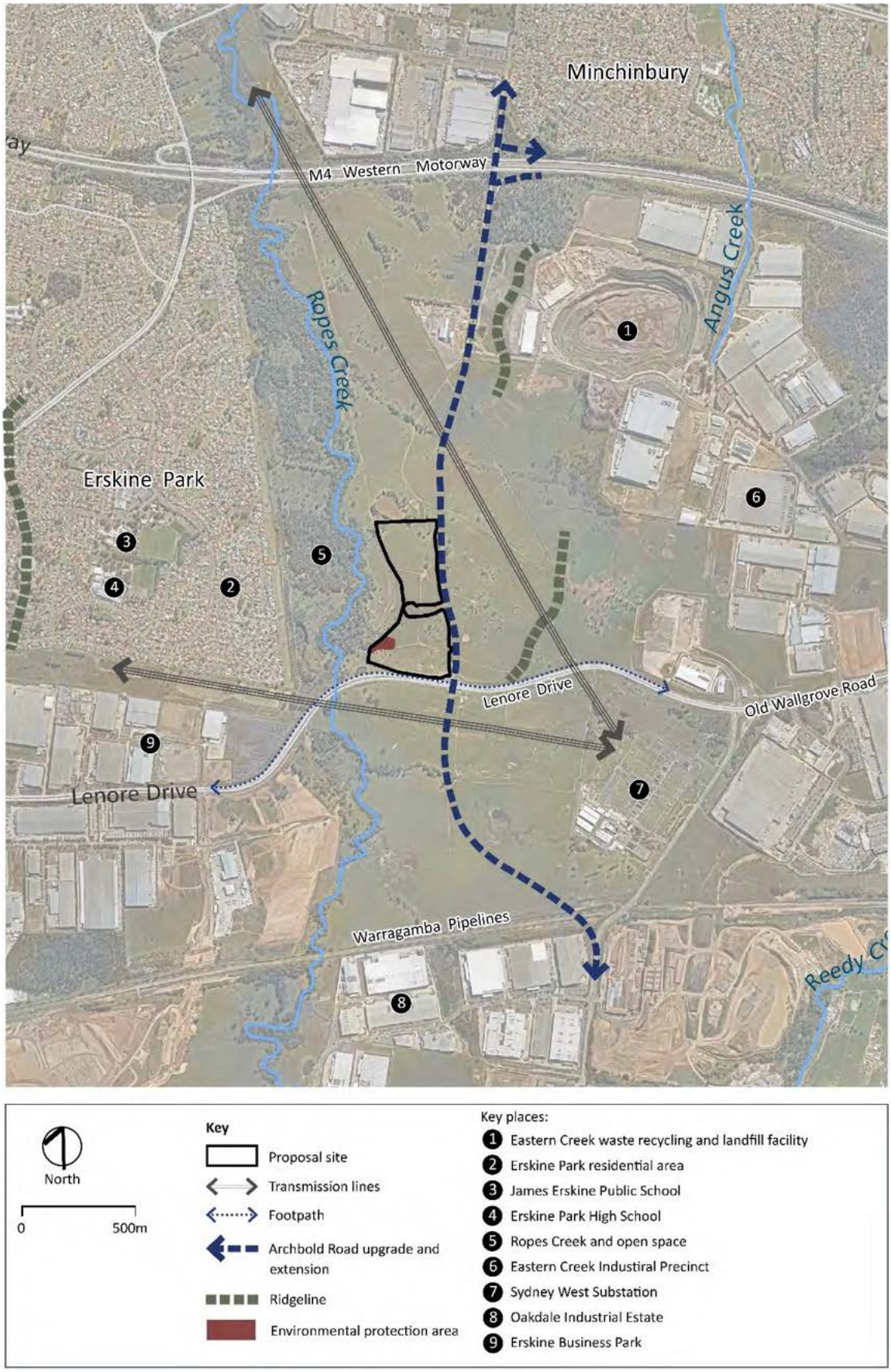


Figure 4-1 Landscape and visual features of the proposal site and surrounds

## 4.2. Visual study area

The landform surrounding the site is gently undulating, consisting of a series of hills and valleys created by South Creek and its tributaries (refer to Figure 4-2). A locally prominent ridgeline runs north to south, about 200 metres to the east of the proposal site. The landform falls from this ridge towards Ropes Creek which is located about 100 to 200 metres to the west of the proposal site. Ropes Creek is zoned for public recreation and environmental conservation (under the *Blacktown LEP 2015*) and is intended to be developed as a regional open space corridor. It is understood public access to this area is not currently formally available. This bushland area along the creek is relatively low-lying and provides a green buffer between the site and the residential area of Erskine Park.

This residential area is located about 375 metres to the west of the proposal site, and includes mainly low density lots on landform which rises to another local highpoint where there is a school, sporting fields and open space reserves (refer to Figure 4-1).

To the north, east and south of the proposal site, are the future industrial and commercial area of the WSEA. This area includes a wide transmission easement with several rows of transmission towers (lattice pylons) crossing the landscape in a north-south direction and connecting to the Sydney West substation to the south-east of the proposal site. The proposal site is surrounded by several industrial areas including, a working quarry and the Eastern Creek Industrial area about 700 metres to the east, the Oakdale Industrial Estate about one kilometre to the south, and Erskine Business Park about 500 metres to the south-west . These industrial areas include a range of large-scale warehouses and distribution centres with office premises.

The M4 Western Motorway is a major east west road corridor, located about 1.5 kilometres to the north of the proposal site. Lenore Drive and Old Wallgrove Road, located on the southern boundary of the Proposal site, is an east west route connecting west from the Westlink M7 (refer to Figure 4-1.

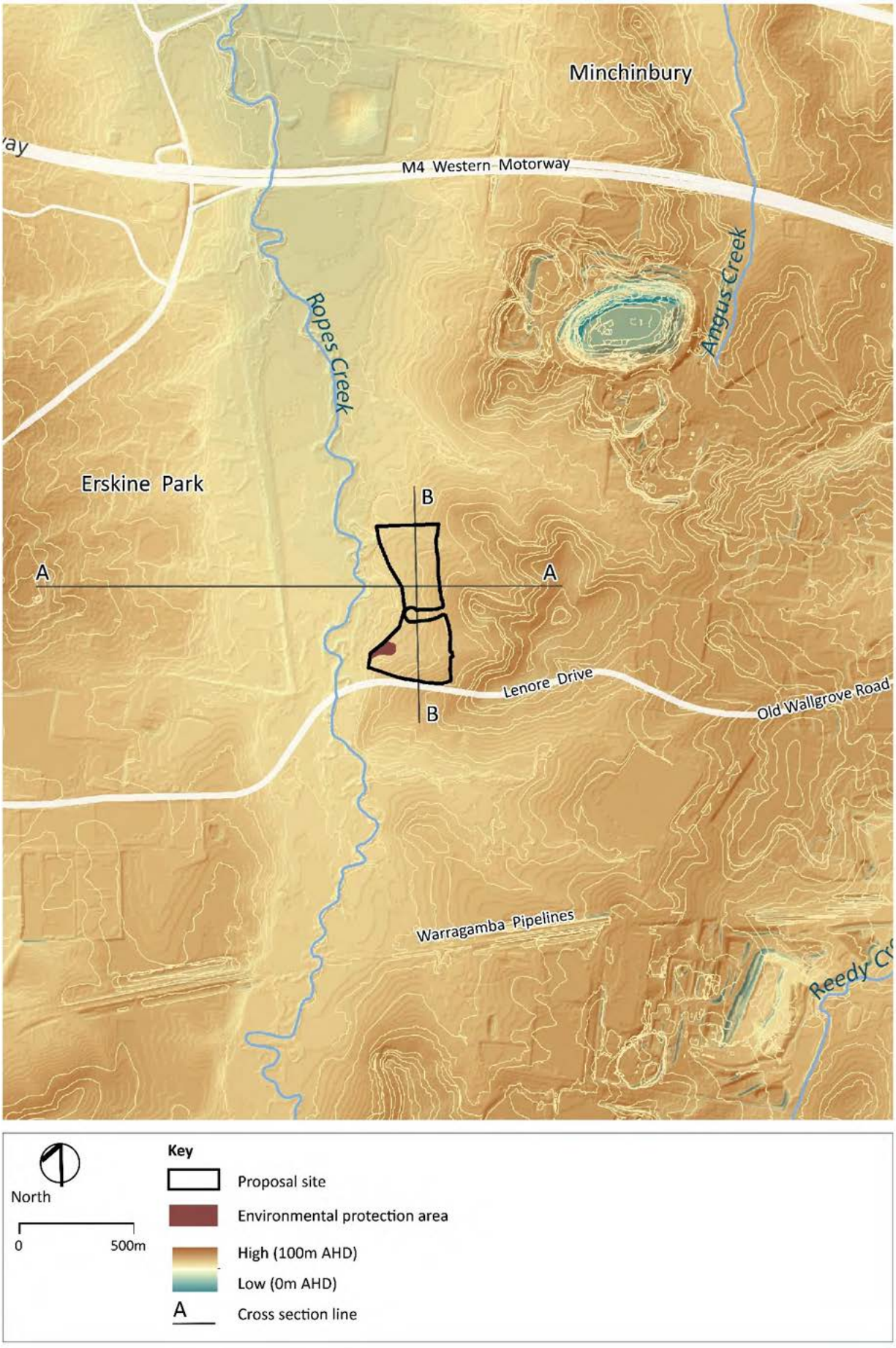


Figure 4-2 Topography

# 5. Impact assessment

The following section provides an assessment of the impact of the proposal on the landscape of the proposal site and surrounds (refer to Table 3-7for impact levels).

## 5.1. Key assumptions

The following assumptions have informed this landscape assessment:

During construction:

- There would be earthworks required to form a series of large flat areas to accommodate the proposal
- All vegetation would be removed within the proposal site except for an area of riparian vegetation in the south-west (in the environmental protection area)
- Heavy vehicles would travel east of the proposal site along haulage routes including Lenore Drive, Old Wallgrove Road and Westlink M7
- Construction would generally occur during standard work hours (7am to 6pm Monday to Friday, 8am to 1pm Saturday, with no work on Sundays or during public holidays).

During operation:

- Sheds would enclose the pre-cast carousel and batch plant and be about eight to 10 metres tall
- The existing mound on the Lenore Drive frontage would be retained
- Concurrent operations of the northern and southern facilities has been assumed for the purposes of the assessment
- The proposal would operate 24 hours a day, seven days a week (i.e. day-time and night-time).

The cross-sections through the proposal site (refer to Figure 5-1 and Figure 5-2), illustrate the spatial relationship between elements within the proposal site and the relationship with adjacent uses.

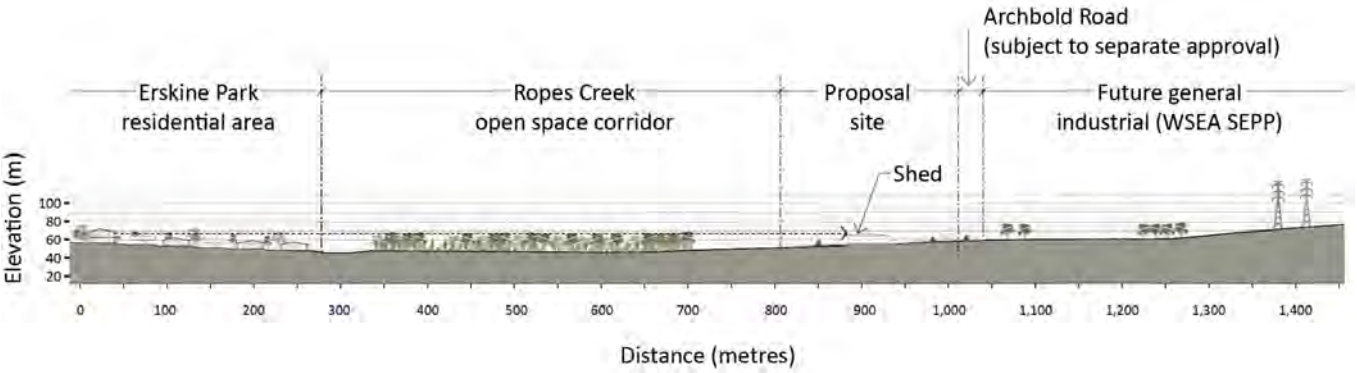


Figure 5-1 East-west cross section (A-A)

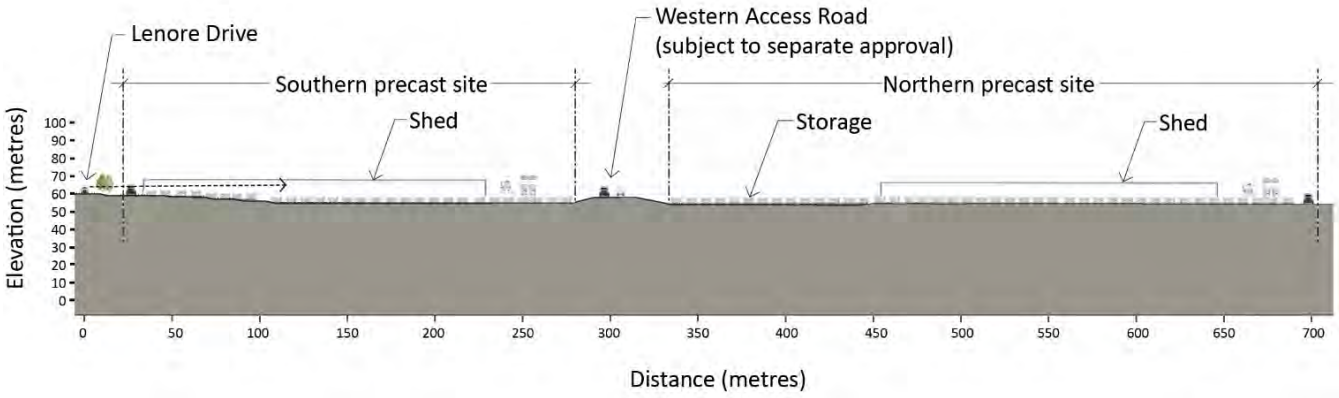


Figure 5-2 North-south cross section (B-B)

## 5.2. Landscape impact assessment

### 5.2.1. Impacts on the proposal site

Existing conditions: The proposal site has an open, undulating character with numerous tracks across the proposal site which appear to be informally used for unauthorised recreational off-road driving and motorcycling. There is no authorised public access to the proposal site. There are no buildings or structures on the proposal site, and there are some scattered trees as well as an area of the Coastal Valley Grassy Woodlands, an environmental protection area associated with Ropes Creek, which extends into the south east corner of the proposal site.

Sensitivity: The proposal site is not open to public use, however, there are some unauthorised recreational uses taking place on the site which likely attracts users from across the local area. The site is located adjacent to the Ropes Creek corridor, which encompasses *'land with scenic and landscape values'*; however, the site does not include any identified valuable scenic areas. An area of the Coastal Valley Grassy Woodlands does extend into the proposal site area and has been designated as an environmental protection area. Overall, the site has a **neighbourhood landscape sensitivity**.

Landscape impact during construction: While the vegetation within the environmental protection area in the south west of the proposal site would be retained, all other existing vegetation within the proposal site would be removed. Earthworks would be carried out across the proposal site and the landform would be shaped and levelled to create platforms to accommodate the northern and southern precast facilities and internal access roads.

Construction activities would include works to install sheds and canopies, and areas of levelled hardstand for segment storage, laydown and car parking areas.

Lenore Drive and the upgraded and extended Archbold Road (when completed by others) would be used for site access. A temporary haul road would be used prior to the completion of Archbold Road works. Heavy machinery and vehicles would be seen approaching the proposal site, loading and unloading equipment and buildings materials.

The proposal site and surrounding land to the north, south and east is zoned IN1 General industrial (under the WSEA SEPP) and would be expected to have a future character that would include large scale warehouses, depots and storage facility buildings.

The proposal site would be transformed from a predominantly open landscape to a working construction site. However, the earthworks and vegetation removal would be relatively minor, and the scale of the construction activities would be generally consistent with the adjacent working industrial areas to the east. Overall, there would be a noticeable reduction in the quality and character of this landscape, which is of neighbourhood sensitivity, and a **negligible landscape impact** during construction. Notwithstanding this, potential impacts during construction would be temporary in nature.

Landscape impact during operation: During operation, the proposal would transition from a construction site into a working industrial site with the northern and southern precast facilities operating side by side.

The proposal would include several large-scale industrial features, which would change the overall character of proposal site, including sheds, mobile gantry cranes and laydown and concrete segment storage areas. Concrete segment storage areas would include multiple stacked piles of concrete segments which would rise as they are stockpiled and then be progressively removed from proposal site.

While the sheds enclosing the precast plants would have a large footprint and visual bulk, they would be generally consistent with the large scale of the built form at nearby industrial sites at Eastern Creek. The movement of gantry cranes and loading of concrete segments onto trucks for transportation would activate the proposal site with continuous activity and movement above the proposal site. Heavy vehicles would also be seen along Lenore Drive and the identified haulage routes and also moving around the proposal site.

The introduction of two precast facilities and supporting infrastructure would change the landscape character from what currently exists, however, given the highly modified landscape character and desired future character of Ropes Creek precinct, the proposal would be consistent with the expected character of general industrial uses which is identified for the site in WSEA SEPP. Overall, there would be a noticeable reduction in the landscape character of the site, which is of neighbourhood landscape sensitivity, and a **negligible landscape impact** during operation.

## 5.3. Visual impact assessment

### 5.3.1. Impacts on daytime views

While the proposal site is somewhat open, it has a relatively limited visual catchment due to the local landform and vegetation within the visual study area.

A ridgeline to the east of the proposal site blocks views from the industrial areas in the east, which in turn limits broader views to the proposal site from further to the east.

Views across the proposal site from Lenore Drive are limited due to this ridgeline and some localised mounding along the road. There is a glimpsed view into the proposal site from the intersection of Lenore Drive and the future upgraded and extended Archbold Road, where there is a break in the mounding. Apart from this section of Lenore Drive, views from the south are limited, due to the lack of access in this location, including Sydney West Substation, transmission easements and privately owned vacant land.

The existing vegetation along Ropes Creek screens views from lower lying open space and residential areas to the east. The nearest residential properties are about 375 metres west of the proposal site, along Weaver Street and Pollux Close, in Erskine Park. These properties overlook Ropes Creek corridor, which would block

views to the ground level of the proposal site. The proposal site is likely to be visible, however, in the background of views from the more elevated residential areas to the west at Erskine Park, including properties to the west of Swallow Drive (about 675 metres from the proposal) and in the vicinity of Aquarius Crescent (about 775 metres from the proposal).

Views to the proposal site from the M4 Western Motorway, located about 1.5 kilometres to the north of the proposal site would be limited by intervening vegetation, landform and this distance.

Based on this analysis, the following viewpoints were selected as representative of views to the proposal:

- Viewpoint 1: View south from the M4 Western Motorway
- Viewpoint 2: View south-west from Hanson Place
- Viewpoint 3: View north-west from future upgraded and extended Archbold Road / Lenore Drive intersection
- Viewpoint 4: View north-east from Lenore Drive at the Ropes Creek crossing
- Viewpoint 5: View east from Aquarius Crescent, Erskine Park
- Viewpoint 6: View east from Park on Sennar Road, Erskine Park.

Figure 5-5 shows the location of the viewpoints.

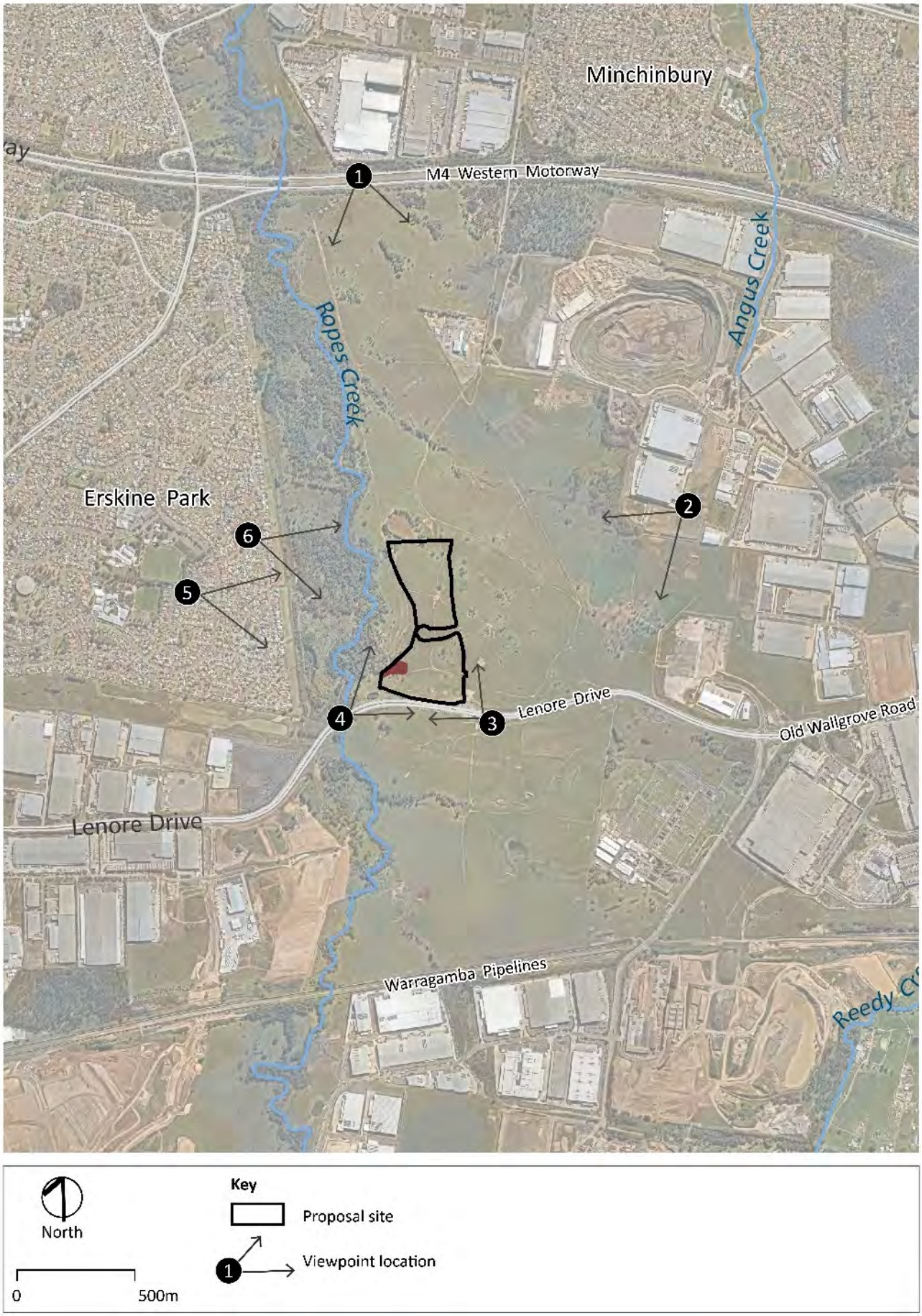


Figure 5-3 Viewpoint location plan

#### 5.3.1.1. Viewpoint 1: View south from the M4 Western Motorway


Figure 5-4 Viewpoint 1: View south from the M4 Western Motorway

Existing conditions: This view is appreciated at speed by a large volume of road users travelling along the M4 Western Motorway. The surrounding landform is generally flat and low lying, typical of the floodplain surrounding Ropes Creek. The mature vegetation south of the road (centre of view) follows the creek and screens views into the residential areas of Erskine Park. The proposal site is located about 1.5 kilometres to the south of the motorway (left of view). A cluster of five large scale transmission line pylons can be seen in the centre of this view, forming a wide corridor of transmission lines which cross the motorway and traverse the plains beside Ropes Creek. These lines continue south towards the Sydney West Substation which is located to the south-east of the proposal site.

Sensitivity: Views from the M4 Western Motorway would be experienced by a large volume of road users moving along the highway at speed. Vegetation alongside the highway in this view is identified as having '*scenic and landscape values*' (Penrith City Council, 2010) and is zoned for environmental conservation (NSW State Government, 2009). The scenic qualities of this view are, however, considerably eroded by the visually prominent large-scale transmission infrastructure. Overall, this view is of **local visual sensitivity**.

Visual impact during construction: The proposal site would be located about 1.5 kilometres to the south of the motorway. Due to the distance and intervening vegetation and landform, views to the construction work would be limited. Any glimpses to the construction works would include the upper portions of the works to construct the sheds and other taller structures. These elements would be in the background of this view and glimpsed for a short duration from a vehicle. The

sequence of views along this motorway includes glimpses to other large-scale infrastructure and industrial development so that any visibility of the proposal site is likely to be absorbed into the character of this landscape.

Overall, due to the distance and visual compatibility of the construction work with the character of this emerging industrial precinct, there would be no perceived change in the amenity of this view. This is a view of local sensitivity and there would be a **negligible visual impact** from this location.

Visual impact during operation: The proposal may be visible in the background of this view, with the upper section of the taller elements potentially being seen in glimpsed views from the motorway. This would include the upper part of the sheds, silos and possibly the movement of gantry cranes shifting the precast segments. The vegetation along the creek in the vicinity of the motorway would remain and continue to contain views in this section of the view. Any glimpsed view would be seen for a short duration in a view that contains large scale power infrastructure and industrial development.

Due to the distance and compatibility of the proposal with the future desired character of the Ropes Creek Precinct, which is zoned for '*general industrial*' use (NSW State Government, 2009), there would be no perceived change in the amenity of this view. This is a view of local sensitivity and there would be a **negligible visual impact**.

#### 5.3.1.2. Viewpoint 2: View southwest from Hanson Place


**Figure 5-5 Viewpoint 2: View southwest from Hanson Place**

Existing conditions: The middle ground of this view includes a ridgeline which conceals the proposal site. A corridor of transmission lines with multiple large-scale lattice pylons can be seen on this ridgeline, rising above the horizon and viewed amongst existing trees. The trees located along this ridge, and in the middle ground of this view, provide further filtering of views towards the site.

The view is more open to the south, (left and centre of view) where it has an industrial character, with existing industrial buildings on Old Wallgrove Road in the middle ground of the view, the Transgrid Sydney West Substation and the industrial areas of the Oakdale Industrial estate in the background. Beyond this industrial development there is a vegetated backdrop which encloses the view.

Sensitivity: Views from this location would generally be experienced by staff and visitors within the industrial estate. This is a highly modified view which includes several industrial uses and power infrastructure and therefore is considered to have a **neighbourhood visual sensitivity**.

Visual impact during construction: The precast facility site would be located about 900 metres to the southwest of this location, located mostly behind the ridgeline. Therefore, views to the ground level works, including site preparation and earthworks would not be seen from this location due to this intervening landform. Tall equipment used at the construction site, including cranes used to install the precast batch plants, boilers and sheds, may be visible rising above the ridgeline, however, these views would be filtered by patches of regrowth native trees along the ridgeline in the middle ground of view. These elements would also be seen in the context of a backdrop of industrial land uses, and the foreground which is zoned for future industry.

Overall, there is a limited visibility to the proposal site and a high visual absorption capacity for the proposed construction activity due to the existing industrial scale uses and presence of existing power infrastructure. This would result in a noticeable reduction in the amenity of this view, which is of neighbourhood visual sensitivity, and a temporary **negligible visual impact** during construction.

Visual impact during operation: The upper part of the stacked piles of concrete segments may be seen from this location, surrounding the precast shed which would include gantry cranes and sheds, boilers, aggregate bins and silos. These elements would be partly screened by the intervening landform and filtered by existing trees in the middle ground of the view. Trucks may be seen accessing the proposal site via Lenore Drive and the proposed upgrade and extension of Archbold Road, from a distance, left of view.

Due to the limited visibility of the proposal and the compatibility of the proposal with the existing and intended future industrial uses seen in the surrounding area, there would only be a noticeable reduction in the amenity of this view, which is of neighbourhood visual sensitivity, and a **negligible visual impact** during operation of the project.

#### 5.3.1.3. Viewpoint 3: View northwest from future entry road

Figure 5-6 Viewpoint 3: Existing view northwest from future upgraded and extended Archbold Road / Lenore Drive intersection

Figure 5-7 Viewpoint 3: View northwest from future upgraded and extended Archbold Road / Lenore Drive intersection, indicative extent of proposal site (indicative location of site shown in yellow)

Existing conditions: This view is located at the intersection of Lenore Drive and the future upgraded and extended Archbold Drive, which would extend north (right of view) and connect with the M4 Western Motorway. This section of Lenore Drive consists of two lanes in each direction with a central median and a shared path for

pedestrians and cyclists along northern side of the road, adjacent to the proposal site. There are some existing street trees, mound and street lighting along this section of Lenore Drive (centre of view, behind parked truck). The southern part of the proposal site can be seen through a break in the landform (right of view) and is mostly cleared of vegetation. The landform of the proposal site falls to the west, towards Ropes Creek, and the backdrop of this view is formed by the existing vegetation along the creek corridor. The residential areas of Erskine Park are screened by this vegetation. There are glimpses to the Blue Mountains in the far background of this view along Lenore Drive (left of view).

In the future, the proposed upgrade and extension of Archbold Road would be seen to the north (right of view) with new street tree planting and native vegetation along the road batters.

Sensitivity: Views from this location would be experienced briefly from vehicles travelling at speed along Lenore Drive, and also from users of the adjacent shared path, along this road. This road is described as a '*vital east-west link connection for the Western Sydney Employment Area*' (Transport for NSW, 2017b). While this location has somewhat of a gateway function to the future Ropes Creek Precinct of Western Sydney Employment Area, and offers distant views to the Blue Mountains, it is of a large scale and passes through a predominantly industrial setting. Due to the number of potential receivers, this view is of **local visual sensitivity**.

Visual impact during construction: A construction site (for the proposal) would be established to the north of Lenore Drive, in the middle ground of this view (right of view). The existing shared pathway and street trees would be retained along Lenore Drive, providing some localised screening to the proposal site. Construction vehicles would be seen approaching the site along Lenore Drive and accessing the proposal site via the future upgraded and extended Archbold Road.

Construction of the southern part of the proposal would be seen in the middle ground of this view and would include site preparation activities including earthworks and civil construction activities, including the construction of roads and large areas of hardstand. The precast plant would be established in the centre of the southern facility site, including cranes and machinery used to install the acoustic sheds, boiler, aggregate bins and silos. These elements would obstruct views to the vegetation along Ropes Creek in the background of the view.

This view to a relatively open landscape with a vegetated backdrop would be converted into a large construction site. Due to the proximity and intensity of the construction activity, this would result in a noticeable reduction in the amenity of this view, which is of local sensitivity, and a temporary **minor adverse visual impact**.

Visual impact during operation: The construction site would become a working industrial site. Heavy and light vehicles would be seen approaching the proposal site from Lenore Drive and accessing the proposal site from the future upgraded and extended Archbold Road with new signalised intersections. The southern precast facility site would be seen in the middle ground of this view and include a shed in the centre of the proposal site, surrounded by outdoor storage areas with stacked

concrete segments. The upper part of silos may be seen rising above and beyond the sheds, in the background of view. The movement of gantry cranes shifting the precast segments and movement of trucks would activate this view. A site office and parking at the southern precast site would be seen at the entrance from the future upgraded and extended Archbold Road (refer to Figure 5-7).

The proposal would be seen within the context of existing and future industrial development and generally compatible with the scale and character of these uses. Due to the proximity of the proposal site, constant movement created by machinery and vehicles, and obstruction of the vegetated background to this view, there would be a noticeable reduction in visual amenity. This is a view of local visual sensitivity and this would result in a **minor adverse visual impact** during operation.

#### 5.3.1.4. Viewpoint 4: View northeast from Lenore Drive at the Ropes Creek crossing

**Figure 5-8 Viewpoint 4: View northeast from Lenore Drive at the Ropes Creek crossing**

Figure 5-9 Viewpoint 4: View northeast from Lenore Drive at the Ropes Creek crossing (indicative location of site shown in yellow)

Existing conditions: In this location Lenore Drive includes two east bound lanes with a shared pedestrian and cycle pathway and two westbound lanes on twin bridges. The landform rises from Ropes Creek towards a local ridgeline in the background of view. This ridge conceals the existing low-rise industrial development located to the east of the proposal site. Existing transmission pylons and lines can be seen on this ridgeline and some scattered trees. Streetlights follow the road and there are some street trees on the northern verge of Lenore Drive along the proposal site. The existing vegetation alongside Ropes Creek is dense and screens views to most of the northern areas of the proposal site.

Sensitivity: Views from this location would be experienced from the footpath, bicycles and vehicles travelling along Lenore Drive. This route is identified as a '*vital east-west link connection for the Western Sydney Employment Area*' (Transport for NSW, 2017b). Vegetation alongside Ropes Creek seen in the foreground of this view, is identified as having '*scenic and landscape values'* (Penrith City Council, 2010) and zoned is for environmental conservation (NSW State Government, 2009). Due to the number of potential receivers on the road and pathway, and visual values of the existing vegetation, this view is of **local visual sensitivity**.

Visual impact during construction: A construction site for the southern precast facility would be established in the middle ground of view, north of Lenore Drive (centre of view). Construction vehicles would be seen travelling along Lenore Drive and accessing the site via the future upgraded and extended Archbold Road which would extend north along the eastern boundary of the proposal site. The existing street trees along Lenore Drive would filter views into the proposal site, however, earthworks and the construction of precast segment storage areas and the

southern shed in the centre on the southern precast site would be seen in the centre of this view. The northern areas of the proposal site would be screened by the existing vegetation alongside Ropes Creek which encloses this view.

Much of the proposal site would be not be seen from this location due to the intervening vegetation, and construction activity on the proposal site would be consistent with the character expected in an area of general industrial zoning. Overall, there would be a noticeable reduction in the amenity of this view, which is of local visual sensitivity, and a temporary minor adverse visual impact during construction.

Visual impact during operation: The southern areas of the precast facility would be seen from this location, with much of the site screened by existing vegetation along Ropes Creek. The upper section stacked precast segments within the southern precast facility site would be seen to the north of Lenore Drive, and the upper section of the shed in this area of the site would rise above these segment storage areas. Heavy and light vehicles would be seen travelling along Lenore Drive and accessing the proposal site via the future upgraded and extended Archbold Road, which would be constructed and follow the eastern boundary of the proposal site. The northern precast facility would be screened from this view by intervening vegetation along Ropes Creek.

These elements would be seen in the context of existing large-scale power infrastructure, in the background of the view, and be generally consistent with the character expected of a general industrial land use.

Overall, due to the limited visibility and visual compatibility of the proposal with the intended future industrial use of the proposal site, there would be a noticeable reduction in the amenity of this view. This view is local visual sensitivity, and this would result in a minor adverse visual impact during operation.

#### 5.3.1.5. Viewpoint 5: View east from Aquarius Crescent, Erskine Park


Figure 5-10 Viewpoint 5: View east from Aquarius Crescent, Erskine Park

Existing conditions: This view along Aquarius Crescent is framed by single and two storey houses set within leafy gardens. Aquarius Crescent rises to a local high point, near the local school, and offers elevated easterly views over Ropes Creek corridor towards the proposal site. The vegetation along Ropes Creek conceals a large part of the proposal site. The higher land (ridgeline) to the east of the proposal site can be seen in the background of this view, glimpsed between and above the existing vegetation. Transmission lines and pylons are located on this ridgeline, visible rising above the skyline.

Sensitivity: This view would be experienced by a concentration of residents and their visitors, in the vicinity of the adjacent schools. The vegetation along Ropes Creek corridor is a visual feature in the background of this view. This view is of **neighbourhood visual sensitivity**.

Visual impact during construction: The ground level works on the proposal site, including earthworks, civil works, building foundations, roads and hardstand area construction would be screened from view, however, the taller elements, including cranes and the acoustic sheds, would be seen in the gaps and rising above the vegetation along Ropes Creek, in the background of this view.

Overall, due to the distance and small extent of works that would be visible, there would be a noticeable reduction in the amenity of this view. This view is of neighbourhood visual sensitivity and there would be a temporary **negligible visual impact** during construction.

Visual impact during operation: During operation, the southern precast facility would be visible in the background of view, glimpsed through the gaps in the vegetation along Ropes Creek. The activity at ground level, and lower sections of the structures would be screened by the vegetation along Ropes Creek. However, the gantry cranes and upper part of the proposed shed may be seen above the tree

canopy. The northern precast facility would be screened from this view by intervening built form (houses within Erskine Park) and vegetation along Ropes Creek.

As the proposal is located in WSEA and zoned general industrial (WSEA SEPP); the scale of the proposal is consistent with the intended future use of the proposal site. The proposal is also seen in the context of the existing transmission lines and pylons which rise above the ridgeline, beyond the proposal site, and seen above the vegetation along the creek, crossing the view.

Due to the limited visibility and compatibility of the proposal with the surrounding context, there would only be a small magnitude of change which would result in a noticeable reduction in the amenity of this view. This view is of neighbourhood visual sensitivity and there would be a **negligible visual impact** during operation. Refer to Figure 5-1 which shows a cross section between Aquarius Crescent and the proposal site.

#### 5.3.1.6. Viewpoint 6: View east from Park on Sennar Road, Erskine Park

Existing conditions: This locally elevated location offers views over the single and two storey houses within Erskine Park, towards Ropes Creek and the proposal site. The vegetation along Ropes Creek conceals a large part of the proposal site. The higher land (ridgeline) to the east of the proposal site can be seen in the background of this view, glimpsed above the existing vegetation. The existing transmission lines and pylons are located on this ridgeline and are a prominent feature visible on the skyline.

Sensitivity: This view would be experienced by recreational users of the park and playground. While the vegetation along Ropes Creek corridor is a visual feature in the background of this view, the character of the existing transmission lines detract from the amenity of this view. This view is of **local visual sensitivity**.

Visual impact during construction: The ground level works on the proposal site, including earthworks, civil works, building foundations, roads and hardstand area construction would be screened from view, however, the taller elements, including cranes and the acoustic sheds, would be seen in the gaps and rising above the vegetation along Ropes Creek, in the background of this view.

Overall, due to the distance and small extent of works that would be visible, there would be a noticeable reduction in the amenity of this view. This view is of local visual sensitivity and there would be a **minor adverse visual impact** during construction.

Visual impact during operation: During operation, the southern precast facility would be visible in the background of view, glimpsed through the gaps in the vegetation along Ropes Creek. The activity at ground level, and lower sections of the structures would be screened by the vegetation along Ropes Creek. There would be a glimpse to the gantry cranes and upper part of the proposed shed seen through the gaps in the tree canopy (refer to Figure 5-12).

Figure 5-11 Viewpoint 6: View east from Park on Sennar Road, Erskine Park


Figure 5-12 Viewpoint 6: View east from Park on Sennar Road, Erskine Park, indicative extent of the proposal site (indicative location of site shown in yellow)

As the proposal is located in WSEA and zoned general industrial (WSEA SEPP); the scale of the proposal is consistent with the intended future use of the proposal site, and areas to the east and north of the proposal site, which may also be seen in this view in the future. The proposal would also be seen in the context of the existing transmission lines and pylons which rise above the ridgeline, beyond the proposal site and detract from the amenity of this view.

Due to the limited visibility and compatibility of the proposal with the surrounding context, there would only be a noticeable reduction in the amenity of this view. This view is of local visual sensitivity and there would be a **minor adverse visual impact** during operation.

### 5.3.2. Assessment of night-time visual impact

Existing conditions: The proposal site is located in a setting of medium district brightness (A3) (refer to section 3.5.1 of this technical paper). While the proposal site is currently vacant, a range of light sources exist in the local area. These include security and outdoor lighting associated with the industrial development within Western Sydney Employment Area to the east and north of the site together with headlights from moving traffic and lighting along Lenore Drive in the south and the M4 Western Motorway to the north. There is a lower level of lighting within the residential areas of Erskine Park with local street lighting and lights from residences adding light to this area.

Some of the lighting would be contained by the existing vegetation along Ropes Creek, somewhat separating the lighting levels between the industrial areas and roads from the residential areas to the west. However, there would be a skyglow above the industrial areas that would be visible from within the industrial areas as well as from the residential areas of Erskine Park.

Visual impact during construction: Construction works would generally be carried out during standard construction hours. Generally, there would be low-level security lighting within the proposal site at night.

Overall, the construction site would result in new lighting at an unlit site. Although this additional lighting would be seen in the context of nearby lit industrial sites to the north, east and south, there would be no perceived reduction in the amenity of views in the local area at night. As this is a location of medium district brightness (A3) and of low sensitivity, this would result in a **negligible visual impact** at night.

Visual impact during operation: The proposal would operate 24 hours a day, seven days a week. Some lighting would be contained within the sheds, however, there would be additional light sources within the proposal site, at ground level, that would add to the brightness of the site. This would include the lighting from vehicles within the site and lighting along the internal access roads, car park and pathways. There would be directional task lighting in areas including the segment storage and gantry crane loading areas. There would also be general security lighting within the proposal site, such as around buildings and sheds, where required. This additional lighting would be viewed in the context of lighting along Lenore Drive and along the future upgraded and extended Archbold Road.

In views from the residential areas of Erskine Park there may be additional skyglow visible above the proposal site. However, this additional lighting would be seen in the context of the surrounding industrial areas and brightly lit roads such as Lenore Drive. It is not likely that there would be a perceived change in the amenity of views from this location.

Overall, there would be a noticeable reduction in the amenity of views at night during the operation of the proposal. As this is a location of medium district brightness (A3) and is of low sensitivity, this would result in a **minor adverse visual impact** at night.

### 5.3.3. Summary of landscape and visual impact

Table 5-1, Table 5-2 and Table 5-3 summarise the potential landscape and visual impacts of the proposal.

**Table 5-1: Landscape impact summary**

| | | | Construction | | Operation | |
|---|---|---|---|---|---|---|
| No. | Landscape | Sensitivity | Magnitude | Impact | Magnitude | Impact |
| 1 | Proposal site | Neighbourhood | Noticeable reduction | **Negligible** | Noticeable reduction | **Negligible** |

**Table 5-2: Daytime visual impact summary**

| | | | Construction | | Operation | |
|---|---|---|---|---|---|---|
| | Location | Sensitivity | Magnitude | Impact | Magnitude | Impact |
| 1 | View south from the M4 Western Motorway | Local | No perceived change | **Negligible** | No perceived change | **Negligible** |
| 2 | View southwest from Hanson Place | Neighbourhood | Noticeable reduction | **Negligible** | Noticeable reduction | **Negligible** |
| 3 | View northwest from future entry road | Local | Noticeable reduction | **Minor adverse** | Noticeable reduction | **Minor adverse** |
| 4 | View northeast from Lenore Drive creek crossing | Local | Noticeable reduction | **Minor adverse** | Noticeable reduction | **Minor adverse** |
| 5 | View east from Aquarius Crescent, Erskine Park | Neighbourhood | Noticeable reduction | **Negligible** | Noticeable reduction | **Negligible** |
| 6 | View east from park on Sennar Road, Erskine Park | Local | Noticeable reduction | **Minor adverse** | Noticeable reduction | **Minor adverse** |

**Table 5-3: Night-time visual impact summary**

| | | | Construction | | Operation | |
|---|---|---|---|---|---|---|
| | Location | Sensitivity | Magnitude | Impact | Magnitude | Impact |
| 1 | Proposal site | Low | No perceived change | **Negligible** | Noticeable reduction | **Minor adverse** |

# 6. Mitigation and management measures

## 6.1. Construction management

Environmental management measures to be implemented during the construction phase of the proposal are listed in Table 6-1.

**Table 6-1 Construction environmental management measures**

| No. | Impact | Mitigation measure |
|---|---|---|
| LV1 | Visual impact | Where feasible and reasonable, the elements within construction site would be located to minimise visual impact (for example storing materials and machinery behind fencing). |

## 6.2. Operational management

Environmental management measures to be implemented during the operational phase of the proposal are listed in Table 6-2.

**Table 6-2 Operational environmental management measures**

| No. | Impact | Mitigation measure |
|---|---|---|
| LV2 | Landscape and visual impact | Sheds would be finished in a colour which aims to minimise visual impacts, if visible from areas external to the site. |
| LV3 | Lighting impacts | Lighting of the sites would be orientated to minimise glare and light spill impacts on adjacent receivers in accordance with AS4282:2019. |

# 7. Conclusion

## 7.1. Impacts during construction

### 7.1.1. Landscape impact

There would be a **negligible landscape impact** during construction due to the limited vegetation removal and relatively minor earthworks that would be required across the proposal site for construction.

### 7.1.2. Visual impacts

The site has a relatively limited visual catchment due to a ridgeline to the east of the site, mounding along Lenore Drive and vegetation along Ropes Creek to the west of the proposal site.

During construction there would be temporary **negligible** visual impacts in views from the M4 Western Motorway in the north (refer to Viewpoint 1), and industrial areas to the east of the site (refer to Viewpoint 2). Views from the M4 Western Motorway would be limited by the distance, intervening vegetation and landform. Similarly, in views from the industrial areas to the east, the existing landform limits views to construction works on the proposal site. Furthermore, in these views, the proposal would be seen in the context of industrial land uses and existing energy infrastructure, increasing the capacity of these views to absorb the proposal.

There would also be temporary **minor adverse** to **negligible visual impacts** in views from the residential areas of Erskine Park due to the distance and screening effect of the vegetation along Ropes Creek (refer to Viewpoints 5 and 6).

There would be a temporary **minor adverse visual impact** in views from Lenore Drive, adjacent to the site (refer to Viewpoints 3 and 4). While the construction activity would be seen in close proximity of the site from this location, the existing mounding and proposed landscaping would screen the site, and the construction of the proposal would be seen in the context of industrial land uses and existing energy infrastructure, increasing the capacity of these views to absorb the proposal.

At night there would be a temporary **negligible visual impact** during construction as there would be limited night works required during construction and any minor lighting associated with the proposal would be absorbed into the setting which has a medium district brightness (A3) and low sensitivity.

## 7.2. Impacts during operation

### 7.2.1. Landscape impact

During operation there would be a **negligible landscape impact.** While the landscape character would be changed, given the highly modified landscape character and desired future character of Ropes Creek precinct, the proposal would be consistent with the general industrial uses identified for the proposal site.

### 7.2.2. Visual impacts

During operation there would be **minor adverse** and **negligible visual impacts** in views from the M4 Western Motorway in the north (refer to Viewpoint 1), and industrial areas to the east of the proposal site (refer to Viewpoint 2), and from the residential areas of Erskine Park (refer to Viewpoints 5 and 6). This is due to the mitigating effects of distance, landform and vegetation which would limit views to the operational proposal.

There would be a **minor adverse visual impact** in closer range views where more activity would be visible, such as from Lenore Drive, adjacent to the proposal site (refer to Viewpoint 3 and 4). Again, the local landform would restrict views into the site and the proposal would be seen in the context of industrial land uses and existing energy infrastructure, increasing the capacity of these views to absorb the proposal during its operation.

At night there would be a **minor adverse visual impact** during operation as the proposal would operate 24 hours a day, seven days a week. Some lighting would be contained in the sheds, however, the lighting within the proposal site would be seen from some locations and also add to the existing skyglow above this area.

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# Appendix F

## Statement of Heritage Impact

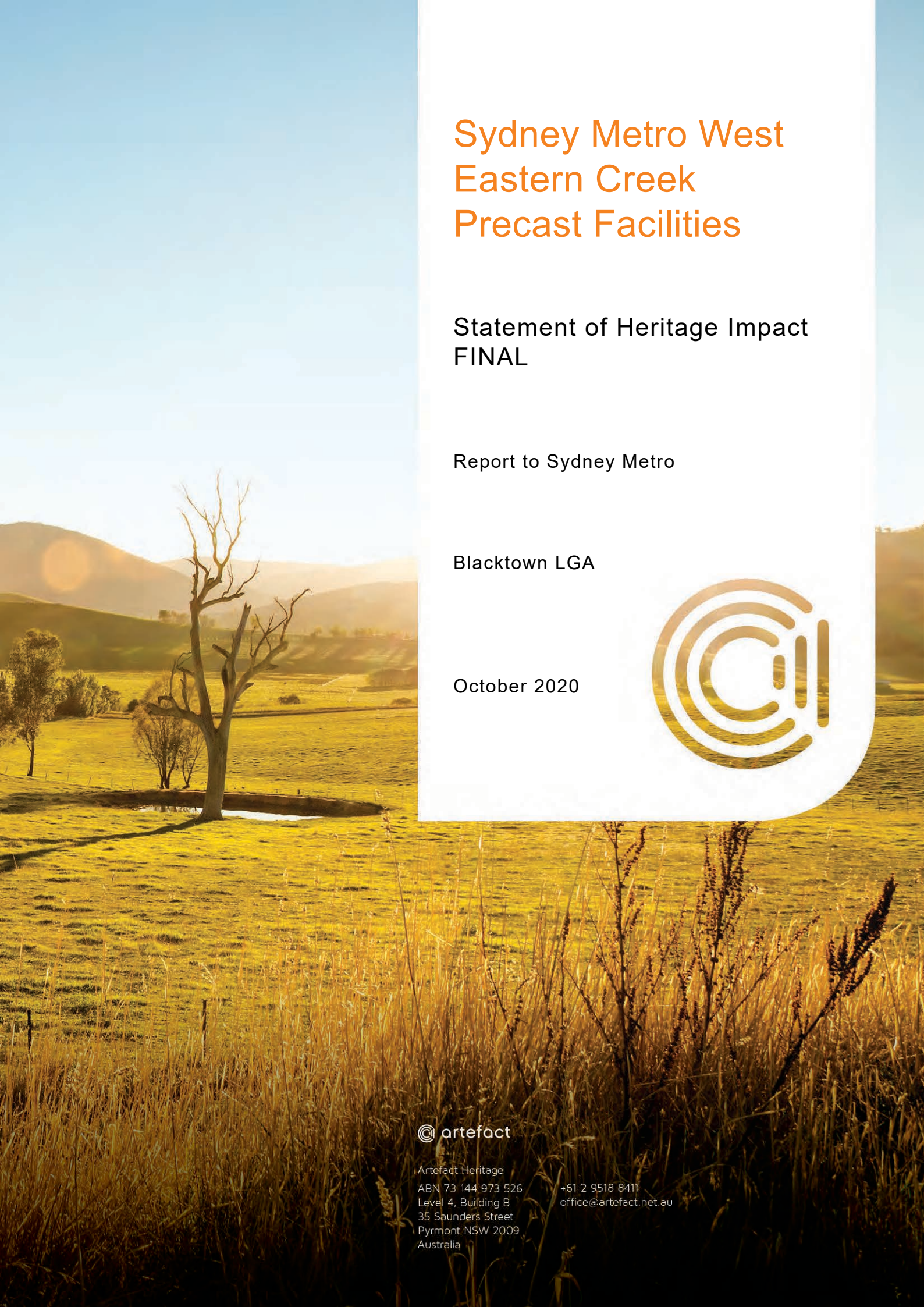
# Sydney Metro West
# Eastern Creek
# Precast Facilities

## Statement of Heritage Impact
## FINAL

Report to Sydney Metro

Blacktown LGA

October 2020



artefact

Artefact Heritage
ABN 73 144 973 526
Level 4, Building B
35 Saunders Street
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au

## Document history and status

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| 1 | 5 May 2020 | Sandra Wallace | Sandra Wallace | 5 May 2020 | First draft |
| 2 | 26 June 2020 | Sandra Wallace | Sandra Wallace | 26 June 2020 | Second draft |
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| | |
|---|---|
| **Project name:** | Sydney Metro West Eastern Creek Precast Facilities |
| **Author:** | Jessica Horton, Sandra Wallace |
| **Project manager:** | Sandra Wallace |
| **Project number:** | 20038 |
| **Name of organisation:** | Artefact Heritage |
| **Document version:** | Draft |

# EXECUTIVE SUMMARY

This Statement of Heritage Impact (SoHI) has been prepared by Artefact Heritage Services Pty Ltd (Artefact) on behalf of Sydney Metro (the proponent) in relation to construction and operation of two precast facilities and associated ancillary infrastructure (the proposal). The facilities would support the construction of Sydney Metro West.

A Review of Environmental Factors is being prepared for the proposal seeking approval under Part 5 of the *Environmental Planning and Assessment Act 1979*. The purpose of this SoHI is to support the Review of Environmental Factors for the proposal.

It was found that:

- There are no listed or potential items of heritage significance identified within the proposal site. As such, there would be no physical or visual impacts to heritage items as a result of the proposal
- The potential for archaeological remains has been identified within the north-east corner of the proposal site which is expected to be subject to physical impact by the proposed works, however these remains are not expected to reach the threshold for local significance
- The remainder of the proposal site has been assessed as having nil to low potential for twentieth century archaeological remains. Potential archaeological remains within the remainder of the proposal site are not expected to reach the threshold for local significance

The following recommendations are made:

- Archaeological remains identified within the north-east corner of the proposal site may be removed as required without further assessment or mitigation
- Unexpected finds must be managed in accordance with the Sydney Metro unexpected heritage finds procedure

# CONTENTS

# FIGURES

# TABLES

# 1.0 INTRODUCTION

## 1.1 Proposal background

This Statement of Heritage Impact (SoHI) has been prepared by Artefact Heritage Services Pty Ltd (Artefact) on behalf of Sydney Metro (the proponent) in relation to construction and operation of two precast facilities and associated ancillary infrastructure (the proposal). The facilities would support the construction of Sydney Metro West.

A Review of Environmental Factors is being prepared for the proposal seeking approval under Part 5 of the *Environmental Planning and Assessment Act 1979*. The purpose of this SoHI is to support the Review of Environmental Factors for the proposal.

## 1.2 Proposal site

The proposal site for this assessment consists of a portion of Lot 10 DP1157491. The proposal site is bounded by Lenore Drive to the south, Ropes Creek to the west and open grassland to the north and east (See Figure 1 and Figure 2).

## 1.3 Proposal description

Sydney Metro propose to construct and operate two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other. The proposal would comprise the following key features and activities:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate and adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
    - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
    - Boiler, aggregate bins and consumables
    - Office facilities
    - On-site parking for up to 60 light vehicles
- Internal roads with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The northern and southern precast facilities would operate concurrently, 24 hours a day, seven days a week for the majority of the lifespan of the project.

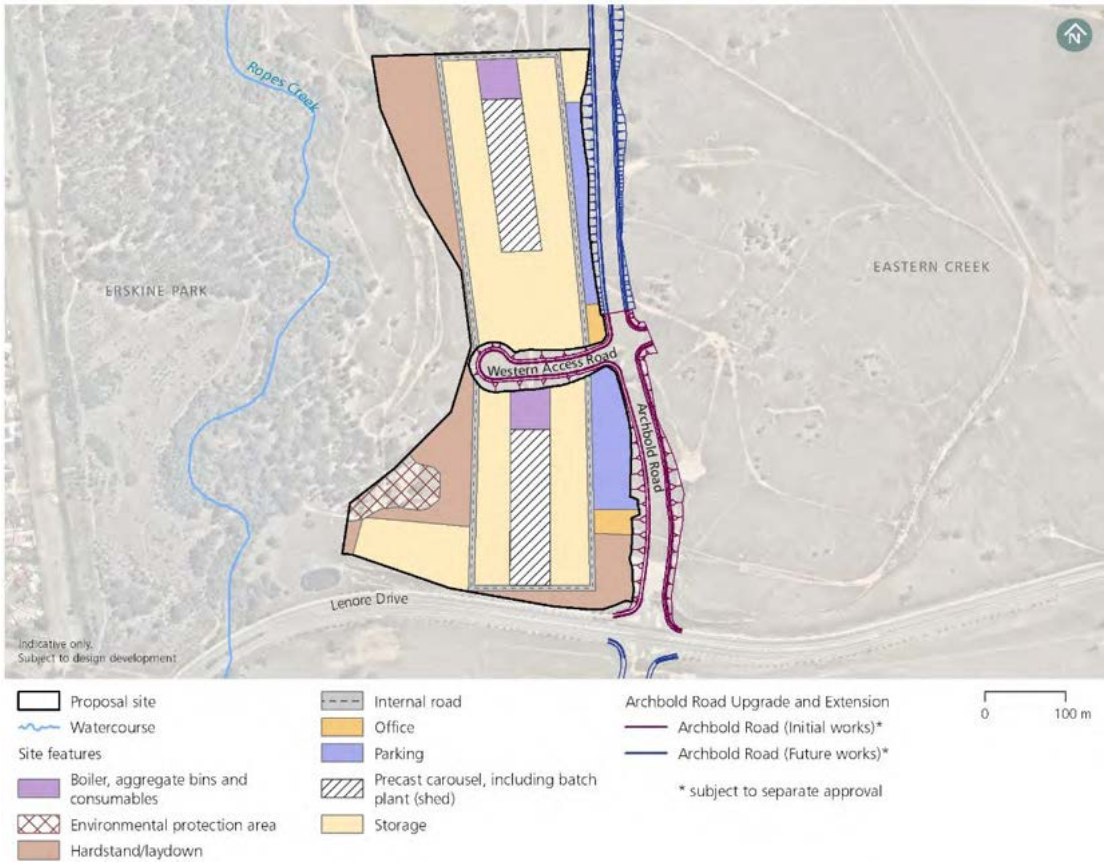


**Figure 1: Overview of the proposal**

## 1.4 Purpose and scope of this report

This technical paper is one of a number of technical papers that form part of the Review of Environmental Factors. The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to non-Aboriginal heritage.

This report includes the following:

- Description of the proposal and identification of the proposal site
- Outline of relevant legislative context in relation to the proposal site
- Description of the methodology for heritage and archaeological assessment
- Overview of the historical context within the proposal site
- Assessment of historical archaeological potential
- Heritage impact assessment for heritage items and historical archaeological resources within the proposal site
- Conclusions and recommendations for heritage sites within the proposal site.

## 1.5 Authorship

This report was prepared by Jessica Horton (Heritage Consultant) and Alyce Haast (Senior Heritage Consultant). Management input and review was provided by Josh Symons (Principal) and Sandra Wallace (Director).

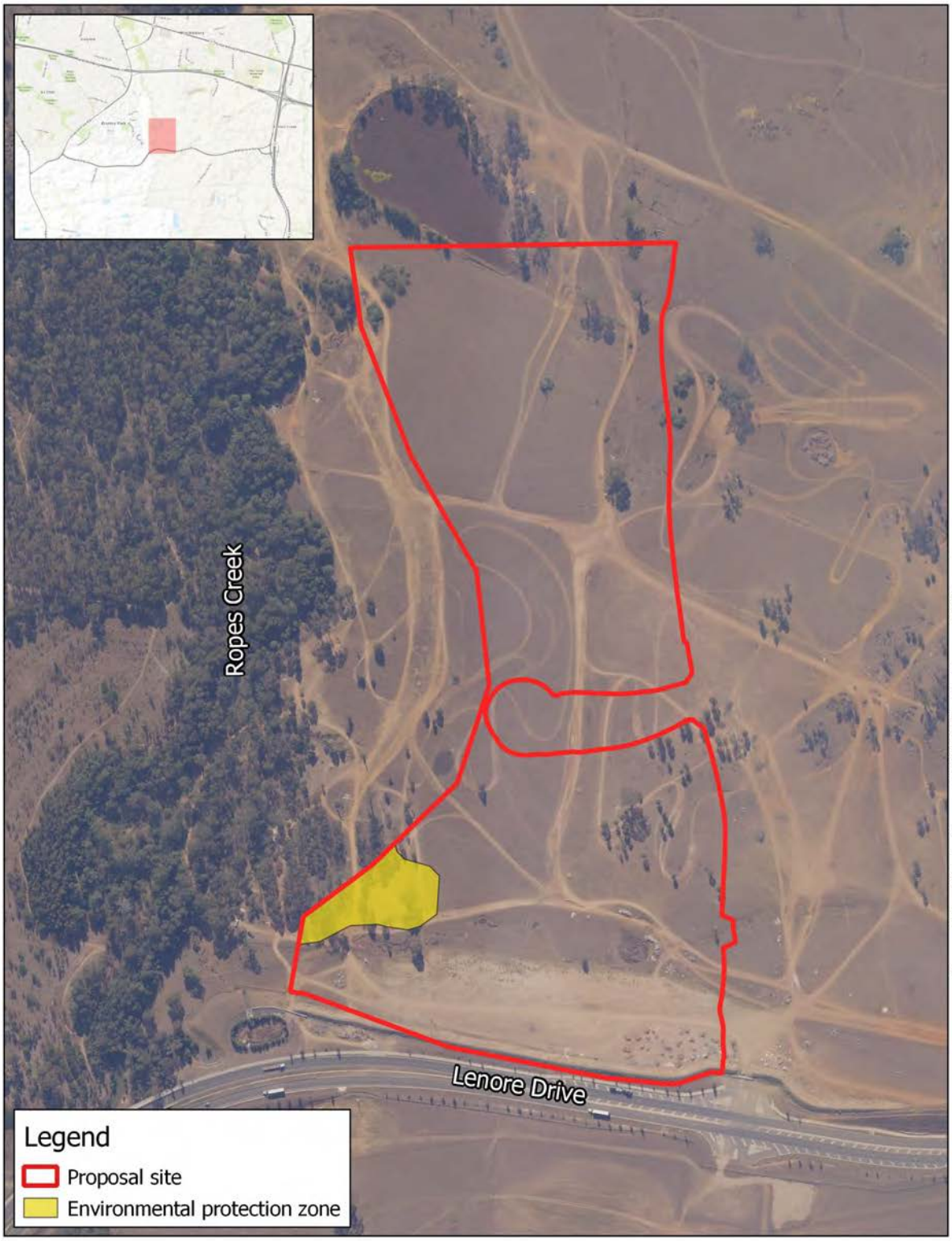


**Figure 2: Proposal site**

# 2.0 LEGISLATIVE CONTEXT

## 2.1 Introduction

A number of planning and legislative documents govern how heritage is managed in NSW and Australia. The following section provides an overview of the requirements under each as they apply to the proposal.

## 2.2 The World Heritage Convention

The Convention Concerning the Protection of World Cultural and National Heritage (the World Heritage Convention) was adopted by the General Conference of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) on 16 November 1972, and came into force on 17 December 1975.

The World Heritage Convention aims to promote international cooperation to protect heritage that is of such outstanding universal value that its conservation is important for current and future generations. It sets out the criteria that a site must meet to be inscribed on the World Heritage List and the role of State Parties in the protection and preservation of world and their own national heritage.

No sites within or near the proposal site are included on the World Heritage List.

## 2.3 National and Commonwealth Legislation

### *2.3.1 Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. These are defined in the EPBC Act as matters of national environmental significance. Under the EPBC Act, nationally significant heritage items are protected through listing on the Commonwealth Heritage List or the National Heritage List.

#### ***2.3.1.1 Commonwealth Heritage List***

The Commonwealth Heritage List has been established to list heritage places that are either entirely within a Commonwealth area, or outside the Australian jurisdiction and owned or leased by the Commonwealth or a Commonwealth Authority. The Commonwealth Heritage List includes natural, Indigenous and historic heritage places which the Minister for Sustainability, Environment, Water, Population and Communities is satisfied have one or more Commonwealth Heritage values.

No sites within or near the proposal site are included on the Commonwealth Heritage List.

#### ***2.3.1.2 National Heritage List***

The National Heritage List was established under the EPBC Act, which provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places.

No sites within or near the proposal site are included on the National Heritage List.

## 2.4 State Legislation

### *2.4.1 Heritage Act 1977*

The *NSW Heritage Act 1977* (Heritage Act) is the primary piece of State legislation affording protection to heritage items (natural and cultural) in New South Wales (NSW). Under the Heritage Act, 'items of environmental heritage' include places, buildings, works, relics, moveable objects and precincts identified as significant based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. State significant items can be listed on the NSW State Heritage Register and are given automatic protection under the Heritage Act against any activities that may damage an item or affect its heritage significance.

The Heritage Act also provides protection for 'relics', which includes archaeological material or deposits. The protection of 'relics' under the Heritage Act is further explained in Section 2.4.1.2.

#### *2.4.1.1 State Heritage Register*

The State Heritage Register was established under Section 22 of the Heritage Act and is a list of places and objects of particular importance to the people of NSW, including archaeological sites. The State Heritage Register is administered by the Department of Premier and Cabinet – Heritage. This includes a diverse range of over 1,500 items, in both private and public ownership. To be listed, an item must be deemed to be of heritage significance for the whole of NSW.

No sites within or near the proposal site are included on the State Heritage Register.

#### *2.4.1.2 Relics Provisions*

The Heritage Act also provides protection for 'relics', which includes archaeological material or deposits. According to Section 139 (Division 9: Section 139, 140-146):

(1) A person must not disturb or excavate any land knowingly or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, damaged or destroyed unless the disturbance is carried out in accordance with an excavation permit.

(2) A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.

(3) This section does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Register.

(4) The Heritage Council may by order published in the Gazette create exceptions to this section, either unconditionally or subject to conditions, in respect of any of the following:

   a. Any relic of a specified kind or description,
   b. Any disturbance of excavation of a specified kind or description,
   c. Any disturbance or excavation of land in a specified location or having specified features or attributes,
   d. Any disturbance or excavation of land in respect of which an archaeological assessment approved by the Heritage Council indicates that there is little likelihood of there being any relics in the land.

Section 4 (1) of the Heritage Act (as amended in 2009) defines a relic as:

> *...any deposit, artefact, object or material evidence that:*

> *relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and is of State or local heritage significance*

A relic has been further defined as:

> *Relevant case law and the general principles of statutory interpretation strongly indicate that a 'relic' is properly regarded as an object or chattel. A relic can, in some circumstances, become part of the land be regarded as a fixture (a chattel that becomes permanently affixed to land).*[1]

Excavation permits are issued by the NSW Heritage Council, or its delegate, under Section 140 of the Heritage Act for relics not within State Heritage Register listed curtilages or under Section 60 for significant archaeological remains within State Heritage Register curtilages. An application for an excavation permit must be supported by an Archaeological Research Design and Archaeological Assessment prepared in accordance with the NSW Heritage Council archaeological guidelines. Minor works that will have a minimal impact on archaeological relics may be granted an exception under Section 139 (4) or an exemption under Section 57 (2) of the Heritage Act.

#### 2.4.1.3 Works

The Heritage Act implies that 'works' are a separate category to archaeological 'relics'. 'Works' refer to remnants of historical structures which are not associated with artefactual material that may possess research value. 'Works' may be buried, and therefore archaeological in nature, however, exposure of a 'work' does not require approved archaeological excavation permits under the Heritage Act.

The following examples of remnant structures have been considered to be 'works' by the Department of Premier and Cabinet – Heritage:

- Former road surfaces or pavement and kerbing.
- Evidence of former drainage infrastructure, where there are no historical artefacts in association with the item.
- Building footings associated with former infrastructure facilities, where there are no historical artefacts in association with the item.
- Evidence of former rail track, sleepers or ballast.

Where buried remnants of historical structures are located in association with historical artefacts in controlled stratigraphic contexts (such as intact historic glass, ceramic or bone artefacts), which have the potential to inform research questions regarding the history of a site, the above items may not be characterised as 'works' and may be considered to be 'relics'. The classification of archaeological remains as a 'work' therefore is contingent on the predicted remains being associated with historical structures as well as there being no prediction of the recovery of intact artefactual deposits which may be of research interest.

#### 2.4.1.4 Section 170 registers

Under the Heritage Act all government agencies are required to identify, conserve and manage heritage items in their ownership or control. Section 170 (s170) requires all government agencies to maintain a Heritage and Conservation Register that lists certain classes of heritage assets identified

[1] *Assessing Significance for Archaeological Sites and 'Relics'*, Heritage Branch, Department of Planning, 2009:7.

in Section 22(1) of the Heritage Regulation 2012. They must ensure that these assets are maintained with due diligence in accordance with State Owned Heritage Management Principles approved by the Government on advice of the Department of Premier and Cabinet – Heritage. These principles serve to protect and conserve the heritage significance of items and are based on NSW heritage legislation and guidelines.

No s170 listed heritage items have been located within or in proximity to the proposal site.

### *2.4.2 Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act requires that environmental impacts are considered prior to land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits.

The EP&A Act also requires that local governments prepare planning instruments (such as Local Environmental Plans) in accordance with the EP&A Act to provide guidance on the level of environmental assessment required.

The proposal site is within the Blacktown Local Government Area (LGA) and is subject to the Blacktown Local Environment Plan 2015 and the *State Environmental Planning Policy (Western Sydney Employment Area) 2009*.

No heritage listed items located on the Blacktown Local Environment Plan have been located within or in the vicinity of the proposal site.

## 2.5 Non-Statutory Considerations

### *2.5.1 Register of the National Estate*

The Register of the National Estate is a list of natural, Aboriginal and historic heritage places throughout Australia. It was originally established under the *Australian Heritage Commission Act* 1975. Under that Act, the Australian Heritage Commission entered more than 13,000 places in the register. The Register of the National Estate is no longer a statutory list; however, it remains available as an archive.

There are no heritage listed items listed on the Register of the National Estate located within or in the vicinity of the proposal site.

### *2.5.2 National Trust of Australia (NSW)*

The National Trust of Australia is a community-based, non-government organisation committed to promoting and conserving Australia's Indigenous, natural and historic heritage. The National Trust Register was established in 1949. It is a non-statutory register.

There are no items listed on the National Trust of Australia register located within or in the vicinity of the proposal site.

# 3.0 ASSESSMENT METHODOLOGY

## 3.1 The proposal site

The proposal site encompasses the extent of both precast facilities (Figure 2).

## 3.2 Identification of heritage listed items

A heritage register search was carried out on 8 April 2020. A search of the following State and Commonwealth statutory registers was undertaken, including:

- World Heritage List
- Commonwealth Heritage List
- National Heritage List
- State Heritage Register
- Blacktown Local Environment Plan 2015
- Section 170 Heritage and Conservation Registers for Sydney Water, Roads and Maritime, RailCorp, Department of Health, NSW Police Service
- NSW State Heritage Inventory database

No listed heritage items are located within or in the vicinity of the proposal site.

A search of nominated heritage places for the World Heritage List, National Heritage List and Commonwealth Heritage List was undertaken on 8 March 2020. No nominated heritage places or items are located within or in the vicinity of the proposal site.

## 3.3 Site inspection

Two site inspections were undertaken of the proposal site to identify potential unlisted heritage items and identify evidence of archaeological remains. The inspections were undertaken on foot, using physical maps and GPS. Photographs were taken to record different aspects of the site including vegetation, levels of disturbance and any areas of archaeological sensitivity.

A summary of the site inspection is provided in Section 5.

## 3.4 Significance assessments

### *3.4.1 NSW heritage assessment criteria*

Cultural significance is defined in Article 1.2 of the *Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013* (Burra Charter) (ICOMOS (Australia), 2013) as meaning "aesthetic, historic, scientific, social or spiritual value for past, present or future generations". Cultural significance may be derived from a place's fabric, association with a person or event, or for its research potential. The significance of a place is not fixed for all time, and what is of significance to us now may change as similar sites are located, more historical research is undertaken, and community tastes change.

Determining the significance of heritage items or a potential archaeological resource is undertaken by utilising a system of assessment centred on the Burra Charter by the International Council on

Monuments and Sites (ICOMOS). The principles of the Burra Charter are relevant to the assessment, conservation and management of sites and relics. The assessment of heritage significance is outlined through legislation in the Heritage Act and implemented through the *NSW Heritage Manual* and the *Archaeological Assessment Guidelines* (NSW Heritage Office and NSW Department of Urban Affairs and Planning 1996).[2]

If an item meets one of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have heritage significance. The significance of an item or potential archaeological site can then be assessed as being of local or state significance. If a potential archaeological resource does not reach the local or state significance threshold, then it is not classified as a relic under the Heritage Act.

*'State heritage significance',* in relation to a place, building, work, relic, moveable object or precinct, means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

*'Local heritage significance',* in relation to a place, building, work, relic, moveable object or precinct, means significance to an area in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.[3]

The overall aim of assessing archaeological significance is to identify whether an archaeological resource, deposit, site or feature is of cultural value. The assessment will result in a succinct statement of heritage significance that summarises the values of the place, site, resource, deposit or feature.

The heritage significance assessment criteria were taken into consideration during the preparation of the non-Aboriginal heritage impact assessment for the proposal.

Where identified, each listed or unlisted potential heritage item, or potential archaeological remain is assessed against the seven criteria outlined in Table 1.

**Table 1: NSW heritage assessment criteria**

| Criteria | Description |
|---|---|
| **A – Historical significance** | An item is important in the course or pattern of the local area or states cultural or natural history. |
| **B – Associative significance** | An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area's or State's cultural or natural history. |
| **C – Aesthetic significance** | An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area or state. |
| **D – Social significance** | An item has strong or special association with a particular community or cultural group in the local area or state for social, cultural or spiritual reasons. |
| **E – Research potential** | An item has potential to yield information that will contribute to an understanding of the local area's or State's cultural or natural history. |

[2] Heritage Office and Department of Urban Affairs and Planning 1996. *NSW Heritage Manual*; 25-27
[3] This section is an extract based on the Heritage Office Assessing Significance for Historical Archaeological Sites and Relics 2009:6.

| Criteria | Description |
|---|---|
| **F – Rarity** | An item possesses uncommon, rare or endangered aspects of the local area's or State's cultural or natural history. |
| **G - Representativeness** | An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places of cultural or natural environments (or the cultural or natural history of the local area or state). |

## 3.5 Heritage impact assessment

This heritage impact assessment has been prepared using the *Statement of Heritage Impact* (NSW Heritage Office 2002) guideline, contained within the *NSW Heritage Manual.*

Impacts on heritage significance are identified as either:

- Physical impacts, resulting in the demolition or alteration of fabric of heritage significance or significant archaeological remains
- Visual impacts, resulting in changes to the setting or curtilage of heritage items or places, historic streetscapes and landscapes, visual amenity or views
- Impacts from vibration, subsidence, architectural noise treatment and demolition of adjoining structures.

Once levels of all three types of impacts are assessed, adverse and positive impacts to aspects of significance are balanced to assess an overall level of impact to the heritage significance of the listed item as a result of the proposal. Where impacts to heritage significance are assessed as major, discussion is provided on whether the item would continue to meet the threshold of significance necessary for heritage listing.

Specific terminology and corresponding definitions are used in this assessment to consistently identify the magnitude of the proposal's physical or visual impact or the potential for vibration and settlement to impact on heritage items or archaeological remains. The terminology and definitions are based on those contained in guidelines produced by the ICOMOS[4] and are shown in Table 2.

**Table 2: Terminology for assessing the magnitude of heritage impact**

| Magnitude | Definition |
|---|---|
| **Major** | Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource.<br>These actions cannot be fully mitigated. |
| **Moderate** | This would include actions involving the modification of a heritage item, including altering the setting of a heritage item or landscape, partially removing archaeological resources, or the alteration of significant elements of fabric from historic structures.<br>The impacts arising from such actions may be able to be partially mitigated. |

[4] Including the document *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*, ICOMOS, January 2011.

| Magnitude | Definition |
|---|---|
| **Minor** | Actions that would result in the slight alteration of heritage buildings, archaeological resources, or the setting of an historical item.<br>The impacts arising from such actions can usually be mitigated. |
| **Negligible** | Actions that would result in very minor changes to heritage items. |
| **Neutral** | Actions that would have no heritage impact. |

## 3.6 Non-Aboriginal archaeological assessment

An overview approach to the identification of potential archaeological resources has been adopted in this SoHI. Historical archaeological potential is defined as the potential of a site to contain significant archaeological remains, including works or relics as identified in the Heritage Act. The assessment of historical archaeological potential is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) may have impacted on archaeological evidence for these former land uses. Knowledge of previous archaeological investigations, understanding of the types of archaeological remains likely to be associated with various land uses, and the results of site inspection are also taken into consideration when evaluating the potential of an area to contain archaeological remains.

### *3.6.1 Assessment of archaeological potential*

The potential for the survival of archaeological relics in a particular place is significantly affected by activities which may have caused ground disturbance. These processes include the physical development of the site (for example, phases of building construction) and the activities that occurred there. The likelihood for the survival of these relics (i.e. their archaeological potential) is distinct from the archaeological/heritage significance of these remains, should any exist. For example, there may be ‘low potential’ for certain relics to survive, but if they do, they may be assessed as being of State significance.

Identification of the potential historical archaeological resource of the proposal site is based on the review and understanding of its land use and development (site formation processes) through historical research, and evaluating whether subsequent actions (either natural or human) may have impacted on evidence of former land use phases.

The grades of archaeological potential are outlined below in Table 3.

**Table 3: Grades of archaeological potential[5]**

| Grading | Justification |
|---|---|
| **Nil** | No evidence of historical development or use, or where previous impacts such as deep basement structures would have removed all archaeological potential |
| **Low** | Research indicates little or low intensity historical development, or where there have been substantial previous impacts, disturbance and truncation in locations where some archaeological remains such as deep subsurface features may survive |
| **Moderate** | Analysis demonstrates known historical development and some previous impacts, but it is likely that archaeological remains survive with some localised truncation and disturbance |
| **High** | Evidence of multiple phases of historical development and structures with minimal or localised twentieth century development impacts, and it is likely the archaeological resource would be largely intact. |

### *3.6.2 Research potential and archaeological significance*

Archaeological assessments of significance presented here are preliminary in nature and based on the potential archaeological remains present within the proposal site. Where potential archaeological remains have been identified the archaeological significance of the remains has been assessed against the NSW Heritage Assessment Criteria. The assessment is informed by the NSW Heritage Division's *Assessing Significance for Historical Archaeological Sites and Relics* (NSW Heritage Division 2009).

Assessing significance for archaeological sites can be difficult, in that the extent and nature of the remains is generally unknown and value judgements based on potential or expected attributes need to be made. Heritage significance in NSW is assessed using the Heritage Council of NSW's seven specific criteria based on the principles of the Burra Charter. How these apply to archaeological heritage assessment is further explained in *'Assessing Significance for Historical Archaeological Sites and Relics'* guidelines from the NSW Heritage Manual (2009). Consideration of the research potential of an archaeological resource is necessary in determining archaeological significance. In addition, the expected intactness or integrity of an archaeological resource influences the evaluation of research potential and significance.

In 1984, Bickford and Sullivan examined the concept and assessment of archaeological research potential; that is, the extent to which archaeological resources can address research questions. They developed three questions which can be used to assess the research potential of an archaeological site:

- Can the site contribute knowledge that no other resource can?
- Can the site contribute knowledge that no other site can?
- Is this knowledge relevant to:
    - General questions about human history?
    - Other substantive questions relating to Australian history?
    - Other major research questions?

In the 2009 guidelines *Assessing Significance for Historical Archaeological Sites and 'Relics'*, the NSW Heritage Division has since provided a broader approach to assessing the archaeological significance of sites, which includes consideration of a site's intactness, rarity, representativeness,

[5] Heritage Division, 2009. *Assessing Significance for Historical Archaeological Sites and Relics.*

and whether many similar sites have already been recorded, as well as other factors. This document acknowledges the difficulty of assessing the significance of potential subsurface remains, because the assessment must rely on predicted rather than known attributes.[6]

[6] NSW Heritage Branch 2009

# 4.0 HISTORICAL CONTEXT

## 4.1 Aboriginal occupation and early European contact

Prior to the appropriation of their land by Europeans, Aboriginal people lived in small family or clan groups that were associated with particular territories or places. It seems that territorial boundaries were fairly fluid, although details are not known. The language group spoken on the Cumberland Plain is known as Darug (Dharruk – alternative spelling).

This term was used for the first time in 1900[7] as before the late 1800s language groups or dialects were not discussed in the literature.[8] The Darug language group is thought to have extended from Appin in the south to the Hawkesbury River, west of the Georges River, Parramatta, the Lane Cove River and to Berowra Creek.[9] This area was home to a number of different clan groups throughout the Cumberland Plain.

British colonisation had a profound and devastating effect on the Aboriginal population of the Sydney region, including Darug speakers. In the early days of the colony Aboriginal people were disenfranchised from their land as the British claimed areas for settlement and agriculture. The colonists, often at the expense of the local Aboriginal groups, also claimed resources such as pasture, timber, fishing grounds and water sources. Overall, the devastation of the Aboriginal culture did not come about through war with the British, but instead through disease and forced removal from traditional lands. It is thought that during the 1789 smallpox epidemic over half of the Aboriginal people of the Sydney region died. The disease spread west to the Darug of the Cumberland Plain and north to the Hawkesbury. It may have in fact spread much further afield, over the Blue Mountains.[10] This loss of life meant that some of the Aboriginal groups who lived away from the coastal settlement of Sydney may have disappeared entirely before Europeans could observe them or record their clan names.[11]

The British initially thought that Aboriginal people were confined to the coast taking advantage of the abundant marine resources available. The first major recorded expeditions west of Sydney did not witness any Aboriginal people, but evidence of their existence was noted. In April 1788, Governor Philip led an expedition west to Prospect Hill, approximately ten kilometres east of the proposal site. It was noted,

> …that these parts are frequented by the natives was undeniably proved by the temporary huts which were seen in several places. Near one of these huts, the bones of kangaroo were found, and several trees where seen on fire.[12]

It wasn't until rural settlement began in the western Cumberland Plain, during the 1790s, that Aboriginal groups in this region came into regular and permanent contact with British colonists. Relations quickly disintegrated, and tensions over land and resources spilled over. Governor King

[7] Matthews, R.H. and Everitt, M.M. 1900. "The organisation, language and initiation ceremonies of the Aborigines of the south-east coast of N.S. Wales." Journal and Proceedings of the Royal Society of NSW 34: 262-281.
[8] Attenbrow, V. 2010. Sydney's Aboriginal Past: Investigating the Archaeological and Historical Records University of New South Wales Press Ltd, Sydney.
[9] ibid
[10] Butlin, N. G. (Noel George) & Australian National University (1985). Australian national accounts 1788-1983. Australian National University, Canberra
[11] Karskens, G. 2010. The Colony: a history of early Sydney. Crow's Nest, N.S.W., Allen & Unwin.
[12] (1978). Historical records of New South Wales. [Vol.1, part 2]. Phillip, 1783-1792. Lansdown Slattery & Co, Mona Vale, N.S.W

sanctioned the shooting of Aboriginal peoples in a General Order made in 1801.[13] Intermittent killings on both sides continued for over 15 years, including the Appin massacre and attacks at South Creek in 1816.[14][15]

## 4.2 Early European exploration and land grants

European exploration in the Prospect area began on 26 April 1788, when Governor Arthur Phillip led an expedition party west from Sydney Cove, climbing what would later be known as Prospect Hill (approximately ten kilometres east of the proposal site).[16] From here, Phillip stated that he was able to view 'for the first time since we landed, Carmarthen Hills'[17], later known as the Blue Mountains. At this time, Phillip named the hill 'Bellevue'. The hill was an exceptional vantage point, used by expedition parties as a reference point.

In 1789, Captain Watkin Tench made an official journey west, using Prospect Hill as a reference. He was taken by the beauty of the rugged Blue Mountains to such a degree that the hill became known as Tench's Prospect Hill, later shortened to Prospect.[18]

Following the agricultural success at James Ruse and Rose Hill within the early years of settlement, Phillip placed a farming settlement of at least twelve families encircling Prospect Hill in 1791.[19] The grants were mostly 30 acres each and settlers included William Butler, James Castle, Samuel Griffiths, John Herbert, George Lisk, Joseph Morely, John Nicols, William Parish and Edward Pugh.

Land parcels in and around the proposal site were also granted during this time. The land in which the proposal site resides forms part of the original 1100-acre land granted to John Thomas Campbell in 1819 (Figure 3).[20] Campbell would go on to name the property 'Mount Philos', presumably after the Philo Free trial of 1817, which saw Campbell sued by Reverend Samuel Marsden after a letter vilifying the Reverend was published in the first issue of the Sydney Gazette. Rev. Marsden accused Campbell of penning and publishing the letter under an alias ('Philo Free'), an accusation that saw damages paid to Rev. Marsden in the amount of 200 pounds.[21]

Other notable grants included James Erskine's 3000 acres to the west of the proposal site and across Ropes Creek in 1818.[22] Additional grants surrounding the proposal site included 50 acres to Joseph Kearns, George Smith, Pearce Collets, Thomas Howard and John Watts; and 60 acres to Richard Partridge. By 1820, much of the land within the area had been cleared, and a number of further land grants made.

[13] Kohen, J.L. 1986. An Archaeological Study of Aboriginal Sites Within the City of Blacktown, Blacktown City Council.
[14] Kohen 1986: 23
[15] Karskens 2010: 225
[16] OEH, 2001. 'Prospect Reservoir and surrounding area'. Accessed online 27 February 2020, https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5045336
[17] Governor Arthur Phillip 'Sydney Cove New South Wales', Letter to Lord Sydney, 15 May 1788.
[18] Frances Pollon, 1991. *The Sydney Book of Suburbs*. NSW: Collins Angus & Robertson Publishers Australia, p. 210.
[19] Pollon, 1991. *The Sydney Book of Suburbs,* p. 210.
[20] NSWLRS. RPA52819
[21] MAGAZINE (1992, September 5). The Canberra Times (ACT: 1926 - 1995), p. 4 (Saturday Magazine). Retrieved April 1, 2020, from http://nla.gov.au/nla.news-article126940871
[22] Navin Officer.2006. Cultural Heritage Assessment. Historic Site EPRCH5 Ropes Creek, Western Sydney.


**Figure 3: Melville parish map, n.d. Approximate location of the proposal site highlighted in red. Source: Historical Land and Property Viewer.**

## 4.3 The Campbell Estate

In 1832, the parcel was sold on to Charles Roberts and his wife Margaret.[23] The Roberts' retained the land for over 20 years, until 1856 when they sold the property to Thomas William Shepherd, David Shepherd and Patrick Lindsay Crawford Shepherd.[24] The Shepherd brothers would go on to combine the land with their portion of the Erskine Park Estate to the west of Ropes Creek and opened "Chatsworth Nursery", a family extension from Darling Nursery in Chippendale which was opened by the family patriarch, Thomas Shepherd.[25]

The early years of the nursery were prosperous, and the land harvested an array of fruits, vegetables, plants and flowers. [26] An 1887 newspaper account (Figure 4) of the nursery paints the surrounding landscape as:[27]

> *The nursery gardens are some three miles from the station, and are reached by a bush track, which, crossing the now-deserted Western road, meanders through half-cleared country that rolls greenly underfoot, rising and falling like the broad*

[23] NSWLRS. 145656-48252-1
[24] ibid
[25] Darling Nursery and Chatsworth. (1872, July 20). Australian Town and Country Journal (Sydney, NSW: 1870 - 1907), p. 12. Retrieved April 1, 2020, from http://nla.gov.au/nla.news-article70495913
[26] Shepherd and Co.'s Catalogue. (1894, March 17). The Sydney Mail and New South Wales Advertiser (NSW: 1871 - 1912), p. 530. Retrieved April 1, 2020, from http://nla.gov.au/nla.news-article163331385
[27] THE CHATSWORTH NURSERY. (1887, December 3). The Daily Telegraph (Sydney, NSW: 1883 - 1930), p. 5. Retrieved April 1, 2020, from http://nla.gov.au/nla.news-article236771081

*waves of the Pacific, in undulating lines as far as the eye can reach…. Wonderfully fruitful is the red soil which is found on the 16a of nursery land before us. Emerging from a pretty house on the estate, Mr F.W.Creswick… welcomes us to the spot… Not far away we find a greenhouse specially built for the accommodation of the camellia… another 10,000 specimens of various ages (are) stored in a bush house, which covers an acre of ground.*

**The Planting Season, 1896.**

**Chatsworth Nursery, Rooty Hill; Darling Nursery, Sydney;**

The Oldest and Largest Establishments in Australia, are the Best and Cheapest places to get everything for Orchards, Gardens, and Pleasure Grounds.

**Shepherd and Co.** HAVE A LARGE STOCK OF

**FRUIT TREES well grown, clean and healthy,**

Comprising—Apples, Apricots, Peaches, Pears, Plums, Nectarines, Cherries, Quinces, Walnuts, Currants, Gooseberries, Raspberries, Japanese Plums, Persimmons, etc.
Also Oranges, Lemons, Citrons, Limes.

*Our Stock of ORNAMENTAL TREES and SHRUBS cannot be Surpassed,*

Suitable for any purpose, viz.: Magnolias, Camellias, Azaleas, Roses, Carnations, Ferns, Bouvardias, Pelargoniums, Daphnes, Fuchsias, Palms, Petunias, Chrysanthemums, etc. Also Planes, Elms, Oaks, Ash, Limes, Sycamore, Poplar, Birch, Maple, Cedars, Pines, Cupressus, Larch, etc.

BULBS, A FINE LOT.

Viz.: Narcissus, Hyacinths, Liliums, Gladioli, Anemones, Tulips, Ranunculus, Crocus, etc

NEW SEEDS OF EVERY DESCRIPTION:
Flower Seeds, Vegetable Seeds, Grass Seeds, Fodder Seeds, etc.
Nothing is too Small, Nothing is too Large for us to attend to.

Honest advice given to all—gratis. CATALOGUES Post FREE on application.

**SHEPHERD AND CO.,**
(Established 69 Years)

**Darling Nursery, Lachlan-street, Waterloo** (No other City Address); **Chatsworth Nursery, Rooty Hill.**

MESSRS. JUDGES BROS., PENRITH AGENTS, from whom Catalogues may be obtained.

**Figure 4: Chatsworth Nursery, Rooty Hill advertisement, 1896. Source: Trove**

The Shepherds renamed the Mount Philo property 'Chatsworth' and built a house of the same name, located outside of the proposal site.[28] The Shepherd Brothers nursery was one of the earliest (if not the earliest) commercial nurseries in Australia. They were instrumental in the development of landscape gardening and horticulture and promoted a wide range of exotic plants for use in Australian colonial gardens. Olives were a variety of plant particularly promoted by the Shepherds and grown at the Chatsworth Nursery. By the 1870s, the Chatsworth nursery was well stocked with large numbers of fruit trees including plantations of apple trees, pear trees, quinces, peaches, apricots, medlars and mulberries, which were shipped throughout New South Wales, Queensland, New Zealand, Melbourne and Western Australia. The estate also produced various kinds of beans intended for supplying the seed trade, while a variety of maize was planted for the purpose of proving them, and also for making the place self supporting for stock.

[28] Ecological 2016, *Lot 10 DP1157491, Eastern Creek, NSW – Historical and Aboriginal Heritage Study.* p. 55.

By the 1880s, the remaining brothers, David and Patrick, were in dispute over the operation of the family business and each began trading separate businesses, using the Chatsworth nursery for their commercial stock. Patrick became proprietor of PLC Shepherd and Son, Seed Merchants. However, by the end of the nineteenth century, the nursery was in decline and with the onset of the 1890s economic depression in NSW, the Shepherd brothers decided to sell the business, which was now largely supplying packeted seeds, to Yates Ltd. Shepherd's Seed Merchants continued to trade under the same name, albeit as a subsidiary of Yates, until the late 1940s.[29]

In 1909, the land on which the proposal site is located was sold to Thomas Baker, a grazier.[30] Baker passed away in 1934,[31] leaving the land to his widow and children. Portions of the land were then sold off and later amalgamated. Burfield Pty Ltd (renamed Ray Fitzpatrick Pty Ltd) bought the land on which the proposal site is located in the mid-1950s.[32]

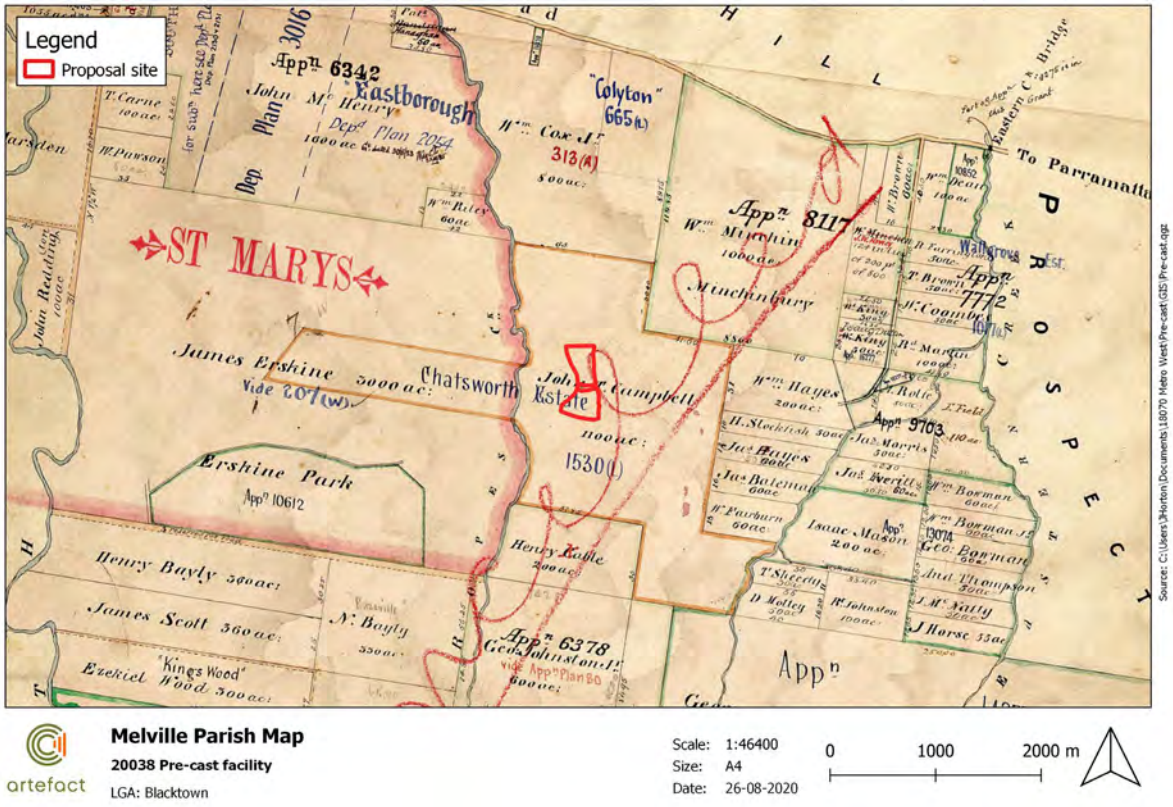


**Figure 5: Melville Parish map showing John Campbell's original grant now included within the Chatsworth Estate[33]**

## 4.4 Land Development

The early land grants at Prospect were extremely successful, and lead to an influx of free settlers living in the area. Infrastructure and transport were developed, particularly following the establishment of a route over the Blue Mountains to the Western Plains.[34] A coach service crossing the Blue

[29] MR. F. W. CRESWICK (1937, April 29). The Cumberland Argus and Fruitgrowers Advocate (Parramatta, NSW: 1888 - 1950), p. 14. Retrieved April 1, 2020, from http://nla.gov.au/nla.news-article106155672
[30] BIG ESTATES (1934, August 27). The Sun (Sydney, NSW : 1910 - 1954), p. 6 (FINAL EXTRA). Retrieved April 1, 2020, from http://nla.gov.au/nla.news-article229562434
[31] Rich Estates. (1934, September 4). Dungog Chronicle : Durham and Gloucester Advertiser (NSW : 1894 - 1954), p. 3. Retrieved April 1, 2020, from http://nla.gov.au/nla.news-article141481418
[32] NSWLRS. RPA52819
[33] Land Registry Services, n.d. 'Melville Parish Map'. Accessed online 1 April 2020, https://hlrv.nswlrs.com.au/
[34] Morrison, 2005. *CMP*. p. 52.

Mountains, passing through Prospect was established in 1832, shortly followed by the railway in 1860. In addition, St Bartholomew's Anglican Church was consecrated in 1841 and several inns began to appear along the newly established roadways.[35]

Following the collapse of the cereal grain industry during the 1870s, the area shifted from crop growing industry to livestock rearing. Many of the earliest structures made by the first settlers had been demolished by this point and land at Prospect and Rooty Hill continued to be used for agricultural purposes up until the construction of the Prospect Reservoir.

Land within the proposal site, and around Prospect continued to be utilised for agricultural purposes throughout the remainder of the nineteenth and into the twentieth century. William Freame, in his 1923 book '*A Delectable Parish: Prospect and Seven Hills'*, described the area as:

> *'largely a land of rural homes…they are gregarious at respectable distances, with garden and orchard plots intervening. They appreciate the personal importance which comes from the private ownership of the land they occupy…cultivated fields and green meadows [are] bisected by long winding red roads.'*[36]

Aerial imagery from the c1950s indicates that this description of Prospect remained accurate. Historical development in the vicinity of the proposal site was limited to a number of rural properties with the proposal site used for open paddocks and crop fields (Figure 6 – Figure 14). As depicted in the below figures, no significant structures are noted within the proposal site from the 1950s, though two modern structures can be seen in the 2004 and 2007 aerial imagery, and some fence lines may be present.

A shed and yard complex is visible directly north-east of the proposal site within these aerials. This shed structure appears to have been demolished by 2007 (Figure 13). The north-eastern corner of the proposal site is located within paddocks associated within this complex (Figure 15). Visible remains of the shed and yard complex were identified on the site inspection undertaken by Artefact Heritage on 18 June 2020 and are discussed in Section 5.

Previous heritage assessments of the shed and yard complex are discussed below in Section 4.5.

[35] Morrison, 2005. *CMP*. p. 53.
[36] Freame, 1923. *A Delectable Parish,* p. 29.


**Figure 6: c1960s aerial imagery depicting the proposal site and surrounding landscape, Source: NSW Department of Finance, Services and Innovation**


**Figure 7: 2004 aerial imagery. Note structure to the north-east of the proposal site and structures to the north of the proposal site boundary (outline in red). Source: Google Earth**

## 4.5 Relevant heritage assessments

**Navin Officer Heritage Consultants, 2006. *Historic Site EPRCH5: Cultural Heritage Assessment.* Report to FDC Building Services Pty Ltd.**

In 2005, Navin Officer Heritage Consultants undertook a cultural heritage assessment for the Erskine Park Employment Area, Ropes Creek, Western Sydney. The project was located on the western side of Ropes Creek, approximately 400 metres south west of the proposal site.

The assessment identified the remains of a wooden slab hut with sandstock brick chimney, approximately dating to the late nineteenth century (Figure 8). The historical context of the remains remain unknown; however, they may have been associated with the original Erskine Park Estate or original Erskine Park Homestead.

The remains were classified as a relic under The Heritage Act, yet it was considered to have little heritage significance and did not fulfil the criteria for local or State heritage listing.


**Figure 8: Slab hut remains as identified by Navin Officer Heritage Consultants, 2006.**

**Artefact Heritage, 2016. *Archbold Road: Statement of Heritage Impact.* Report to Parsons Brinkerhoff.**

Artefact Heritage prepared a SoHI for the upgrade and southern extension of Archbold Road between the Great Western Highway, Minchinbury and to the Southern Link Road, Eastern Creek. A portion of the assessment area falls within the proposal site. The assessment found that the area was associated with the early nineteenth century estates of William Cox, John Thomas Campbell and Henry Kable. It has typically been associated with pastoralism and horticulture, including orchards of the Chatsworth Estate during the mid-nineteenth century. By the late twentieth century, the area had become highly urbanised and industrialised.

The SoHI identified an area within the proposal site with potential to contain archaeological remains of a shed and yard complex on land originally belonging to the former Chatsworth Estate. However, historical resources and imagery indicate that the yards were developed post-1900, and the shed was constructed between 1950 and 1960. This would indicate that these remains would not have been associated with the development of Chatsworth Estate; rather twentieth century development. The paddocks associated with these remains are partially located within the proposal site, in the north-east corner (Figure 15). In addition, the SoHI noted that the location of Chatsworth House was likely to be located between Ropes Creek and the shed and yard complex, outside the proposal site.

The development of the shed and yard complex is detailed within Figure 9 – Figure 15. The yard areas are visible within the c1950s aerial imagery (Figure 9), however, the shed does not appear until the c1960s (Figure 10). The complex appears to have been utilised throughout the late twentieth and into the twenty-first century, with the shed demolished c2007 (Figure 13).

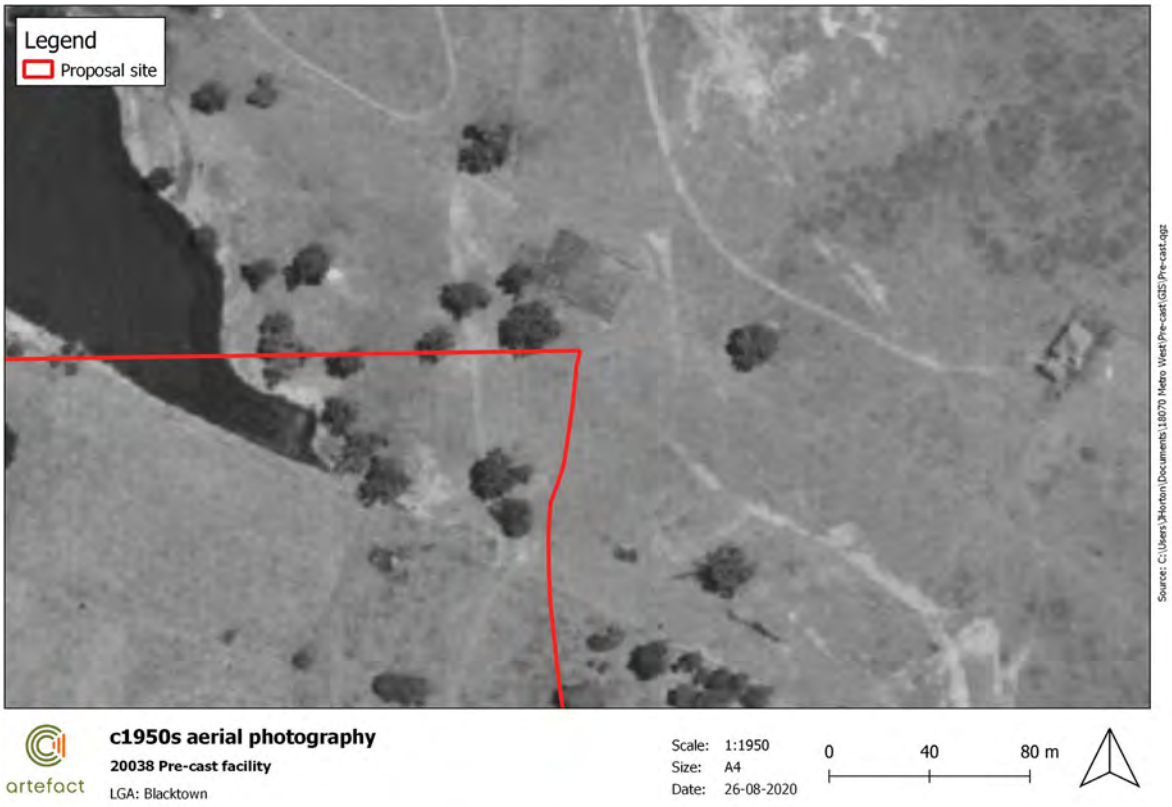


**Figure 9: Detail of shed and yard complex to the north-east of the proposal site on c1950s aerial imagery.**

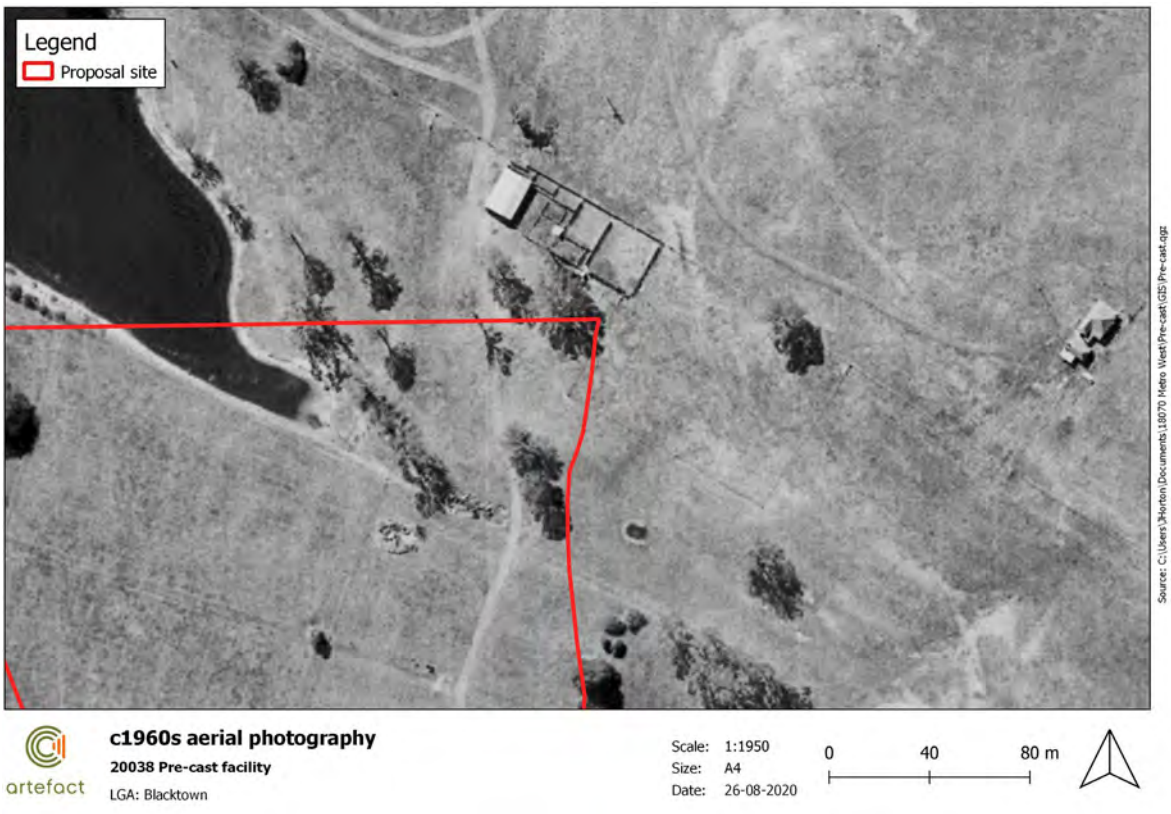


**Figure 10: Detail of shed and yard complex to the north-east of the proposal site on c1960s aerial imagery. Proposal site outlined in red.**


**Figure 11: Detail of shed and yard complex to the north-east of the proposal site on c1970s aerial imagery. Proposal site outlined in red.**


**Figure 12: Detail of shed and yard complex to the north-east of the proposal site, 2004 aerial imagery. Source: Google Earth**


**Figure 13: Detail of shed and yard complex to the north-east of the proposal site, note demolitions, 2007 aerial imagery. Source: Google Earth**


**Figure 14: Detail of shed and yard complex to the north-east of the proposal site (outlined in red), present-day aerial imagery. Source: Google Earth**

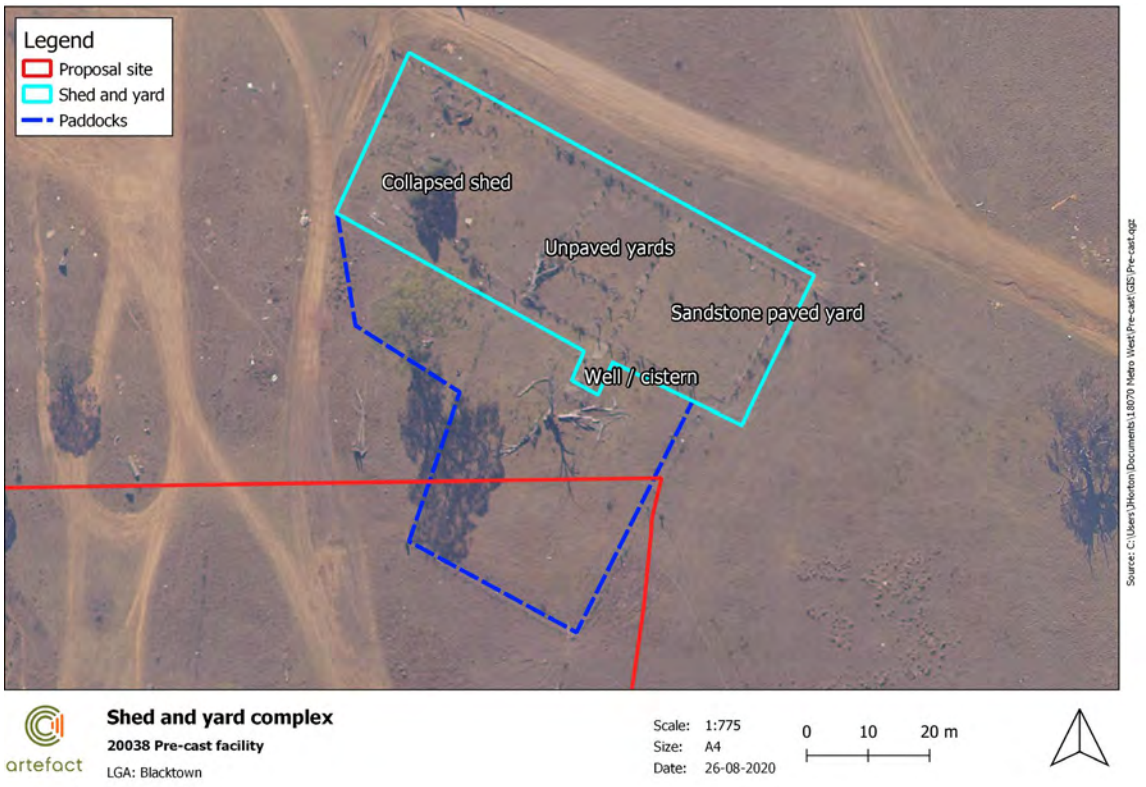


**Figure 15: Present day aerial imagery showing remains of former shed and yard complex, potentially associated with the Chatsworth Estate. Note proposal site within associated paddock area**

**Ecological, 2016. *Lot 10 DP 1157491, Eastern Creek, NSW: Aboriginal and Historical Heritage Study*. Report to Department of Planning and Environment.**

Ecological were commissioned to prepare a Historical and Aboriginal Heritage Study to inform a Development Control Plan for Lot 10 DP1157491 at Eastern Creek, NSW which includes the current proposal site. The report found that the area contained high potential for the survival of an archaeological resource relating to the occupation and development of the Chatsworth homestead site over time. The archaeological resource was assessed as possessing local significance for association with the Chatsworth nursery and the Shepherd family. The Chatsworth homestead is indicated in Figure 16 and is located outside the proposal site.

The other historical archaeological areas identified by Ecological, including the shed and yard complex were not considered to reach the threshold for local significance. These items are common on rural properties and were all constructed around or after 1900.

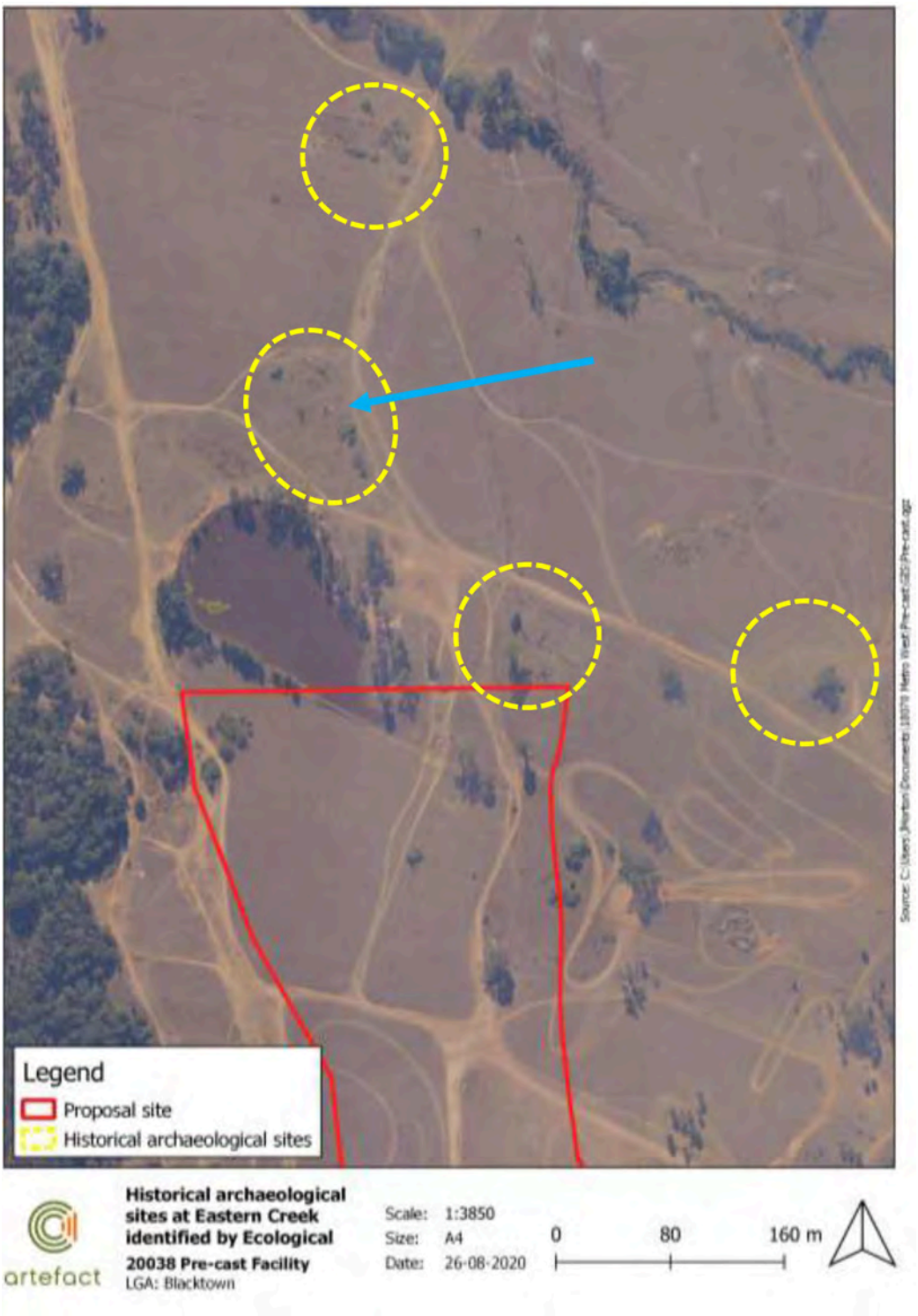


**Figure 16: Historical archaeological sites at Eastern Creek identified by Ecological. The Chatsworth homestead is located directly north of the reservoir, at the centre of the image (blue arrow).**[37]

[37] Ecological 2016, *Lot 10 DP1157491, Eastern Creek, NSW – Historical and Aboriginal Heritage Study.* p. 55.

# 5.0 SITE INSPECTION

An inspection of the proposal site and immediate surrounds was undertaken by Jessica Horton (Heritage Consultant, Artefact Heritage) and Alyce Haast (Senior Heritage Consultant, Artefact Heritage) on 8 April 2020. An additional site inspection was undertaken on 18 June 2020 by Alyce Haast and Josh Symons (Principal, Artefact Heritage).

The proposal site is comprised of a 16 hectare area of open paddock which is bound by open paddock to the north and east; Ropes Creek to the west; Lenore Drive to the south, and the industrial and commercial development further to the east. The proposal site is defined by open grassed paddock interspersed with vegetation. A number of dirt tracks extend throughout the proposal site; however, vegetation and grass has also grown over a number of these tracks (Figure 17 – Figure 18).

Visible archaeological remains within the proposal site were limited to the north-eastern corner of the proposal site and include the remains of the shed and yard complex and a small partially subsurface rubbish dump.

Identified remains of the shed and yard complex included a sandstone paved yard feature, sandstone edging, several former fence lines and a concrete structure (Figure 19 – Figure 22). The sandstone paved yard feature included hand cut sandstone blocks which have been roughly paved across the yard structure. Based on the rough nature of these sandstone blocks it is considered likely that these features may have been re-used as part of construction of the yard feature. An additional fenced yard was located to the north-west of the sandstone paved feature with no evidence of sandstone or other formalisation of the surface identified. The two yard features were separate from the remainder of the paddock area by consistent and relatively closely spaced rectangular wooden fence posts. Minimal remains associated with the shed structure were noted with small pieces of corrugated iron noted in the north-western portion of the structure.

Additional remains to the south of the yard structures include a concrete pad feature which measures approximately 10 m x 3 m. The concrete feature is comprised of three sections, including a central rounded portion which dips slightly into the centre of the feature. The central portion included portions of brick lining which appeared to extend to some depth into the ground surface.

Both the yard features and shed feature are located outside of proposal site. Portions of the shed and yard complex within the proposal site were limited to a paddock fence line which was comprised of a mixture of star pickets and circular wooden fence posts.

Further historic remains were identified in a small rubbish dump (Figure 23- Figure 24) approximately 75 m south of the shed and yard complex. The rubbish dump included a variety of metal and brick debris including remains of a metal fridge as well as several fence posts and star pickets. Material within the rubbish dump appears to date to the mid twentieth century.

**Figure 17: View within proposal site showing dirt accessway and grasses. Artefact Heritage, 2020.**

**Figure 18: View within proposal site showing vehicle tracks and dense grasses**

**Figure 19: Sandstone paved yard surface north-east of the proposal site. Artefact Heritage, 2020.**

**Figure 20: Former fence line north-east of the proposal site. Artefact Heritage, 2020.**

**Figure 21: Concrete surface north-east of the proposal site. Artefact Heritage, 2020.**

**Figure 22: Raised sandstone paddock boundary north-east of the proposal site. Artefact Heritage, 2020.**

**Figure 23: Rubbish dump within north-east corner of proposal site. Artefact Heritage, 2020.**

**Figure 24: Rubbish dump within north-east corner of proposal site. Artefact Heritage, 2020.**

# 6.0 ARCHAEOLOGICAL ASSESSMENT

## 6.1 Introduction

Non-Aboriginal archaeological potential is defined as the potential of a site to contain historical archaeological 'relics', as classified under the Heritage Act.

Non-Aboriginal archaeological potential is assessed by identifying former land uses and associated features through historical research and evaluating whether subsequent actions (either natural or human) may have impacted on evidence for these former land uses. The following section constitutes a preliminary archaeological assessment within the proposal site, where ground disturbing activities are anticipated.

## 6.2 Archaeological assessment

The following assessment of archaeological potential has been divided into the following historical phases:

- Phase one – early land use and grants (c1819 – mid-19th century)
- Phase two – horticultural and agricultural development, the Chatsworth Estate (mid-19th century – mid-20th century)
- Phase three – current landscape and cattle grazing (mid-20th century – present).

### *6.2.1 Phase one: c1819 – mid-19th century*

There are no records of any significant developments taking place within the proposal site during Phase one.

Localised vegetation removal and preparation of the land for agricultural use are likely to have been the earliest land-use activities, however historical descriptions of the site indicate that much of the proposal site remained under heavy bushland into the 1890's. Potential archaeological remains typically associated with nineteenth century clearing and agricultural use are ephemeral in nature. Activities such as tree clearance, fence construction, the development of unsealed tracks and agricultural planting leave little material evidence and are not likely to be identified. There is no evidence of any structures being located within the proposal site during this phase.

Phase one is associated with localised land clearance, low intensity pastoral / agricultural uses, early subdivisions and animal rearing.

**There is nil potential for archaeological remains associated with Phase one to be present within the proposal site.**

### *6.2.2 Phase two: Mid-19th century – mid-20th century*

Historical descriptions of the proposal site during this phase, as detailed in Section 4 above, note that much of the proposal site retained heavy bushland up to the 1890s, by which point a number of dwellings and buildings associated with horticultural practices began to be developed.

Archaeological remains associated with this phase may include evidence of former access ways, roads, fence lines, and evidence of horticultural and farming practices.

Archaeological remains of a shed and yard complex were identified to the north-east of the proposal site (Figure 15). Historical aerials identify that a distinctive paddock and yard shape was present at

the location of the shed and yard complex by the 1950's. The yard area is unlikely to pre-date c1900 as grazing activities were limited at the site prior to this time. Use of the yard appears to be expanded during phase three with construction of the shed identified as being between 1950 to 1960 in historical aerials. Use of the shed and yard facility in phase two is likely to have been associated with less extensive structures. Potential remains associated with this phase are likely associated with postholes and former yard surfaces.

There is high potential for the area around the shed and yard complex to contain archaeological remains associated with phase two. These remains may include structural remains (footings and postholes associated with yard fencing), evidence of water collection and storage (drains, wells, cisterns) and former yard surfaces. The majority of these features are likely to be located immediately north of the proposal site (see Figure 15 – Figure 16), however there is potential for former yard surfaces, postholes associated with yard fencing, and evidence of water collection to be present within the proposal site. As the site was primarily associated with agricultural use, there is low potential for occupation deposits to be present. The proposal site does have the potential to contain discarded artefacts associated with its former use, including horse shows, nails and tools.

**There is high potential for archaeological remains associated with Phase two to be present within a portion of the proposal site.**

### *6.2.3 Phase three: Mid-20th century – present*

Historical aerial imagery from c1950 to present day (Figure 9 – Figure 14) show that by this time the majority of the land with the proposal site had been cleared with remaining landscape elements such as dams and heavy vegetation spread throughout the proposal site. The proposal site is primarily associated with cattle grazing during this period.

Historical aerials identify that the shed and yard complex underwent substantial expansion between 1950 and 1960 with the shed structure and more substantial fence lines constructed in the main yard area.

Extant remains associated with the shed and yard complex, which were identified during a site inspection undertaken by Artefact Heritage on 18 June 2020, included the remnants of three yards, a collapsed shed, two circular well / cistern structures and a concrete pad. The easternmost yard features a sandstone block floor which has been loosely laid as a paving structure. This construction technique is considered to represent the opportunistic use of the sandstone materials (potentially reuse) which are considered to have been associated with the wider expansion of the structure in the 1950's. The presence of the concrete surface would further suggest the continued modification of the shed and yard structure into the later twentieth century. These features are located to the north-east of the proposal site.

The site inspection undertaken by Artefact Heritage on 18 June 2020 also identified the remains of a rubbish dump dating to phase three. Remains included refuse material such as star pickets, fence posts and a fridge.

Archaeological evidence of smaller structures (possibly sheds or outbuildings) identified on the eastern boundary of the proposal site, and constructed between the 1950s and 2004, may also survive within the proposal site.

**There is high potential for archaeological remains associated with Phase three to be present within a portion of the proposal site.**

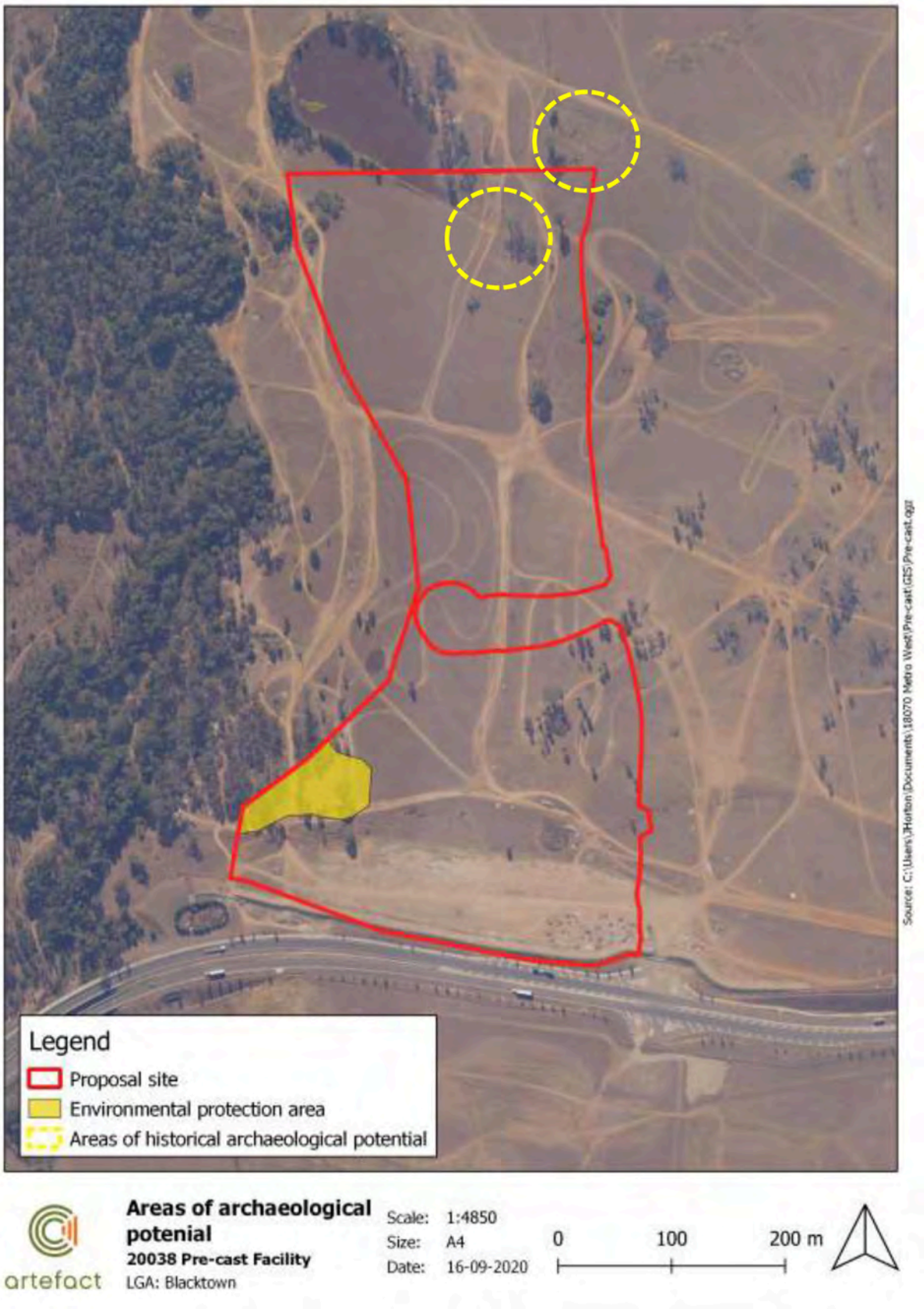


**Figure 25: Areas of historical archaeological potential relating to Phases two and three at the proposal site. The northernmost area of historical archaeological potential relates to the shed and yard complex, whilst the southernmost relates to the rubbish dump.**

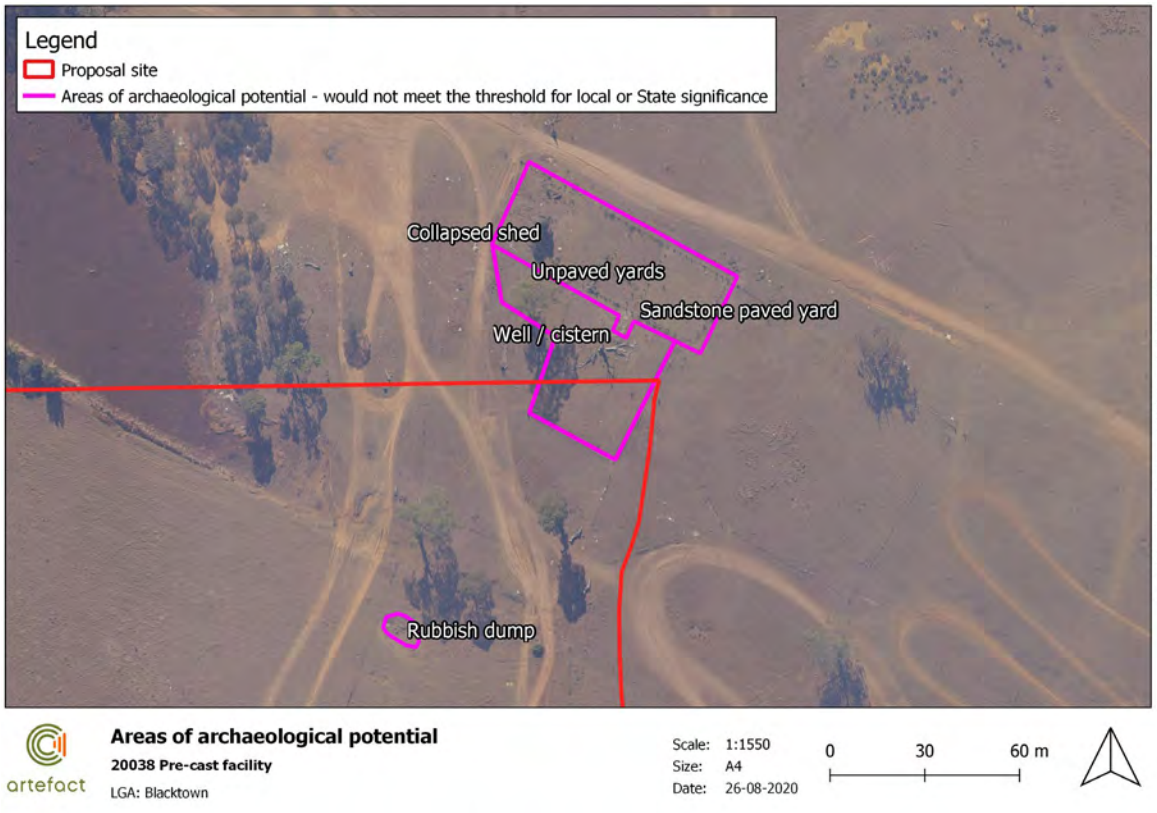


**Figure 26: Areas of historical archaeological potential relating to Phases two and three at the proposal site.**

## 6.3 Assessment of archaeological significance

### *6.3.1 NSW Heritage Significance Criteria*

The methodology for this assessment of archaeological significance has been outlined in Section 3.

The significance assessment for the archaeological potential of the potential significant archaeological remains is outlined in Table 4.

**Table 4: Heritage significance of the shed and yard complex potential archaeological remains**

| Criteria | Description |
|---|---|
| **A – Historical Significance** | The proposal site is located within the original Mount Philo Estate (later known as the Chatsworth Estate). The area was later acquired by Charles Roberts who established a stud farm on the property. The Chatsworth Estate was established during the 1850s. The land encompassing the proposal site was sold in 1909. The former fenced paddocks within the proposal site, associated with the shed and yard complex, would have been constructed post-1900 as grazing activities were limited at the site prior to this time. The appearance of the item in the c1950s - c1960s aerials indicates that it was maintained up until the mid-20th century. Therefore, the use of the item is related to Phase 2 and Phase 3. Although potential archaeological remains within the proposal site are associated with the local area's history, development, and rural economy, they are unlikely to provide information not available from any other source.<br><br>The potential archaeological resources for phases 2 and 3 do not meet the local significance threshold for this criterion. |
| **B – Associative Significance** | The proposal site is located within the former estates of John Thomas Campbell, Charles Roberts and the Chatsworth Estate. It is unlikely that the archaeological resource would contain remains directly associated with these land owners.<br><br>The potential archaeological remains for phases 2 and 3 do not meet the local significance threshold for this criterion. |
| **C – Aesthetic Significance** | Although it is recognised that exposed in situ archaeological remains may have distinctive/attractive qualities, only rarely are these considered 'important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW'.<br><br>The potential archaeological remains for phase 2 and 3 do not meet the local significance threshold for this criterion. |
| **D – Social Significance** | Community consultation was not undertaken for this assessment. It is unlikely the remains would have social significance as their whereabouts are not well known to the public.<br><br>The potential archaeological remains for phase 2 and 3 do not meet the local significance threshold for this criterion. |
| **E – Research Potential** | The former fenced paddocks within the proposal site, associated with the shed and yard complex, would have been constructed post-1900 as grazing activities were limited at the site prior to this time. Although there is potential for the archaeological resource to provide information on former pastoral practices within the region, it is unlikely to provide information not available from any other source.<br><br>The potential archaeological remains for phase 2 and 3 do not meet the local significance threshold for this criterion. |
| **F – Rarity** | The archaeological resource is not considered rare as there are many similar archaeological sites in rural NSW.<br><br>The potential archaeological remains do not meet the local significance threshold for this criterion. |
| **G - Representativeness** | The archaeological resource is unlikely to demonstrate any particular characteristics of NSW's cultural or natural places of cultural or natural environments or for the local area.<br><br>The potential archaeological remains do not meet the local significance threshold for this criterion. |

### 6.3.2 *Preliminary Statement of Significance*

The former shed and yard complex site is connected with the twentieth century rural history and development of the local area. Depending on the nature of the archaeological remains, in particular if there were artefacts or remains indicating specific activities within the complex, they could provide evidence of the site's former uses and answer research questions regarding rural practices of the local area. The majority of the shed and yard complex is located outside of the proposal site. The former fenced paddocks associated with the shed and yard complex within the proposal site are unlikely to contain archaeological remains which could provide information regarding rural farming practices which other sources could not. Therefore, potential archaeological remains of the former fenced paddocks associated with the shed and yard complex are unlikely to reach the threshold of local significance.

Potential archaeological remains associated with Phase two and three (i.e. 20th century rural structures and the identified rubbish dump) may be present within the proposal site. However, these remains are not expected to reach the threshold for local significance, as they do not fulfil the heritage significance criteria as outlined in Table 4.

## 6.4 Summary of archaeological potential and significance

A summary of archaeological potential and significance of potential remains in outlined in Table 5.

**Table 5: Summary of archaeological potential and significance**

| Phase | Potential remains | Significance | Potential |
|---|---|---|---|
| **Phase one** | Evidence of early land grants and subdivisions, land clearance, agricultural use | n/a | Nil |
| **Phase two** | Evidence of horticultural and agricultural activities, evidence of fence lines | n/a | Nil |
| | Former fenced paddocks associated with the shed and yard complex | Nil | High |
| **Phase three** | Shed feature, formalised and continued use at the shed and yard complex, rubbish dump, existing development | Nil | High |

# 7.0 HERITAGE IMPACT ASSESSMENT

## 7.1 Heritage impact assessment

The proposed works would comprise the construction and operation of two precast facilities to support tunnelling for Sydney Metro West. There are no heritage listed items in or within the vicinity of the proposal site therefore there would be neutral physical and visual impacts to listed items. Impacts to listed items associated with vibration or settlement would also be neutral.

## 7.2 Archaeological impact assessment

The proposal site overlaps with the paddocks associated with a former shed and yard complex in the north-eastern corner of the site as well as a small rubbish dump. This complex is associated with twentieth century rural history and development of the local area. However, these potential archaeological remains are not expected to reach the threshold for local significance.

The remainder of the proposal site has been assessed as having nil to low potential for archaeological remains. Potential archaeological remains which may be identified across the remainder of the proposal site associated with twentieth century agricultural use of the site are not expected to reach the threshold for local significance.

There would be no non-Aboriginal archaeological impacts as a result of the proposal.

## 7.3 Statement of heritage impact

There are no listed or unlisted items of heritage significance identified within or within the vicinity of the proposal site. As such, there would be neutral physical and visual impact as a result of the proposal. While the potential for archaeological remains within the proposal site has been identified, the current assessment has identified that these remains are unlikely to meet the threshold for local significance.

A statement of heritage impact has been prepared in accordance with the model provided in the NSW Heritage Division guidelines which delineates a statement of heritage impact into three key component questions[38] in Table 6.[39]

**Table 6: Statement of heritage impact for the proposal**

| Development | Discussion |
|---|---|
| What aspects of the proposal respect or enhance the heritage significance of the proposal site? | The proposal site is situated in a location which avoids locally significant structural remains associated with the former Chatsworth Estate homestead to the north. No areas of heritage significance have been identified within the proposal site. No heritage items have been identified as subject to visual impacts associated with the proposed development. |

[38] NSW Heritage Division, *Statements of Heritage Impact.* Accessed online https://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf

[39] The guidelines also provide examples of further assessment questions which may be appropriate in relation to modification to existing identified Heritage items. As no heritage listed items or unlisted items of local significance were identified within the proposal site, further consideration of these questions is not required.

| Development | Discussion |
|---|---|
| What aspects of the proposal could have a detrimental impact on the heritage significance of the proposal site? | The proposed works would have a physical impact on potential archaeological remains within the north-eastern corner of the proposal site, however these remains are not expected to reach the threshold for local significance. No listed heritage items or areas of archaeological potential which may reach the local significance threshold have been identified. Consequently there would be no detrimental impacts to the heritage significance of the proposal site. |
| Have more sympathetic options been considered and discounted? | The proposed works would not have a physical or visual impact on heritage listed items or significant remains so consideration of more sympathetic options was not required. |

# 8.0 CONCLUSIONS AND RECOMMENDATIONS

## 8.1 Conclusions

It was found that:

- There are no listed or potential items of heritage significance identified within the proposal site. As such, there would be neutral physical and visual impacts to heritage items as a result of the proposal
- The potential for archaeological remains have been identified within the north-east corner of the proposal site and are expected to be subject to physical impacts by the proposed works, however these remains are not expected to reach the threshold for local significance
- The remainder of the proposal site has been assessed as having nil to low potential for twentieth century archaeological remains. Potential archaeological remains within the remainder of the proposal site are not expected to reach the threshold for local significance.

## 8.2 Recommendations

The following recommendations are made:

- Archaeological remains identified within the north-east corner of the proposal site may be removed as required without further assessment or mitigation
- An Unexpected Finds Procedure, to be implemented in the event that potential non-Aboriginal heritage objects are exposed during construction, would be prepared that complies with the Heritage Act 1977.

# 9.0 REFERENCES

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artefact

Artefact Heritage

ABN 73 144 973 526
Level 4, Building B
35 Saunders Street
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au
www.artefact.net.au

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# Sydney Metro West
# Eastern Creek Precast Facilities

## Review of Environmental Factors

### Volume 3 Technical Appendices G - J

November 2020

Cover: A precast facility used on the Sydney Metro City & Southwest project.

# Appendix G

## Archaeological Survey Report

# Sydney Metro West
# Eastern Creek
# Precast Facilities

## Archaeological Survey Report
## FINAL

Report to Sydney Metro

Blacktown LGA

October 2020

artefact

Artefact Heritage
ABN 73 144 973 526
Level 4, Building B
35 Saunders Street
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au

## Document history and status

| Revision | Date issued | Reviewed by | Approved by | Date approved | Review type | Revision type |
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| 1 | 1 May 2020 | Josh Symons | Sandra Wallace | 1 May 2020 | Internal review | First draft |
| 2 | 26 May 2020 | JAE and Sydney Metro | Alyce Haast | 27 May 2020 | Client review 1 | First draft |
| 3 | 28 May 2020 | Josh Symons | Sandra Wallace | 2 June 2020 | Internal review | Second draft |
| 4 | 29 June 2020 | Josh Symons | Sandra Wallace | 30 June 2020 | Internal review – post second site visit | Second draft |
| 5 | 27 August 2020 | Josh Symons | Sandra Wallace | 31 August 2020 | Internal review | Third draft |
| 6 | 22 September 2020 | Josh Symons | Sandra Wallace | 22 September 2020 | Internal review | Final draft |
| Final | 23 October 2020 | Sandra Wallace | Sandra Wallace | 23 October 2020 | Client review 2 | Final |

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| **Name of project:** | Sydney Metro West Eastern Creek Precast Facilities |
| **Name of document:** | Sydney Metro West Eastern Creek Precast Facilities – Aboriginal Archaeological Survey Report |
| **Document version:** | Final |

# EXECUTIVE SUMMARY

This Aboriginal Archaeological Survey Report (ASR) has been prepared by Artefact Heritage Services Pty Ltd (Artefact) on behalf of Sydney Metro (the proponent) in relation to construction and operation of two precast facilities and associated ancillary infrastructure (the proposal). The facilities would support the construction of Sydney Metro West.

A Review of Environmental Factors is being prepared for the proposal seeking approval under Part 5 of the *Environmental Planning and Assessment Act 1979*. The purpose of this ASR is to support the Review of Environmental Factors for the proposal.

This report meets the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in* NSW (Department of Environment, Climate Change and Water, 2010a) and provides recommendations as to whether further archaeological investigation may be required in relation to the current proposal.

It was found that:

- Ten Aboriginal sites are located within the proposal site
  - Blacktown Southwest 11 (AHIMS ID 45-5-0563)
  - Blacktown Southwest 7 (AHIMS ID 45-5-0559)
  - RCIF 2 (AHIMS ID 45-5-3159)
  - RCAS 4 (AHIMS ID 45-5-3162)
  - RCAS 5 (AHIMS ID 45-5-3163)
  - AIF-06 (AHIMS ID 45-5-4599)
  - AIF-05 (AHIMS ID 45-5-4605)
  - RCAS09 (AHIMS ID 45-5-5355)
- RCAS 10 (AHIMS ID 45-5-5354)RCAS 11 (AHIMS ID 45-5-5353)The current assessment has identified an area of potential archaeological deposit (PAD) associated with the wider site extent of Aboriginal sites RCIF 2 (AHIMS ID 45-5-3159) and Blacktown Southwest 7 (AHIMS ID 45-5-0559) as well as the area of PAD identified within RCAS 09 (AHIMS ID 45-5-5355)
- RCIF 2 (AHIMS ID 45-5-3159) and Blacktown Southwest 7 (AHIMS ID 45-5-0559) would be subject to partial harm as a portion of their identified site extents are located outside of the current impact area
- All remaining identified surface artefact sites within the proposal site would be subject to total harm resulting in total loss of value to all remaining sites.

The following recommendations are made:

- Archaeological test excavation would be limited to the proposal site and undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (Department of Environment, Climate Change and Water, 2010a) to confirm the geographic extent of RCIF 2 (AHIMS ID 45-5-3159), Blacktown Southwest 11 (AHIMS ID 45-5-0559) and the area of PAD identified within Ropes Creek Artefact Scatter 09 (AHIMS ID 45-5-5355)
  Test excavation would be limited to areas subject to potential impacts by the proposed works and outside the area already salvaged as part of the St Mary's Wastewater System Augmentation

project. Archaeological test excavation would be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010a)

- As part of the preparation of the test excavation methodology and ACHAR, comprehensive Aboriginal stakeholder consultation would be carried out in accordance with the *Aboriginal cultural heritage consultation requirements for proponents* (Department of Environment, Climate Change and Water, 2010b) and the National Parks and Wildlife Regulation 2019
- An AHIP would be submitted to the Department of Premier and Cabinet NSW (DPC) for those portions of the proposal site subject to impacts once test excavation is completed. The AHIP application would be supported by an ACHAR and test excavation report. An AHIP would be issued for the proposal prior to construction works commencing in areas where known Aboriginal sites and areas of PAD are located
- Sydney Metro would liaise with Transport for NSW regarding overlapping impacts to Aboriginal site AIF-06 (AHIMS ID 45-5-4599) and coordinating further assessment and management
- If suspected human remains are located during any stage of the proposed works, the Sydney “Metro Unexpected Finds Procedure” would be followed.

# CONTENTS

# FIGURES

# TABLES

# ABBREVIATIONS

| | |
|---|---|
| ACHAR | Aboriginal Cultural Heritage Assessment Report |
| AHIP | Aboriginal Heritage Impact Permit |
| AHIMS | Aboriginal Heritage Information Management System |
| Artefact Heritage | Artefact Heritage Services Pty Ltd |
| ASR | Archaeological Survey Report |
| ha | hectares |
| IMT | Indurated Mudstone/ Tuff |
| km | kilometres |
| m | metres |
| mm | millimetres |
| PAD | Potential Archaeological Deposit |

# 1.0 INTRODUCTION

## 1.1 Introduction

This archaeological survey report (ASR) has been prepared by Artefact Heritage Services Pty Ltd (Artefact Heritage) on behalf of Sydney Metro in relation to construction and operation of two precast facilities and associated ancillary infrastructure (the proposal). The facilities would support the construction of Sydney Metro West.

A Review of Environmental Factors has been prepared for the proposal seeking approval under Part 5 of the *Environmental Planning and Assessment Act 1979*. The purpose of this ASR is to support the Review of Environmental Factors for the proposal.

This report meets the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010a) and provides recommendations as to whether further archaeological investigation and an Aboriginal Heritage Impact Permit (AHIP) may be required in relation to the current proposal.

## 1.2 Proposal site

The proposal site for this assessment consists of a portion of Lot 10 DP1157491. The proposal site is bounded by Lenore Drive to the south, Ropes Creek to the west and open grassland to the north and east (See Figure 1).

The proposal site includes an area designated as an environmental protection area which would not be subject to works.

The proposal site is within the Parish of Rooty Hill and the county of Cumberland. The proposal site is within the boundaries of Deerubbin Local Aboriginal Land Council (LALC).


**Figure 1: Proposal site**

## 1.3 Description of works

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels.

The proposed works are further described in Section 9.1.

## 1.4 Purpose and scope of this report

This technical paper is one of a number of technical papers that form part of the Review of Environmental Factors. The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to Aboriginal heritage.

This report includes the following:

- A description of the proposal and identification of the proposal site
- A description of Aboriginal community involvement and Aboriginal consultation conducted for the ASR
- Discussion of the environmental context of the proposal site
- Discussion of the Aboriginal historical context of the proposal site
- A summary of the archaeological context of the proposal site including a discussion of previous archaeological work in the area
- Development of an archaeological predictive model
- Assessment of Aboriginal archaeological potential
- Description of Aboriginal sites within the proposal site
- Development of a significance assessment for these sites addressing archaeological values
- Impact assessment for Aboriginal sites in the proposal site
- Recommendations for management and mitigation measures for Aboriginal sites.

## 1.5 Authorship

Sandra Wallace (Director, Artefact Heritage) provided management input and technical review. Sandra has a Doctorate in archaeology and has over 17 years' experience in non-Aboriginal and Aboriginal heritage management.

Josh Symons (Principal, Artefact Heritage) provided management input and technical review. Josh has a Bachelor of Arts (Hons) in historic and prehistoric archaeology and has over 15 years' experience in non-Aboriginal and Aboriginal heritage assessments.

Alyce Haast (Senior Heritage Consultant, Artefact Heritage) managed the project and supervised the archaeological survey. Alyce also assisted in report preparation. Alyce has a master's degree in Professional Archaeology. Alyce has over five years' experience in Aboriginal and non-Aboriginal archaeology and has completed numerous projects within the Sydney region.

Gareth Holes (Heritage Consultant, Artefact Heritage) assisted in background research and report preparation. Gareth has a Master of Arts and has over 14 years' experience in archaeology in Australia and the United Kingdom.

## 1.6 Report structure

- **Section 2 – Legislative context**: outlines relevant legislation for this assessment
- **Section 3 – Environmental context:** Provides a succinct overview of the environmental context of the proposal site
- **Section 4 – Aboriginal historical and archaeological context:** Provides an overview of the Aboriginal history of the area and the results of previous archaeological investigation
- **Section 5 – Archaeological survey:** Describes the survey conducted for this assessment
- **Section 6 – Results:** Describes the Aboriginal sites present within the proposal site
- **Section 7 – Analysis and discussion:** Provides a discussion of the results of the site survey
- **Section 8 – Significance assessment:** Provides an assessment of the archaeological significance of the proposal site
- **Section 9 – Impact assessment:** Assesses potential impacts to identified Aboriginal sites and areas of archaeological potential
- **Section 10 – Management and mitigation measures:** Outlines relevant management and mitigation measures for the proposal
- **Section 11 – Recommendations:** Outlines recommendations for future assessment as required

# 2.0 LEGISLATIVE CONTEXT

## 2.1 State legislation

### *2.1.1 National Parks and Wildlife Act 1974*

The *National Parks and Wildlife Act 1974* provides statutory protection to all Aboriginal Places and objects. An Aboriginal object is defined by the *National Parks and Wildlife Act 1974* as:

> *any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.*

An Aboriginal Place is declared by the Minister for Energy and Environment, under Section 86 of the *National Parks and Wildlife Act 1974*, in recognition of its special significance with respect to Aboriginal culture. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is of special significance to Aboriginal culture. Aboriginal Places gazetted under the *National Parks and Wildlife Act 1974* are listed on the State Heritage Register established under the *Heritage Act 1977*.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. Aboriginal objects and places are afforded automatic statutory protection in NSW whereby it is an offence to knowingly or unknowingly harm or desecrate an Aboriginal object or Aboriginal Place under Section 86 of the *National Parks and Wildlife Act 1974*.

In accordance with Section 89A any person who is aware of the location of an Aboriginal object must in the prescribed manner, notify the Chief Executive within a reasonable time after the person first becomes aware of that object. The prescribed manner is to complete an AHIMS Site Recording Form (Department of Environment, Climate Change and Water, 2010: 14).

In order to undertake a proposed activity which is likely to involve harm to an Aboriginal Place or object, it is necessary to apply to Heritage NSW for an AHIP. AHIPs are issued by the Heritage NSW under Section 90 of the *National Parks and Wildlife Act 1974*, and permit harm to certain Aboriginal objects or Aboriginal Places.

There are no gazetted Aboriginal Places in the proposal site. There are seven previously registered AHIMS sites within the proposal site. Three additional sites were recorded and registered as part of the current assessment. Previously registered AHIMS sites are discussed in Section 4.5 and shown in Figure 10.

One AHIP permit has previously been issued for a portion of the proposal site, AHIP C0000501, which is further discussed in Section 2.1.1.1.

#### *2.1.1.1 AHIP C0000501*

AHIP C0000501 was issued to Sydney Water Corporation in relation to the St Mary's Wastewater Sydney Augmentation Detailed Planning Stage 2 Project on 5 August 2014 (St Mary's Wastewater System Augmentation Project). The AHIP authorised salvage excavation, community collection and harm to Aboriginal objects through the proposed works. Two sites within the current proposal site (AHIMS ID 45-5-0559 and AHIMS ID 45-5-3159) were subject to salvage and partial harm in accordance with AHIP C0000501 (Figure 2). Salvage reporting associated with this AHIP was completed in 2015 and is detailed in Section 4.4.

The AHIP was surrendered on 10 July 2018 and poses no constraints to the current proposal.

Redacted for public display

**Figure 2: Portion of AHIP C0000501 located within the proposal site**

### 2.1.2 *Native Title Act 1994*

The *Native Title Act 1994* was introduced to work in conjunction with the Commonwealth *Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

No Native Title Claims within the proposal site were identified on the National Native Title Tribunal *Native Title Vision* mapping service.

### 2.1.3 *Aboriginal Lands Right Act 1983*

The *Aboriginal Land Rights Act 1983* established Aboriginal Land Councils (at State and Local levels). These bodies have a statutory obligation under the *Aboriginal Land Rights Act 1983* to:

(a) take action to protect the culture and heritage of Aboriginal persons in the council's area, subject to any other law, and

(b) promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area.

The proposal site is within the boundary of Deerubbin Local Aboriginal Land Council.

### 2.1.4 *Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The *Environmental Planning and Assessment 1979* requires that environmental impacts are considered prior to land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits. The proposal is subject to assessment under Part 5 of the *Environmental Planning and Assessment Act 1979*.

The *Environmental Planning and Assessment Act 1979* also requires that local governments prepare planning instruments (such as Local Environmental Plans and Development Control Plans) in accordance with the *Environmental Planning and Assessment Act 1979*, to provide guidance on the level of environmental assessment required. The proposal site falls within the boundaries of the Blacktown Local Government Area. Schedule 5 of each Local Environment Plan lists items of heritage significance within each Local Government Area. If agreement is reached with the Aboriginal community, items or Aboriginal places of heritage significance are also listed within this schedule.

No Aboriginal places of heritage significance were identified within the Blacktown Local Environment Plan 2015.

## 2.2 Commonwealth legislation

### 2.2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* provides a legislative framework for the protection and management of matters of national environmental significance, that is, flora, fauna, ecological communities and heritage places of national and international importance. Heritage items are protected through their inscription on the World Heritage List, Commonwealth Heritage List or the National Heritage List.

Under Part 9 of the *Environment Protection and Biodiversity Conservation Act 1999*, approval is required for any action occurring within, or outside, a Heritage place that has, will have, or is likely to

have a 'significant impact' on the heritage values of a World, National or Commonwealth heritage listed property (referred to as a 'controlled action' under the Act). A 'significant impact' is defined as:

> *An impact which is important, notable, or of consequence, having regard to its context or intensity. If an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.*

The *Environment Protection and Biodiversity Conservation Act 1999* stipulates that a person who has proposed an action that will, or is likely to, have a significant impact on a site that is listed on the World Heritage List, National Heritage List or Commonwealth Heritage List must refer the action to the Minister for Sustainability, Environment, Water, Population and Communities. The Minister will then determine if the action requires approval under the *Environment Protection and Biodiversity Conservation Act 1999*. If approval is required, an environmental assessment would need to be prepared. The Minister would approve or decline the action based on this assessment.

There are no World, National or Commonwealth heritage listed sites within the proposal site and therefore referral of the proposal under the *Environment Protection and Biodiversity Conservation Act 1999* in relation to Aboriginal heritage would not be required.

### 2.2.2 *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* deals with Aboriginal cultural property (intangible heritage) in a wider sense. Such intangible heritage includes any places, objects and folklore that 'are of particular significance to Aboriginals in accordance with Aboriginal tradition'. These values are not currently protected under the *National Parks and Wildlife Act 1974*.

There is no cut-off date, and the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* may apply to contemporary Aboriginal cultural property as well as ancient sites. The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* takes precedence over state cultural heritage legislation where there is conflict. The Commonwealth Minister who is responsible for administering the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* can make declarations to protect these areas and objects from specific threats of injury or desecration. The responsible Minister may make a declaration under Section 10 of the Commonwealth Act in situations where state or territory laws do not provide adequate protection of intangible heritage.

Where an Aboriginal individual or organisation is concerned that intangible values within the proposal are not being adequately protected, they can apply to the Minister for a declaration over a place.

No intangible places were identified during the preparation of this report.

# 3.0 ENVIRONMENTAL CONTEXT

The environmental context of the proposal site is to assist in the prediction of:

- The potential of the landscape over time to have accumulated and preserved Aboriginal objects
- The ways Aboriginal people have used the landscape in the past with reference to the presence of resource areas, surfaces for art, other focal points for activities and settlement
- The likely distribution of the material traces of Aboriginal land use based on the above.

## 3.1 Environmental background

The proposal site is located within the Cumberland Plain, which is typified by an undulating landscape of rolling hills and prominent rises. The underlying geology of the proposal site consists of late Triassic period Bringelly shale deposits belonging to the Wianamatta Group (Clark and Jones, 1991). These deposits consist predominantly of claystone and siltstone with thin laminate horizons. Areas of sandstone are minor and sporadic within the Bringelly formation. However, sandstone is prominent along north to south trending flat crest ridgelines from Minchinbury through Cecil Park to Leppington and from Orchard Hills through Luddenham and Bringelly to Cobbitty (Clark and Jones, 1991).

The western portion of the proposal site includes areas of Quaternary alluvium above the underlying Bringelly shale formations. The Quaternary alluvium is associated with Ropes Creek and is largely comprised of fine-grained silt, sand and clay (Clark and Jones, 1991).

A diatreme is located 1.2 kilometres to the north-east of the proposal site, known as Jv17 Minchinbury (Clark and Jones, 1991:71). The Hanson Wallgrove Quarry is located on the diatreme. Prior to quarrying activities, the diatreme featured an outcrop of volcanic breccia which had been pushed up through the surrounding Bringelly Shale.

A significant feature of the regional geological landscape included a significant source of silcrete at Plumpton Ridge, approximately eight kilometres north of the proposal site. Silcrete, a raw material used by Aboriginal people across the Sydney Basin, was extracted from underlying Tertiary period geology called the St Marys formation. The silcrete raw material source at Plumpton Ridge was an important and extensively used quarry where extraction and tool manufacture activities took place (Jo McDonald Cultural Heritage Management, 2006).

Soils across the proposal site consist of the residual Blacktown soil landscape (Bannerman & Hazelton 1990). The Blacktown soils are shallow (<100 cm) hard setting mottled red and brown podzolic soils on crests and yellow podzolic soils on lower slopes and along drainage lines (Bannerman & Hazelton, 1990). The Blacktown soil landscape is generally associated with gently undulating rises. The soils are primarily poorly drained with very little erosional activity.

The proposal site runs parallel to Ropes Creek, a major water source in the region. Ropes Creek flows into South Creek, which eventually drains into the Hawkesbury River, approximately 22 kilometres to the north. Several smaller unnamed tributaries branch from Ropes Creek including one first order tributary across the northern portion of the proposal site (SixMaps, 2020). Based on historical aerials, additional unmapped drainage lines also cross the proposal site in several locations.

Other prominent watercourses nearby include Eastern Creek four kilometres to the east and the Nepean River 17 kilometres to the west.

## 3.2 Historical background and land use

European expansion throughout the Cumberland Plain displaced Aboriginal people from their traditional land and effectively cut off access to many resources. The first European activity in the area was exploratory; with Governor Arthur Phillip leading an expedition party west from Sydney Cove, climbing what would later be known as Prospect Hill (approximately ten kilometres east of the proposal site) (Office of Environment and Heritage, 2001). From here, Phillip stated that he was able to view 'for the first time since we landed, Carmarthen Hills' (Phillip, 15 May 1788), later known as the Blue Mountains. At this time, Phillip named the hill 'Bellevue'. The hill was an exceptional vantage point, used by expedition parties as a reference point.

In 1789, Captain Watkin Tench made an official journey west, using Prospect Hill as a reference. He was taken by the beauty of the rugged Blue Mountains to such a degree that the hill became known as Tench's Prospect Hill, later shortened to Prospect (Pollon, 1991: 210).

The first land grants in the Blacktown region were located at Prospect Hill. Governor Phillip granted a total of 13 plots to emancipated convicts in July 1791, ranging in size from 30 to 70 acres (Historical Records of NSW, 1978). Land parcels in and around the proposal site were also granted during this time. The land in which the proposal site resides forms part of the original 1100-acre land granted to John Thomas Campbell in 1819 (NSW LRS). Campbell would go on to name the property 'Mount Philos'.

In 1856 the parcel on which the proposal site is located was sold to Thomas William Shepherd, David Shepherd and Patrick Lindsay Crawford Shepherd (NSW LRS). The Shepherd brothers would go on to combine the land with their portion of the Erskine Park Estate to the west of Ropes Creek and opened "Chatsworth Nursery", a family extension from Darling Nursery in Chippendale (Australian Town and Country Journal, 20 July 1872).

The early years of the nursery were prosperous, and the land harvested an array of fruits, vegetables, plants and flowers (Shepherd and Co's Catalogue, 17 March 1894). An 1887 newspaper account of the nursery paints the surrounding landscape as:

> *The nursery gardens are some three miles from the station, and are reached by a bush track, which, crossing the now-deserted Western road, meanders through half-cleared country that rolls greenly underfoot, rising and falling like the broad waves of the Pacific, in undulating lines as far as the eye can reach…. Wonderfully fruitful is the red soil which is found on the 16a of nursery land before us. Emerging from a pretty house on the estate, Mr F.W.Creswick… welcomes us to the spot… Not far away we find a greenhouse specially built for the accommodation of the camellia… another 10,000 specimens of various ages (are) stored in a bush house, which covers an acre of ground. (The Daily Telegraph, 3 December 1887)*

Land within the proposal site, and around Prospect continued to be utilised for agricultural purposes throughout the remainder of the nineteenth century and into the twentieth century.

Aerial imagery from the c1960s indicate that built structures within the proposal site were limited to a number of rural residences and associated outbuildings, barn structures, open paddocks and crop fields. As depicted in Figure 3, no structures are noted within the proposal area in the 1960s. A 2004

aerial (Figure 4) depicts the location of a small outbuilding or shed to the north-eastern corner of the proposal site. This structure appears to have been demolished by 2012.

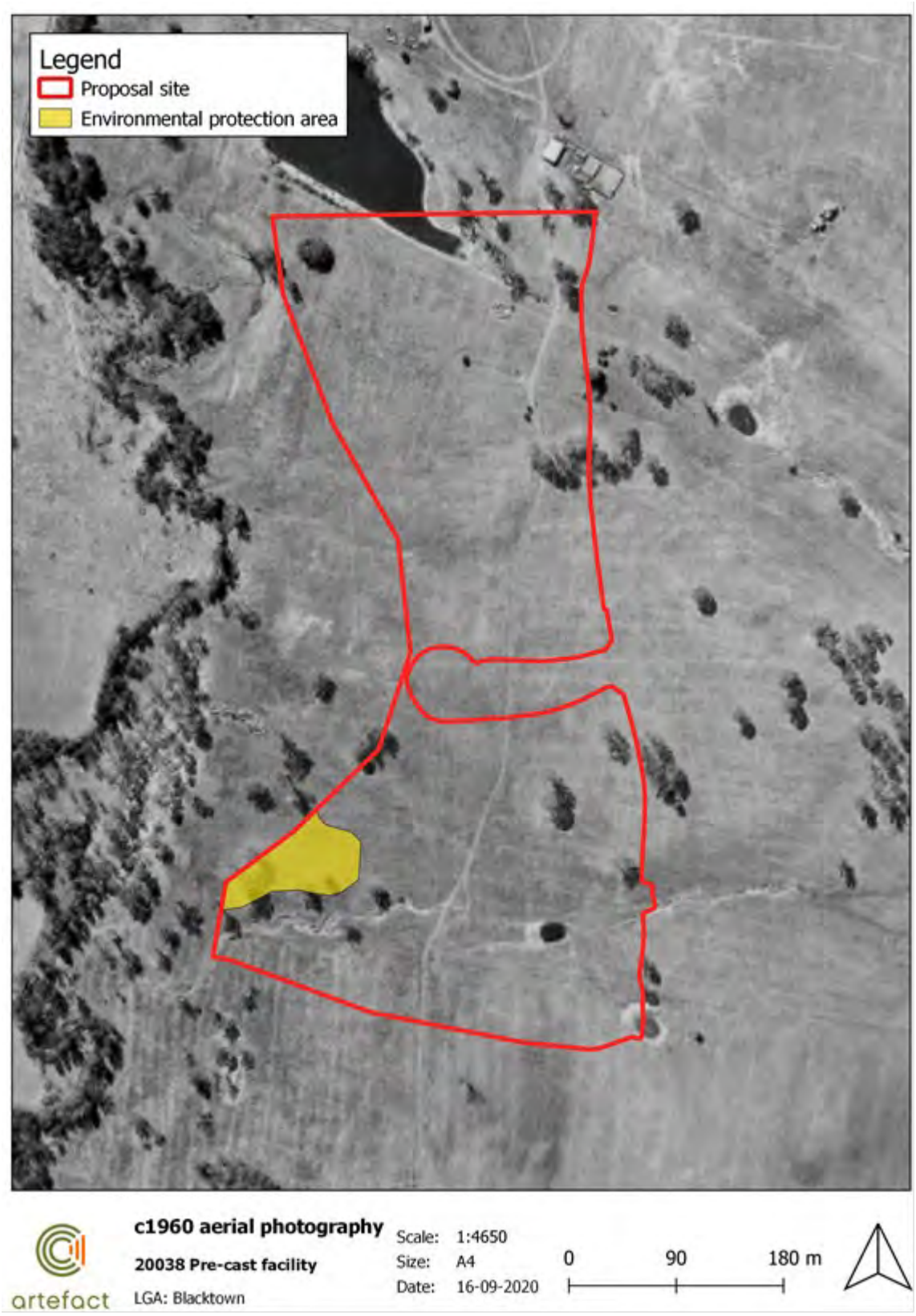


**Figure 3: 1960's aerial depicting the proposal site (highlighted in red) and surrounding landscape (Source: NSW Department of Finance, Services and Innovation)**


**Figure 4: 2004 aerial image (Source: Google Earth)**

# 4.0 ABORIGINAL HISTORICAL AND ARCHAEOLOGICAL CONTEXT

## 4.1 Aboriginal material culture

The archaeological understanding of the early Aboriginal settlement of the Sydney Basin and surrounds is constantly expanding and developing. The oldest evidence of human occupation in the vicinity of the study area comes from Cranebrook Terrace, located approximately 14 kilometres north west of the study area (Attenbrow, 2010: 18-20). Cranebrook Terrace has been dated to 41,700 years before present. Several other radiocarbon dates across the Sydney region have recovered dates of a similar antiquity including excavation in Parramatta dated to 30,725 years before present (Jo McDonald Cultural Heritage Management, 2005) and Pitt Town dated to 36,000 years before present.

Evidence of Aboriginal occupation has been found dated to 50-60,000 years before present at Lake Mungo in NSW, so it is likely that Aboriginal people have lived in the Sydney region for even longer than indicated by the oldest recorded dates we have at present. The archaeological material record provides evidence of this long occupation, but also provides evidence of a dynamic culture that has changed through time.

The existing archaeological record is limited to certain materials and objects that were able to withstand degradation and decay. As a result, the most common type of Aboriginal objects remaining in the archaeological record are stone artefacts. Archaeological analyses of these artefacts in their contexts have provided the basis for the interpretation of change in material culture over time. Technologies used for making tools changed, along with preference of raw material. Different types of tools appeared at certain times, for example ground stone hatchets are first observed in the archaeological record around 4,000 years before present in the Sydney region (Attenbrow, 2010:102). It is argued that these changes in material culture were an indication of changes in social organisation and behaviour.

The Eastern Regional Sequence was first developed by McCarthy in 1948 to explain the typological differences he was seeing in stone tool technology in different stratigraphic levels during excavations such as Lapstone Creek near the foot of the Blue Mountains (McCarthy et al. 1948). The sequence had three phases that corresponded to different technologies and tool types (the Capertian, Bondaian and Eloueran). The categories have been refined through the interpretation of further excavation data and radiocarbon dates (Hiscock and Attenbrow, 2005; Jo McDonald Cultural Heritage Management, 2006). It is now thought that prior to 8,500 years before present tool technology remained fairly static with a preference for silicified tuff, quartz and some unheated silcrete. Bipolar flaking was rare with unifacial flaking predominant. No backed artefacts have been found of this antiquity.

After 8,500 years before present silcrete was more dominant as a raw material, and bifacial flaking became the most common technique for tool manufacture. From about 4,000 years before present to 1,000 years before present backed artefacts appear more frequently. Tool manufacture techniques become more varied and bipolar flaking increases (Jo McDonald Cultural Heritage Management, 2006). It has been argued that from 1,400 to 1,000 years before contact there is evidence of a decline in tool manufacture. This reduction may be the result of decreased tool making, an increase in the use of organic materials, changes in the way tools were made, or changes in what types of tools were preferred (Attenbrow, 2010:102). The reduction in evidence coincides with the reduction in frequency of backed blades as a percentage of the assemblage.

After European colonisation, Aboriginal people of the Cumberland Plain often continued to manufacture tools, sometimes with new materials such as bottle glass or ceramics. There are several

sites in Western Sydney where flaked glass has been recorded including Prospect (Ngara Consulting, 2003) and Oran Park (Jo McDonald Cultural Heritage Management, 2007).

## 4.2 Aboriginal Ethno-historic Context

Prior to the appropriation of their land by Europeans, Aboriginal people lived in small family groups that were associated with particular territories or places. It seems that territorial boundaries were fairly fluid, although details are not known. The language group spoken on the Cumberland Plain is known as Darug (Dharruk – alternative spelling).

This term was used for the first time in 1900 (Matthews and Everitt) as before the late 1800s language groups or dialects were not discussed in the literature (Attenbrow, 2010:31). The Darug language group is thought to have extended from Appin in the south to the Hawkesbury River, west of the Georges River, Parramatta, the Lane Cove River and to Berowra Creek (Attenbrow, 2010:34). This area was home to a number of different groups throughout the Cumberland Plain.

British colonisation had a profound and devastating effect on the Aboriginal population of the Sydney region, including Darug speakers. In the early days of the colony Aboriginal people were disenfranchised from their land as the British claimed areas for settlement and agriculture. The colonists, often at the expense of the local Aboriginal groups, also claimed resources such as pasture, timber, fishing grounds and water sources. Overall, the devastation of the Aboriginal culture did not come about through war with the British, but instead through disease and forced removal from traditional lands. It is thought that during the 1789 smallpox epidemic over half of the Aboriginal people of the Sydney region died. The disease spread west to the Darug of the Cumberland Plain and north to the Hawkesbury. Some suggest that the disease may have spread much further afield, over the Blue Mountains (Butlin, 1983). This loss of life meant that some of the Aboriginal groups who lived away from the coastal settlement of Sydney may have disappeared entirely before Europeans could observe them or record their group names (Karskens, 2010:425).

The British initially thought that Aboriginal people did not live inland and were confined to the coast taking advantage of the abundant marine resources available. The first major expeditions into the interior did not witness any Aboriginal people, but evidence of their existence was noted. In April 1788 Governor Philip led an expedition west to Prospect Hill. It was noted, '…that these parts are frequented by the natives was undeniably proved by the temporary huts which were seen in several places. Near one of these huts, the bones of kangaroo were found, and several trees where seen on fire' (Phillip, 1789).

In 1789 Captain Watkin Tench led an expedition to the Nepean River. He noted that:

> *Traces of the natives appeared at every step, sometimes in their hunting huts which consist of nothing more than a large piece of bark bent in the middle and opened at both ends, exactly resembling two cards set up to form an acute angle; sometimes in marks on trees which they had climbed; or in squirrel-traps….We also met with two old damaged canoes hauled up on the beach*. (Tench, 1789)

It wasn't until rural settlement began in the western Cumberland Plain, around 1791 that the colonists and Aboriginal peoples came face to face away from the coast. Relations quickly disintegrated, and tensions over land and resources spilled over. Governor King sanctioned the shooting of Aboriginal people in a General Order made in 1801 (Kohen, 1986:24). Intermittent killings on both sides continued for over 15 years, including the Appin massacre and attacks at South Creek in 1816 (Kohen, 1986:23; Karskens, 2010:225).

Although tensions existed between Aboriginal people and Europeans on the Cumberland Plain, a number of Aboriginal families continued to live semi-traditional lives in the area. The first parcels of land granted to an Aboriginal person were to the north of the proposal site between Richmond Road and Plumpton Ridge along Bells Creek. Governor Macquarie granted this land to Colebee and Nurragingy in 1819. Colebee did not stay long but Nurragingy lived on the land and it remained in the family until 1920 when it was resumed by the Aboriginal Protection Board (Kohen, 1986:27). The Colebee and Nurrgingy land grant is located approximately 12 kilometres north of the proposal site.

The government policy to remove Aboriginal children from their parents in order to assimilate them into white society began fairly early on in the colony's history and was epitomized by the development of the Native Institution at Parramatta in 1814.

The Native Institution facility was moved to the Black Town settlement in 1823. It was closed in 1829 and the land was used for farming, but the site remains significant for its historical, archaeological and social values (GML, 2007:36). The Blacktown Native Institute is located approximately 11 kilometres north of the proposal site.

Descendants of Darug language speakers continued to live in Western Sydney into the nineteen and twentieth centuries along with Aboriginal people from other areas of NSW.

## 4.3 Existing regional predictive models

Over the last 30 years, several regional predictive models related to the presence of Aboriginal archaeological sites have been developed. This includes several of relevance to the Cumberland Plain. These include a predictive model based on the relationship between stream order Aboriginal site distribution (White and McDonald, 2010), as well as further assessment and investigation of this model in other investigations across the Cumberland Plain (Artefact, 2013; ENSR/AECOM, 2009; Owen and Cowie, 2017).

A summary of relevant regional predictive models is included below.

**White and McDonald 2010**

Beth White and Jo McDonald developed a predictive model based on the relationship between stream order and the nature of Aboriginal site distribution based on the analysis of excavated sites in the Rouse Hill Development Area (White & McDonald, 2010). The paper provides a spatial and distributive analysis of Aboriginal objects in relation to freshwater resources and along varying landform units. The findings of this study highlighted the relationship between proximity to fresh water and landscape with Aboriginal occupation. The following predictive statements were asserted (White & McDonald, 2010: 36):

- Archaeological evidence of past Aboriginal peoples will be limited and be representative of background scatter within proximity to first order creek lines.
- Within the reaches of second order creek lines, archaeological evidence will again be representative of background scatter and will likely consist of one-off camp locations and / or isolated events.
- Within the reaches of third order creeks, archaeological evidence will consist of repeated occupation by small groups of people. Archaeological expressions will likely consist of knapping floors and evidence of repeated use over time.
- Along major fourth order creek lines archaeological expressions will consist of continued and repeated use by past Aboriginal peoples and may include stratified deposits.

This stream order model identifies that the confluences of creek lines across the Cumberland Plain will likely have evidence of a foci of activity with stratified deposits (White & McDonald, 2010: 33). It was found that artefacts were most likely within 50 – 100 metres of higher (fourth) order streams, within 50 metres of second order streams, and that artefact distribution around first order streams was not significantly affected by distance from watercourse (White & McDonald, 2010: 33).

The study also found that artefact densities were most likely to be greatest on terraces and lower slopes within 100 metres of freshwater resources (White & McDonald, 2010). The predictive model identified that ridgelines and crests located between drainage lines will contain archaeological evidence though usually representative of background scatter (White & McDonald, 2010).

**Further assessment of the stream order model**

The stream order model suggests that artefacts would generally be retrieved in higher densities at sites associated with high order watercourses, with low densities of less than one artefact per square metre at sites associated with first order watercourses, and densities of between two to ten artefacts per square metre associated with second order watercourses (Jo McDonald Cultural Heritage Management, 2010b: 43).

Further exploration and differing perspectives on artefact distribution across Cumberland Plain, particularly the southern portion of the Cumberland Plain, have been discussed in reporting for archaeological investigation by Artefact (2012), ENSR/AECOM (2009), Jo McDonald Cultural Heritage Management (2005) and Owen and Cowie (2017).

Jo McDonald Cultural Heritage Management's (2005) large archaeological investigation program at Second Ponds Creek in Blacktown is one the most extensive and detailed subsurface investigations undertaken in that area. One of the aims of the investigation was to test the different landform units represented within the Second Ponds Creek valley, including flat, lower slope, mid-slope, upper slope and crest (Jo McDonald Cultural Heritage Management, 2005: 64). A total of 32,987 artefacts were retrieved from 1,130 square metres of excavation, as well as 7,922 artefacts retrieved from a surface collection in an eroded creek channel of Second Ponds Creek (Jo McDonald Cultural Heritage Management, 2005: 64).

The results indicate a clear drop in artefact density with increasing distance from Second Ponds Creek, which also correlates with a change in landform context from flat and lower slope to upper slope and crest (Jo McDonald Cultural Heritage Management, 2005: 64). Excavation bordering Second Ponds Creek yielded a high average density of 59 artefacts per square metre, compared to an average of between 0.5 and one artefact per square metre in crest and upper slope contexts respectively.

Jo McDonald Cultural Heritage Management (2005: 131) suggested that the excavation results reflected some evidence of raw material rationing at the lower density artefact scatters in the upper slope and crest landform contexts. This was evidenced by a higher frequency of modified artefacts and retouch / usewear, discard of smaller cores, low frequency of cortex, and presence of better-quality raw material (Jo McDonald Cultural Heritage Management, 2005: 131).

Several projects in the southern portion of the Cumberland Plain have further investigated both the variation in artefact density with increasing distance from creek line as well as variation in raw material utilisation. These studies are discussed below:

ENSR/AECOM (2009: 65-66) suggest that Aboriginal artefact clusters were likely to occur in a continuous low density scatter up to 300 metres from major watercourses, and 120 metres from second order streams, with landscape characteristics, including reliable water and good outlook over surrounding valleys also determining factors irrespective of distance from major watercourses.

Excavation at Spring Farm (site SFPAD5) at Menangle Park revealed a high artefact density from test excavation (8.5 per square metre) in association with a first order watercourse and swamp (Jo McDonald Cultural Heritage Management, 2010b). The high artefact density in association with a low order stream was suggested as being due to the proximity of the swamp and the relatively close proximity (750 metres) of the Nepean River (Jo McDonald Cultural Heritage Management, 2010b: 46). Jo McDonald Cultural Heritage Management (2010b: 45) also suggest that the relatively fewer archaeological excavations across the southern portion of the Cumberland Plain make it difficult to interpret results in the area in the context of the stream order model.

Like SFPAD5, results of archaeological excavation by Artefact at Menangle Park (Artefact 2013) demonstrate a relatively high mean artefact density (5.9 per square metre) in association with a first order watercourse. The relatively high artefact densities identified at Menangle Park in association with first order watercourses (Artefact, 2013; Jo McDonald Cultural Heritage Management, 2010b) supports ENSR/AECOM's (2009: 65-66) assertion that landscape context and reliable water, regardless of stream order, were important factors in the distribution of archaeological material across the landscape. These findings also support Jo McDonald Cultural Heritage Management's (2010b: 45) statement that further subsurface archaeological investigation in the region would provide a better framework for interpreting the distribution of archaeological material across the southern portion of the Cumberland Plain.

Further north of the Menangle Park and Oran Park areas investigated by Jo McDonald Cultural Heritage Management, ENSR/AECOM and Artefact, Owen and Cowie assessed a variety of more recent predictive models against results of the Cumberland Plain based on works completed at the East Leppington Precinct. The study utilised the Stream Order Model developed by White and McDonald (2010) and three different and complementary models to explain their findings. Owen and Cowie identified limitations in the Stream Order Model, as a broad regional based model with limited ability to consider small-scale intra-landform variations.

Owen and Cowie (2017) describe three other models that can be used to more accurately assess the archaeological potential within the landscape, the Economic Resource Model, the Activity Overprinting Model and the Domiciliary Spacing Model. Post excavation analysis considered that the combination of these models provided a good understanding of the over-arching archaeological potential of the East Leppington landscape.

The Economic Resource Model identifies locations with substantial resources (such as food and knapping sources) as economic zones. The model identifies a correlation between the relative yield of the economic zone and the distance that sites are likely to be away from the economic zone. Site locations are also considered to relate to changes in 'textures' across the landscape which may include changes in landform. Varying landforms within the influence of an economic zone can then be ranked according to their suitability for repeated occupation. Substantial creek lines are considered to be high resource zones due to the richness in flora and fauna. The model suggests that the evidence of Aboriginal activities will decrease with distance from these resource rich nodes.

The Activity Overprinting Model explains the density of sites at increasing distances from the creek. The model requires the examination of local environmental resources to identify zones of 'complexity' which would represent areas where repeated occupation and therefore 'activity overprint' were more likely. Areas of complexity were identified as more likely near an environmental focus, with evidence of activity overprint becoming sparser with increasing distance from environmental resources.

The Domiciliary Spacing Model was used to describe the features and spatial variation of a site by describing the layout of and features of a habitation site. The Domiciliary Spacing model suggests the division of a campsite into several distinct camping locations based on smaller family units or activity requirements. The model suggests the presence of archaeological evidence would be discretely

spaced corresponding to the location of each small campsite with areas in between campsites associated with a general scarcity of archaeological material.

### 4.3.1 Implications of existing predictive models for the proposal site

The above predictive models have identified a number of factors which influence the presence, density and type of Aboriginal objects likely to be present within the proposal site. These factors include:

- Distance to watercourses of varying orders
- Presence of additional resources such as raw material sources and subsistence resources
- Visibility and outlook towards surrounding environments
- Spatial variation associated with habitation.

## 4.4 Previous archaeological assessments

A number of archaeological investigations have been completed in the vicinity of the proposal site. These have generally been associated with the development of infrastructure and industrial projects. The following discussion presents a review of the most recent and relevant studies and aims to provide contextual information for the current study.

**The Archaeological Investigation of Lot 2, DP 120673 the site of a proposed new clay and shale extraction area, Old Wallgrove Road Horsley Park, NSW (John Appleton, 2002)**

An archaeological assessment of Lot 2, DP 120673 was undertaken by Appleton as part of the assessment of a proposed clay/shale extraction site. The assessment area is located approximately one kilometre south of the proposal site between Old Wallgrove Road and Ropes Creek. The survey identified an area of PAD associated with an isolated mudstone flake along the banks of Ropes Creek and an isolated mudstone flake within an unmarked vehicle track.

The area of PAD was identified based on the location of the identified artefact eroding out of the creek bank at a depth of 20 centimetres below the surface. Appleton stated that it could then be reasonably assumed that other artefactual material may also be buried at the same or a similar depth.

Appleton also recorded an area of Potential Archaeological Sensitivity (PAS) surrounding the PAD on the basis that any artefactual material recovered would have been associated with camp sites and/or activity areas along the creek bank. A second PAS was identified on a tributary of Ropes Creek within the vicinity of a previously recorded artefact. This area encompassed a slight rise in the landform which was interpreted as an attractive location for use as a camp site. These areas of sensitivity were not recorded as sites with AHIMS but were highlighted within the report to indicate the potential of areas surrounding Ropes Creek and its tributaries for containing Aboriginal objects below the surface.

**Proposed 132kV Transmission Line Erskine Park, NSW Cultural Heritage Assessment (Navin Officer Heritage Consultants, 2003)**

Navin Officer conducted an Aboriginal cultural heritage assessment for Integral Energy for the proposed 132kV transmission line extending between the Sydney West Substation and Erskine Park. The majority of the assessment was undertaken on land 50 metres south of the proposal site. The assessment identified two Aboriginal sites and an area of archaeological potential.

The Aboriginal sites identified were both artefact scatters. The first, Erskine Park 1 (AHIMS ID 45-5-3235) was located within an eroded area adjacent to a minor drainage line. There were seven

artefacts recorded consisting of silcrete and mudstone flakes, broken flakes and a core. The second site, Erskine Park 2 (AHIMS ID 45-5-3311) was located within a backhoe hole and consisted of eight artefacts. The assemblage consisted of silcrete flakes, broken flakes, a core and three blades.

An area of archaeological potential was recorded on both sides of Ropes Creek, near the junction of the creek with an unnamed tributary. EP PAD 1(AHIMS ID 45-5-3062) was identified based on the raised landform surrounding the creek and previous studies within the Cumberland Plain which have demonstrated larger sites with higher artefact densities are more likely to occur near permanent water sources.

**Archaeological Investigations at SEPP59 EC3, Wonderland Surplus (Jo McDonald Cultural Heritage Management, 2006)**

Jo McDonald Cultural Heritage Management was commissioned to conduct a salvage excavation program within the Wonderland Surplus lands in accordance with AHIP 2470. The salvage area is located approximately 1.6 kilometres north-east of the proposal site.

The salvage area included investigation of two areas of PAD, EC3-PAD1 (AHIMS ID 45-5-3201) and EC3-PAD2 (AHIMS ID 45-5-3202). The salvage program targeted areas identified in earlier works as having good potential to contain intact archaeological deposits. The deposits within the sites were found to be relatively shallow with the A1 horizon largely no longer present across the site and artefacts recovered from the remnant A2 horizon.

The first PAD, EC3-PAD1 sampled a hill slope and drainage gully. The open area within this PAD recovered a low density, sometimes discontinuous scatter. The artefacts were found to have been displaced in a downslope direction and assessed as likely to be subject to colluvial processes.

The second area of salvage sampled an adjacent ridge top. Lithic distribution within the area was continuous but fairly low density. The open area excavation revealed that the assemblage had been dispersed in a generally east to north-east direction. This dispersal was interpreted to have likely occurred due to behavioural or environmental events more so than colluvial processes given the ridgetop location of the artefacts.

A total of 1,550 artefacts were recovered from the PAD sites, equating to densities of 0.8 and 0.9 lithics per square metre. The predominant raw material was silcrete with some silicified tuff, quartz and petrified wood.

Based on the low densities of artefacts across the salvage areas, both sites were interpreted as being used in an intermittent manner. Further, the accumulation of lithics at the site was assessed as likely to have occurred slowly over long time periods rather than as part of an intense period of discard associated with tool production or domestic areas.

**Erskine Park Employment Area, Ropes Creek, Western Sydney, NSW, Archaeological Subsurface Testing Program (Navin Officer, 2007)**

A subsurface testing program was conducted by Navin Officer within part of the Erskine Park Employment Area, located 750 metres south-west of the proposal site. The test excavations focussed on three previously identified sites, EPRC1 (AHIMS ID 45-5-3234), EPRC2 (AHIMS ID 45-5-3312) and EPRC3 (not registered).

Areas of archaeological potential ranging from low to high were defined in relation to these sites and 112 test pits were excavated to test that potential. A total of 261 artefacts were recovered from test excavation with an average density of 5.7 artefacts per square metre recovered across the test excavation program. The raw material present at the sites included silcrete, tuff, quartzite and chert, with silcrete being the dominant lithology. The artefacts present included flakes, broken flakes, cores,

core fragments, and microblades. Bipolar flaking, utilised pieces and backed flakes were also identified within the assemblage.

Out of the four investigation areas, the two areas closest to Ropes Creek returned the highest number of artefacts. One of these areas was located on the basal midslopes and crest of a north-south running spur line above Ropes Creek. Navin Officer proposed these results suggest that the whole broad spur line was the location of repeated and ephemeral habitation involving transitory camp sites.

The areas with the lowest incidence of artefacts were located adjacent to first order drainage lines and were furthest away from Ropes Creek. These results fit within the broader regional model that predicts these areas to have low to moderate potential.

**Energy from Waste Facility, Eastern Creek, Aboriginal Heritage Test Excavation (Artefact Heritage, 2014)**

Artefact Heritage conducted test excavations within Aboriginal site EFW South (AHIMS ID 45-5-4491), an area located approximately 500 metres east of the northern portion of the proposal site. The site was located on an elevated area at the confluence of three drainage lines.

The subsurface testing involved the excavation of thirty-seven 500x500 millimetre test pits. An assemblage of 14 artefacts from nine of these test pits were retrieved resulting in an artefact density of 0.76 artefacts per square metre. Silcrete was the only raw material represented within the assemblage. Reduction types present included angular fragments, flakes and broken flakes.

The assemblage was interpreted to represent general stone reduction and causal discard. It was considered likely that use of the site was intermittent and opportunistic. The assessment identified that while the area was close to water sources it was also prone to flooding which would have limited use of the site. Following the predictive model established by previous studies, it was assessed that the higher slopes and crests surrounding the area would have been more preferable camp sites.

**St Marys Wastewater System Augmentation Salvage Excavation Report (ENSure JV, 2015)**

ENSure JV was engaged to undertake salvage excavation of several sites as part of the St Marys Wastewater System Augmentation project located along a four kilometre pipeline route running parallel to Ropes Creek. Works were undertaken as a condition of AHIP C0000501 which authorised impacts to seven Aboriginal sites including two sites within the proposal site. These sites included Southwest 12 (AHIMS ID 45-5-0564), RCAS 8 (AHIMS ID 45-5-3160), Blacktown Southwest 7 (AHIMS ID 45-5-0559), RCIF 2 (AHIMS ID 45-5-3159), RC1 (AHIMS ID 45-5-0206), EP PAD 1 (AHIMS ID 45-5-3062) and Oakdale Campsite 1 (AHIMS ID 45-5-3383).

A total of 2128 artefacts were recovered during the salvage excavation program. The majority of these (1346,) were recovered from Blacktown Southwest 7 (AHIMS ID 45-5-0559) located on the north western border and extending partially within the proposal site.

Blacktown Southwest 7 (AHIMS ID 45-5-0559) is located on a low to mid-level rise which is located approximately six metres above the surrounding floodplain. Prior to surface excavation a total of 27 surface artefacts were identified and collected within the site extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) in accordance with AHIP C0000501 (Figure 5). Salvage excavation at this location included the excavation of 20 shovel test pits and 20 test pits resulting in a total excavation area of 25 square metres (Figure 6). A total of 1,346 artefacts were excavated from this salvage area.

The relative high density of artefacts from Blacktown Southwest 7 (AHIMS ID 45-5-0559) was considered to support the theory that the site and elevated landform adjacent to Ropes Creek was visited with a higher intensity than other sites investigated as part of the salvage program.

Salvage excavation was also completed across a portion of RCIF2 (AHIMS ID 45-5-3159). RCIF2 (AHIMS ID 45-5-3159) is located on a low rise approximately 100 metres north of Ropes Creek within the south-western corner of the proposal site. Prior to salvage a total of eight surface artefacts were recovered from the portion of RCIF2 (AHIMS ID 45-5-3159) within boundary of AHIP C0000501 (Figure 7). Salvage excavation at this location was comprised of 20 shovel test pits and 20 test pits resulting in the excavation of 25 square metres (Figure 8). A total of 463 artefacts were recovered from salvage excavation in this area with the artefacts identified as containing a low proportion of cortex and low mean size. This in conjunction with the results of Blacktown Southwest 7 (AHIMS ID 45-5-0559) was used as evidence to suggest that the low rises above the floodplain were utilised more intensively for tool curation than the surrounding flood plain landform.

The majority of the sites investigated as part of the salvage excavation program contained stone artefacts, although artefact density varied considerably. Elevated well drained landforms adjacent to the floodplain of Ropes Creek saw the greatest density of artefacts with salvage excavation recovering an average of between 18.52 – 53.84 artefacts per square metre at these locations. The salvage works also included the excavation of five sites within the Ropes Creek flood zone. Artefact concentrations across these areas were substantially lower than the results of Blacktown Southwest 7 (AHIMS ID 45-5-0559) and RCIF 2 (AHIMS ID 45-5-3159) with average artefact densities ranging between 0-8.5 artefacts per square metre.

Following salvage excavation, artefacts salvaged from Blacktown Southwest 7 (AHIMS ID 45-5-0559) and RCIF2 (AHIMS ID 45-5-3159) were reburied within their existing site extents (see Figure 5 and Figure 7).

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**Figure 5: Portion of AHIMS ID 45-5-0559 subject to salvage and surface collection as part of AHIP C0000501**

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**Figure 6: Location of ENSure JV salvage excavation pits AHIMS ID 45-5-0559 with current proposal site overlaid in red (Source: ENSure JV, 2015: 37)**

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**Figure 7: Portion of AHIMS ID 45-5-3159 subject to surface collection and salvage investigation as part of AHIP C0000501**

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**Figure 8: Location of ENSure JV salvage excavation pits AHIMS ID 45-5-3159 with current proposal site overlaid in red (Source: ENSure JV, 2015: 37)**

**Archbold Road, Archaeological survey report (Artefact Heritage, 2015)**

Artefact Heritage was engaged by Transport for NSW to conduct an archaeological survey as part of a proposal to upgrade and extend Archbold Road. The survey area extended between the M4 motorway and Old Wallgrove Road, a portion of which includes the eastern portion of the current proposal site.

The study area was divided into four survey units, Survey unit 3 was located partially within the proposal site. The survey unit was comprised of a relatively flat landform with some small hills. The southern area of the survey unit was located adjacent to Lenore Drive and was identified as having a high degree of disturbance due to its use as a compound area and illegal dumping.

A total of six artefact sites were located across survey unit including four sites within the proposal site. RCAS4 (AHIMS ID 45-5-3162) and RCAS5 (AHIMS ID 45-5-3162) were both revisited as part of the assessment for this proposal. RCAS4 was not relocated due to dense grass regrowth at the proposal site. RCAS5 was not relocated due to identified inaccuracies in the site coordinates. AIF-05 (AHIMS ID 45-5-4605) and AIF-06 (AHIMS ID 45-5-4599) were identified during the survey and recorded as isolated finds along vehicle track exposures.

The assessment identified the areas surrounding Ropes Creek and its tributaries as containing potential for intact surface deposits. The assessment did not identify any areas of subsurface potential within the eastern half of the proposal site.

**Lot 10 DP 1157491, Eastern Creek, NSW, Aboriginal and historical heritage Study (Ecological, 2016)**

Ecological was engaged to prepare a Historical and Aboriginal Heritage Study to inform a Development Control Plan for Lot 10 DP1157491 at Eastern Creek, NSW. The assessment included the entirety of the current proposal site area.

The assessment identified areas of substantial disturbance associated with the proposal site including the southernmost portion of the lot which had been highly disturbed by construction associated with the upgrade of Lenore Drive and the St Marys Wastewater System Augmentation Project.

The assessment identified that the dense ground cover limited the identification of further artefacts during the site survey. The assessment further identified that due to the low levels of disturbance across the assessment area, proximity to water and presence of multiple sites within the assessment area, that it was likely that additional Aboriginal objects would be present within the assessment area.

Ecological assessed the surface artefact sites within the assessment area as common and representative of the region but noted that the potential for subsurface Aboriginal objects was largely unknown. Ecological recommended that further archaeological investigation should be undertaken across all landform units to understand the nature, extent and significance of the archaeological resource.

**Archbold Road extension and upgrade, Great Western Highway to Southern Link Road, cultural heritage assessment report (Kelleher Nightingale Consulting, 2017a)**

Kelleher Nightingale Consulting was engaged to complete an Aboriginal cultural heritage assessment report as part of the proposed upgrade and extension of Archbold Road. The report follows the survey report completed for the road project completed by Artefact (2015).

Kelleher Nightingale Consulting's assessment identified that much of the road project area had been completely modified through former erosion events with soils considered likely to be less than 150 years old. The assessment suggested that older soils were likely to have been removed due to

substantial erosion from flooding, clearing and mining which was present uphill of portions of the site. The assessment identified that remnant archaeological deposit within the project area were limited to narrow strips along creek terraces which were situated high enough to avoid the effects of fluvial energy.

Four sites were located within the assessment area including one site, AIF-06 (AHIMS ID 45-5-4599) within the proposal site. AIF-06 (AHIMS ID 45-5-4599) was identified as an isolated artefact within a bike access track. The site was assessed as heavily disturbed and of low significance. The assessment identified that the road project would result in a direct impact resulting in total loss of value to AIF-06. The assessment recommended that an AHIP be sought to impact AIF-06 (AHIMS ID 45-5-4599) with no further mitigation measures recommended. It is understood that at the time of the preparation of this report, the AHIP application for Archbold Road upgrade had not yet been submitted.

Two sites were recommended for archaeological salvage excavation, RCAS 1 (AHIMS ID 45-5-3165) and Ropes Creek AS3 (AHIMS ID 45-5-3937). Both sites were located within terrace landforms above tributaries to Ropes Creek and considered to contain relatively intact soils. No further archaeological investigation or management was recommended within the proposal site.

**Lot 103 DP 1189012, Eastern Creek NSW, Archaeological salvage excavation (Kelleher Nightingale Consulting, 2017b)**

Kelleher Nightingale Consulting was engaged to complete salvage excavation and surface collection as part of a proposed commercial development of Lot 103 Eastern Creek. Salvage excavation was undertaken across three sites, Archbold Artefact Scatter 1 (AHIMS ID 45-5-4377), Archbold Artefact Scatter 2 (AHIMS ID 45-5-4378) and Archbold Artefact Scatter 3 (AHIMS ID 45-5-4487), with surface collection undertaken of an additional 14 sites.

Salvage excavations consisted of the excavation of 60 x 1 metre square excavation units within a 20 metre staggered grid. Excavation retrieved a total of 55 artefacts with no localised concentrations identified across the salvage area. The excavation results were interpreted as a low-density archaeological deposit which had been heavily disturbed and contained no evidence of intact deposits. While the assessment was broadly considered to support the concept that the salvage area represented a transitional landscape between Ropes Creek and Eastern Creek, the high level of disturbance was considered to limit the further analytic and comparative potential of the excavation results.

### 4.4.1 Archaeological Implications

Previous surface and subsurface archaeological investigations in the area have identified some proportionately high concentrations of artefacts in raised areas adjacent to Ropes Creek (in some cases greater than 40 artefacts per square metre) (ENSure JV, 2015). Test excavation completed at greater distances from Ropes Creek by comparison have identified lower artefact concentrations consistent with intermittent background scatter (Jo McDonald Cultural Heritage Management, 2006; Artefact, 2014; Keller Nightingale Consulting, 2017b). Subsurface artefact deposits have also been identified in proximity to first order watercourses. Artefact densities associated with these watercourses have been identified as highest in areas in close proximity to Ropes Creek (Navin Officer, 2007).

The results of previous investigations in the region is generally consistent with existing regional predictive models including the Stream Order Model (White and McDonald, 2010) and the Economic Resource Model (Owen and Cowie, 2016). In addition, the increased concentration of artefacts identified along first order watercourses in close proximity to Ropes Creek is consistent with the

findings of test excavation completed by Jo McDonald Cultural Heritage Management (2010b) and Artefact (2013).

The proximity of several silcrete sources to the proposal site including a source in Erskine Park (approximately 3.7 kilometres west of the proposal site) and Plumpton Ridge (8.2 kilometres to the north-east) suggest that stone artefacts within the proposal site would be predominantly comprised of silcrete.

Several areas within the proposal site have been subject to substantial disturbance associated with agricultural use (dam construction) as well as construction programs including the construction of Lenore Drive and the Sydney Water pipeline for the St Mary's Wastewater System Augmentation project. These areas have been subject to high level of disturbance and would contain low archaeological potential (Figure 9).


**Figure 9: Identified areas of high disturbance**

## 4.5 Aboriginal Heritage Information Management System

**The location of Aboriginal sites is considered culturally sensitive information. It is advised that this information, including the AHIMS data appearing on the heritage map for the proposal be removed from this report if it is to enter the public domain.**

An extensive search of the AHIMS database was undertaken on the 27 March 2020 (AHIMS search ID 491998). An area of approximately 3.6 kilometres by 3.9 kilometres was included in the search. The AHIMS search provides archaeological context for the area and identifies whether any previously recorded Aboriginal sites are located within or near the proposal site. The parameters of the search were as follows:

| | |
|---|---|
| GDA 1994 MGA 56 | 296267 - 299859 metres East<br>6255686 - 6259638 metres South |
| Buffer | 0 metres |
| Number of sites | 112 |

A total of 112 Aboriginal sites were identified in the extensive AHIMS search area. The frequency of recorded site features is summarised in Table 1.

A registered Aboriginal site is made up of one or more site features. Heritage NSW lists 20 standard site features that can be used to describe a site registered with AHIMS. For the 112 sites within the search area, three combinations of site features were recorded. The majority of recorded site features are artefacts (n=107).

**Table 1: Frequency of site features from AHIMS data (proposal site and surrounds)**

| Site Feature | Frequency | Percentage (%) |
|---|---|---|
| Artefact | 107 | 95.5 |
| Artefact, Potential Archaeological Deposit (PAD) | 4 | 3.6 |
| Potential Archaeological Deposit (PAD) | 1 | 0.9 |
| *Total* | *112* | *100* |

Figure 10 illustrates that a substantial number of sites are located within and in close proximity to the open grassland areas adjacent to Ropes Creek. While many sites have been identified within proximity of Ropes Creek and its tributaries, artefact sites located to the north of the proposal site include a density of artefact sites associated with slope and crest landforms several hundred metres away from the creek line.

Artefact sites within the vicinity of the study area are limited to either artefact sites or areas of PAD, suggesting that environmental conditions and former land clearance and modification make the identification of scarred trees, grinding grooves or artwork unlikely within the proposal site.

Nine sites previously recorded either within or in the immediate vicinity of the proposal site are summarised in Table 2. The distribution of these recorded sites is illustrated in Figure 11.

**Table 2: Summary of sites located within or in close proximity to the proposal site**

| Site name and AHIMS ID | Site type | Proximity to proposal site[1] | Description |
|---|---|---|---|
| Blacktown Southwest 8, AHIMS ID 45-5-0560 | Artefact scatter | About 85m west | • Artefact scatter consisting of two large silcrete flakes eroding out of an artificial terrace alongside Ropes Creek |
| Bankstown Southwest 10, AHIMS ID 45-5-0562 | Artefact scatter | About 22m south | • Artefact scatter identified in an exposure located within the mid slope of a ridgeline<br>• Comprised of 4 chert flakes, 2 silcrete flakes and a quartz flake |
| Blacktown Southwest 11, AHIMS ID 45-5-0563 | Open site | Within | • Artefact scatter within an erosion scar associated with a small creek as well as one artefact within adjacent dam feature<br>• Site area was assessed as grossly disturbed by creation of a dam<br>• Site consists of a quartzite pebble and quartz flake as well as a chert flake identified 8m from quartzite artefacts within adjacent dam |
| Bankstown Southwest 7, AHIMS ID 45-5-0559 | Artefact scatter | Partially within | • Artefact scatter eroding out of a raised terrace alongside Ropes Creek<br>• Several artefacts including a basalt pebble with evidence of grinding identified on terrace and surrounding slope landform<br>• Subject to partial salvage under AHIP C0000501 recovering 1346 artefacts<br>• Artefacts reburied within portion of the proposal site subject to AHIP C0000501, with artefact reburial located immediately adjacent to proposal site. |
| RCIF 2, AHIMS ID 45-5-3159 | Artefact scatter | Partially within | • Originally recorded as mudstone flake located on the top of an eroding creek gully<br>• Subject to salvage excavations under AHIP C0000501 which identified a further 463 artefacts from a 25 square metre salvage excavation area<br>• Artefacts reburied within portion of site subject to AHIP C0000501, with artefact reburial located in proposal site |

[1] Based on identified site extents identified in AHIMS site cards

| Site name and AHIMS ID | Site type | Proximity to proposal site[1] | Description |
|---|---|---|---|
| RCAS 4, AHIMS ID 45-5-3162 | Artefact scatter | Within | • Originally recorded as seven artefacts located within an exposure caused by animal and vehicle traffic<br>• Site was recorded as six silcrete flakes and a single quartz flake |
| RCAS 5, AHIMS ID 45-5-3163 | Artefact scatter | Within | • Originally recorded as three silcrete flakes eroding from the edge of a water pool on the original course of a tributary for Ropes Creek<br>• Originally assessed within site card as likely to have been redeposited into their current location through construction of the water pool<br>• Site was considered to indicate the likely presence of additional artefacts within the immediate vicinity of the proposal site |
| AIF-06, AHIMS ID 45-5-4599 | Isolated find | Within | • Single red silcrete flake identified in an exposure caused by a bike track<br>• Artefact located on a gently undulating plain |
| AIF-05, AHIMS ID 45-5-4605 | Isolated find | Within | • Single yellow silcrete distal flake identified within an exposure caused by vehicle access track<br>• Artefact located on a gently undulating plain |

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**Figure 10: Results of Extensive AHIMS Search**

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**Figure 11: AHIMS within and in the vicinity of the proposal site**

## 4.6 Predictive model

Based on the background environment, existing predictive models and the results of previous archaeological investigations, the following conclusions can be made regarding the predicted archaeological sensitivity and potential of the proposal site:

- Stone artefact scatters are the most likely Aboriginal site type to be identified within the proposal site. Based on the underlying geology and historical land use, scarred trees, grinding sites and art sites are unlikely to be identified within the study area.
- Silcrete will be the dominant raw material of stone artefact assemblages.
- Artefacts sites are likely to be concentrated along Ropes Creek and its tributaries.
- High density subsurface distributions of artefacts have been identified within elevated landforms adjacent to the Ropes Creek floodplain. For the proposal site this means that areas within the western portion of the project area are more likely to contain higher artefact densities.
- Floodplain landforms are likely to exhibit lower densities of subsurface artefacts as a result of fluvial action.
- Crest and ridgeline landforms are likely to exhibit low artefact densities consistent with ephemeral use.
- Visibility is likely to be low, obstructed by dense grass cover; sites are most likely to be identified in exposed areas including vehicle tracks, recently cleared areas and eroded banks.
- Archaeological deposits within the proposal site are likely to have been impacted by former and current land use including land clearance and agricultural activity, however these impacts are likely to have largely been superficial in nature.
- Small portions of the proposal site have been subject to substantial disturbance associated with the installation of the Sydney Water pipeline for the St Mary's Wastewater System Augmentation project and former use of the southern portion of the proposal site as a construction compound (Figure 9).

This review of the background information suggests that portions of the proposal site are likely to have high archaeological potential.

# 5.0 ARCHAEOLOGICAL SURVEY

## 5.1 Aims

The aims of the archaeological survey were to:

- Cover a representative sample of the proposal site that would potentially be impacted by the proposed works
- Reinspect any previously registered sites
- Record any new Aboriginal objects or sites observed during the survey
- Identify areas of PAD that may be present in areas that have had no or minimal disturbance
- Liaise with stakeholders present regarding the archaeological potential of the proposal site
- Collect information to ascertain whether further archaeological investigation is required

## 5.2 Timing and personnel

Initial archaeological survey was undertaken on the 8 April 2020. The survey was supervised by Alyce Haast (Senior Heritage Consultant, Artefact Heritage) with Jessica Horton (Heritage Consultant, Artefact Heritage) also present. A second archaeological survey was undertaken on 18 June 2020 with Alyce Haast, Josh Symons (Principal, Artefact Heritage) and Steve Randall (Deerubbin LALC) in attendance.

## 5.3 Methodology and coverage

The proposal site generally consists of an area of open grassland with several unsealed vehicle and bike access tracks across the study area. Given the extremely limited visibility, sample survey of the study area was undertaken on foot by teams of two or three, with survey focused on areas of exposure, sensitive landforms as identified through predictive modelling and the site extents of formerly registered sites.

A handheld non-differential Global Positioning System was used to track the path of the survey team and record the coordinates of survey transects as well as the location of Aboriginal sites.

A photographic record was kept during the survey. Photographs were taken to record aspects of survey units including surface exposures, vegetation, areas of surface disturbance, and any identified Aboriginal sites and areas of archaeological potential. Scales were used for photographs where appropriate as specified in the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment Climate Change and Water, 2010a).

Survey was delineated into three survey units based on landform, breaks in the landscape (such as access tracks) and evidence of former disturbances. The survey units are illustrated in Figure 12.

Previously registered Aboriginal sites in the immediate vicinity of the proposal site were also visited to confirm the nature of these sites and assess whether the extent of those sites includes the proposal site.

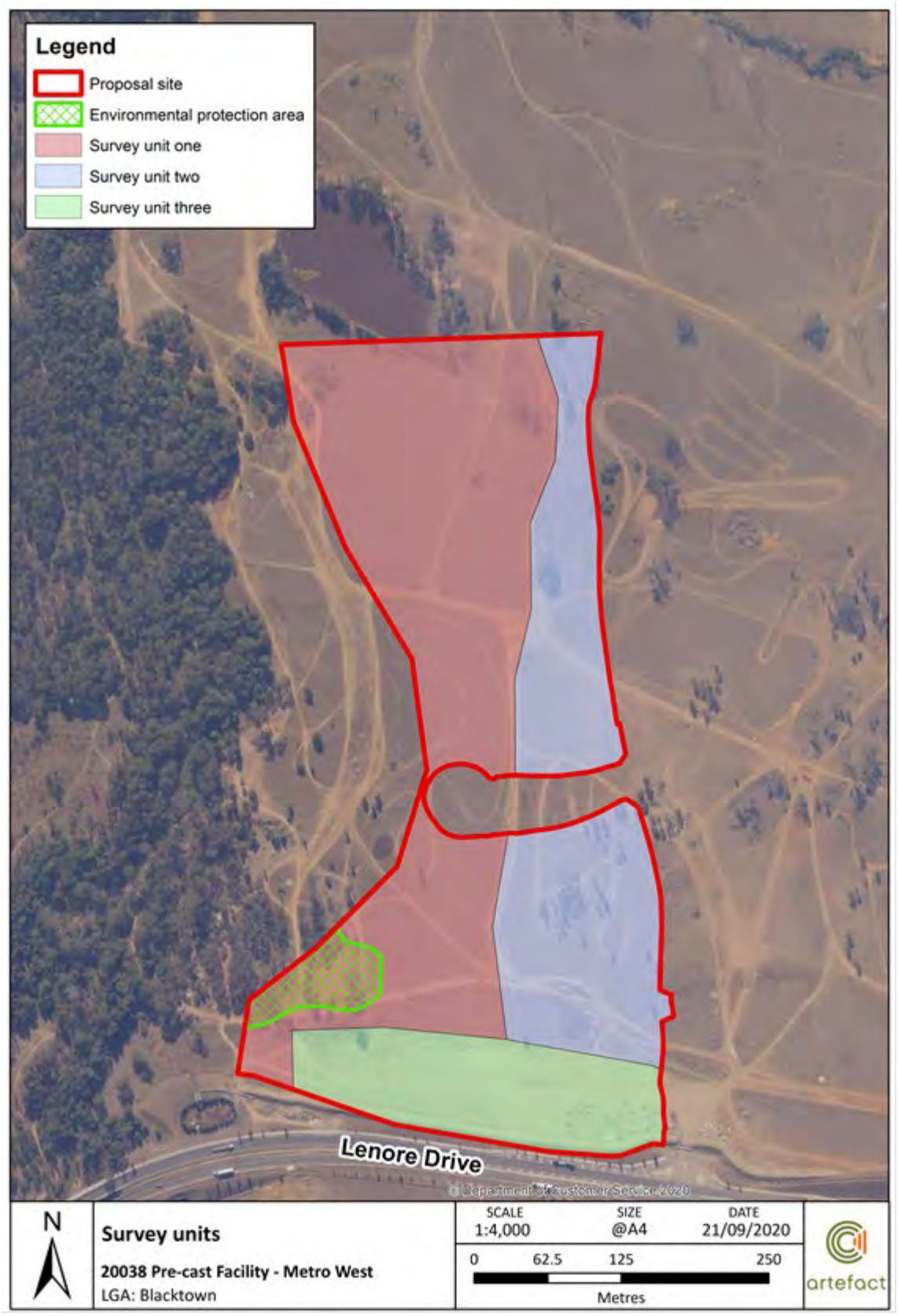


**Figure 12: Survey units**

### 5.3.1 Survey unit one

Survey unit one was comprised of the western portion of the study area encompassing the gently sloping raised terrace landform located above the Ropes Creek floodplain. The survey unit was heavily vegetated with thick grasses obscuring the majority of the ground surface (Figure 13). Several areas of exposure were noted within the survey unit associated with vehicle tracks and areas of former Sydney Water pipeline works for the St Marys Wastewater System Augmentation Project (Figure 14 – Figure 16, Figure 18). The survey unit included several modified drainage lines, one which of had been modified into a large dam partially located in the north of the survey unit (Figure 17).

Old growth trees within the proposal site were inspected for cultural scarring. One tree within the south-western portion of the survey unit was identified as containing a potential Aboriginal cultural scar. Detailed inspection of the scar and tree surface identified irregularities in the scar shape which was inconsistent with an Aboriginal cultural scar. In addition the presence of several other irregular scars across the tree surface suggested that the scar was created as part of the natural growth of the tree (Figure 19). The scar has been assessed as unlikely to represent an Aboriginal scar tree.

Three previously recorded AHIMS sites were located within survey unit one during the April 2020 survey, Blacktown Southwest 7 (AHIMS ID 45-5-0559), Blacktown Southwest 11 (AHIMS ID 45-5-0563) and RCIF 2 (AHIMS ID 45-5-3159). Both Blacktown Southwest 7 and RCIF 2 were inspected during the survey with additional artefacts recorded at their location. The recorded site location of Blacktown Southwest 11 was also visited but was unable to be relocated.

Two newly identified sites, RCAS 09 (AHIMS ID 45-5-5355) and RCAS 10 (AHIMS ID 45-5-5354) were located within survey unit one during the April 2020 and June 2020 survey. Further detail regarding RCAS 09 (AHIMS ID 45-5-5355) and RCAS 10 (AHIMS ID 45-5-5354) is located in Section 6.2.

**Figure 13: Grasslands across raised terrace landform, south-western aspect**

**Figure 14: Wide vehicle track exposure across south western portion of survey unit one**

Figure 15: Large exposure in south-western portion of survey unit one

Figure 16: Sandstone based fill material within former Sydney Water pipeline route immediately west of survey unit one

Figure 17: Large dam in northern portion of survey unit one

Figure 18:Heavily eroded vehicle track within south-western portion of survey unit one

Figure 19: Potential Aboriginal culturally scarred tree

### 5.3.2 Survey unit two

Survey unit two was comprised of the eastern portion of the proposal site encompassing the transition between a gently sloping terrace landform located across survey unit one and the slightly steeper lower slopes of the foothills located to the east of the proposal site (Figure 20). The survey unit was heavily vegetated with thick grasses obscuring the majority of the ground surface (Figure 21). Small pockets of regrowth eucalypt species were also noted in the south-eastern portion of the survey unit. Visibility was generally very low with small areas of exposure associated with vehicle tracks and erosion scours (Figure 22). Evidence of disturbance was largely limited to tree clearance and isolated areas of dumped rubbish.

Four previously recorded AHIMS sites were located within survey unit two, AIF-05 (AHIMS ID 45-5-4605), RCAS 4 (AHIMS ID 45-5-3162), RCAS 5 (AHIMS ID 45-5-3163) and AIF 06 (AHIMS ID 45-5-4599). None of the previously recorded sites within survey unit two were relocated during April 2020 survey.

One additional Aboriginal site, RCAS 11 (AHIMS ID 45-5-5353) was identified within survey unit two during the June 2020 survey.

**Figure 20: Transitional landscape between terrace and adjacent foothills**

**Figure 21: High grasses associated with survey unit two**

**Figure 22: Vehicle track exposure within survey unit two**

### 5.3.3 Survey unit three

Survey unit three was comprised of an artificial slope landform located in the southern portion of the proposal site (Figure 23). Based on historical aerials the survey unit was formerly utilised as a construction compound area with substantial earthworks noted between 2013 and 2018. The survey

area was heavily obscured by high grasses with exposed areas showing a sandstone based fill located across the surface within this landform (Figure 24 – Figure 26).

No Aboriginal objects or areas of potential were identified within survey unit three.

**Figure 23: Artificial slope landform, eastern aspect**

**Figure 24: Sandstone based fill material across survey unit three, with raised road batter in background**

**Figure 25: View of artificial slope landform towards Ropes Creek**

**Figure 26: View across artificial slope landform showing access from Lenore Drive**

### 5.3.4 Survey coverage

A summary of survey coverage, in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water 2010a) is outlined in Table 3 and Table 4.

**Table 3: Survey coverage summary - survey units**

| Survey unit | Survey unit area ($m^2$) | Landform | Visibility (%) | Exposure (%) | Effective coverage ($m^2$) | Effective coverage (%) |
|---|---|---|---|---|---|---|
| 1 | 82,506 | Slope, Drainage line | 50 | 20 | 8250.6 | 10 |
| 2 | 48,262 | Slope, Drainage line | 25 | 10 | 1206.5 | 2.5 |
| 3 | 24,787 | Artificial slope | 5 | 5 | 61.9 | 0.25 |

**Table 4: Survey coverage summary - landforms**

| Landform | Landform area ($m^2$) | Area effectively surveyed ($m^2$) | Percentage of landform effectively surveyed (%) | Number of sites |
|---|---|---|---|---|
| Slope | 123,941 | 8675.9 | 7.0 | 10 |
| Drainage line | 6,827 | 507.3 | 7.4 | 0 |
| Artificial slope | 24,787 | 63.5 | 0.25 | 0 |

# 6.0 RESULTS

## 6.1 Registered Aboriginal sites

Summaries of sites identified during the survey and previously recorded sites within the proposal site are outlined below.

### 6.1.1 Blacktown Southwest 11 (AHIMS ID 45-5-0563)

**Site type:** Artefact scatter
**Centroid:** [redacted]

Blacktown Southwest 11 (AHIMS ID 45-5-0563) was originally recorded in an erosion scour associated with a small creek line. The site card notes that a small dam had been built lower down the gully. The site was originally recorded by Kohen in 1986 as including a quartzite pebble and quartz flake which were identified as non-local raw material along with a small chert flake which was identified within the dam wall.

The site coordinates were visited as part of the April 2020 site survey. It was found that the coordinates of the site recorded on AHIMS do not match the description of the landform in the site card. The registered site coordinates were approximately 45 metres north of the drainage line identified within the site card, therefore it is assumed the site coordinates are an error (see Figure 35).

During the April 2020 site survey the registered site location was heavily vegetated by thick grasses (Figure 27 – Figure 28). The site coordinates of the assessed site location were visited during the June 2020 survey. No Aboriginal objects were located within the registered site coordinates or assessed site location.

**Figure 27: Location of Blacktown Southwest 11 recorded site coordinates, northern aspect**

**Figure 28: High grasses obscuring the ground surface across Blacktown Southwest 11, south-western aspect**

### 6.1.2 Blacktown Southwest 7 (AHIMS ID 45-5-0559)

**Site type:** Artefact scatter
**Centroid:** [redacted]
**Artefact reburial centroid:** [redacted]

Blacktown Southwest 7 (AHIMS ID 45-5-0559) was originally recorded by Kohen in 1986 as an artefact scatter eroding out of a slope and top of a raised terrace landform (Figure 29 – Figure 30).

The site has been partially destroyed by Sydney Water pipeline works for the St Marys Wastewater System Augmentation Project associated with AHIP C0000501. Salvage excavation prior to impact resulted in the recovery of 1,346 artefacts from a 25 square metre salvage area. Following salvage excavation, the artefacts were reburied within the wider site extent within the proposal site.

The site extent was inspected as part of the April 2020 survey. Evidence of earthworks associated with impacts under AHIP C0000501 were noted, with a clear exposure identifying the pipeline route (Figure 31 – Figure 32). Additional evidence of disturbance was noted with sandstone based fill material spread across the wider site extent. Survey identified five new artefacts within the former AHIP boundary (Figure 33 – Figure 34). High grasses obscured the remainder of the site extent.

A summary of newly identified artefacts is provided in Table 5.

**Table 5: Summary of artefacts identified at AHIMS ID 45-5-0559**

| Material | Colour | Artefact type | Length (mm) | Width (mm) | Thickness (mm) |
|---|---|---|---|---|---|
| Silcrete | Pink | Proximal flake fragment | 28 | 14 | 6 |
| Silcrete | Pink | Proximal flake fragment | 18 | 24 | 9 |
| Mudstone | Orange | Multi-platform core | 61 | 48 | 36 |
| Silcrete | Pink | Medial flake fragment | 29 | 33 | 22 |
| Silcrete | Red | Proximal flake fragment | 24 | 18 | 5 |

During the June 2020 site survey, the site extent of AHIMS ID 45-5-0559 was reassessed. Site survey identified that the raised landform which delineated the site extent within the site card extended to the east of the registered site extent as part of a wider low-lying spur crest feature. Examination of exposures confirmed that visible soils within this portion of the project site were relatively intact. The site extent was modified to encompass the entirety of the localised rise associated with this landform (see Figure 35).

**Figure 29: Recorded site centroid location of AHIMS ID 45-5-0559, southern aspect**

**Figure 30: Recorded site centroid location of AHIMS ID 45-5-0559, western aspect**

**Figure 31: Visible gravel fill associated with Sydney Water pipeline works**

**Figure 32: Vehicle track exposure in which newly identified artefacts were identified**

**Figure 33: Silcrete and mudstone artefacts located within site extent of AHIMS ID 45-5-0559**

**Figure 34: Silcrete artefacts identified within site extent of AHIMS ID 45-5-0559**

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**Figure 35: Registered and reassessed site extent of AHIMS ID 45-5-0559**

### 6.1.3 RCIF 2 (AHIMS ID 45-5-3159)

**Site type:** Artefact scatter, PAD
**Centroid:** [redacted]
**Artefact reburial centroid:** [redacted]

RCIF 2 (AHIMS ID 45-3-3159) was originally recorded by Environmental Resources Management in 2005 as an isolated mudstone flake located within an eroding creek gully. The original site recording noted the likely presence of additional artefacts including subsurface deposits. Salvage excavation of the site was undertaken as a condition of AHIP C0000501 in 2014 which recovered 463 artefacts from 25 square metres of excavation. Artefacts recovered from the salvage excavation were reburied on site.

The site was revisited during the current survey with multiple large areas of exposure associated with the wider site extent. The site centroid was located directly adjacent to the remains of a tributary of Ropes Creek with a wide vehicle track extending east – west directly adjacent to it (Figure 36 – Figure 37). The area subject to salvage excavation was also surveyed with large exposures extending approximately 80 metres x 50 metres across and surrounding the former salvage area (Figure 38). Portions of the exposure included gravel topsoil which was interpreted as related to a fill event from the St Marys Wastewater System Augmentation Project (Figure 39).

Survey identified nine additional artefacts within the exposures associated with AHIMS ID 45-5-3159 (Figure 40). A summary of the artefacts identified in the clearing is provided in Table 6.

**Table 6: Summary of artefacts identified at AHIMS ID 45-5-3159**

| Material | Colour | Artefact type | Length (mm) | Width (mm) | Thickness (mm) |
|---|---|---|---|---|---|
| Silcrete | Pink | Right proximal flake fragment | 32 | 28 | 6 |
| Silcrete | Pink | Angular fragment | 38 | 28 | 5 |
| Silcrete | Yellow | Distal flake fragment | 18 | 21 | 2 |
| Silcrete | Yellow | Medial flake fragment | 22 | 9 | 6 |
| Silcrete | Yellow | Proximal flake fragment | 46 | 35 | 8 |
| Silcrete | Red | Complete flake | 24 | 12 | 3 |
| Silcrete | Red | Medial flake fragment | 23 | 7 | 4 |
| Silcrete | Red | Complete flake | 25 | 22 | 4 |
| Silcrete | Red | Single platform core | 21 | 11 | 4 |

During the April 2020 site survey it was identified that the landscape to the east and west of the originally recorded extent of AHIMS ID 45-5-3159 was relatively intact with limited evidence of

disturbance and was associated with the same drainage line as the original site recording. The site area was therefore reassessed and extended with areas of potential identified to the east and west of the original site extent (Figure 41).

**Figure 36: Location of recorded site centroid of AHIMS ID 45-5-3159**

**Figure 37: Exposed vehicle track directly adjacent to site centroid**

**Figure 38: Open clearing where new artefacts were identified**

**Figure 39: Sandstone cobbles within backfill layer**

**Figure 40: Artefacts identified within site extent of AHIMS ID 45-5-3159**

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**Figure 41: Former and reassessed site extent of AHIMS ID 45-5-3159**

### 6.1.4 RCAS 4 (AHIMS ID 45-5-3162)

**Site type:** Artefact Scatter
**Centroid:** [redacted]

RCAS 4 (AHIMS ID 45-5-3162) was previously recorded by Environmental Resources Management in 2005 as an artefact scatter comprised of seven artefacts identified within a vehicle track exposure. The site consisted of four red silcrete flakes, two grey silcrete flakes and one quartz flake.

The site was visited during the current survey and was observed to be heavily overgrown by thick grasses (Figure 42 – Figure 43). Visibility across the site during the survey was nil with no Aboriginal objects located.

**Figure 42: View of current site condition of AHIMS ID 45-5-3162, northern aspect**

**Figure 43:View of heavy grasses over assessed former location of exposure**

### 6.1.5 RCAS 5 (AHIMS ID 45-5-3163)

**Site type:** Artefact Scatter
**Centroid:** [redacted]

RCAS 5 (AHIMS ID 45-5-3163) was recorded by Environmental Resources Management in 2005 as an artefact scatter eroding out of the margins of a water pool located along the original course of a tributary of Ropes Creek. The site was recorded as three red silcrete flakes scattered along an eight-metre area.

The site coordinates were visited as part of the April 2020 site survey (Figure 44). The coordinates of the site recorded on AHIMS did not match description of the landform within the site card. Desktop assessment of historical aerials of the study area suggest that the water pool mentioned in the site card is comprised of a dam located approximately 50 metres south of the recorded site coordinates (see Figure 47). It is therefore assumed the registered site coordinates are in error.

The reassessed site location was also visited during the April 2020 and June 2020 survey with the dam noted in aerials re-identified. The dam was heavily overgrown with grasses (Figure 46). No Aboriginal objects were relocated.

**Figure 44: Location of AHIMS ID 45-5-3163 based on site card coordinates, northern aspect**

**Figure 45: View of overgrown water pool and dumped rubbish piles assessed as likely site location, eastern aspect**

### 6.1.6 AIF-06 (AHIMS ID 45-5-4599)

**Site type:** Isolated Find
**Centroid:** [redacted]

AIF-06 (AHIMS ID45-5-4599) was originally recorded by Artefact Heritage in 2015 as an isolated find located within an eroded unauthorised bike track. The site was comprised of a red silcrete flake measuring 19 millimetres long x 22 millimetres wide x 4 millimetres thick.

The recorded site location was covered by dense grasses during reinspection of the area (Figure 46). Due to the limited surface visibility, no evidence of the unauthorised bike track or the recorded artefacts were identified. No evidence of surface disturbance since the original site recording was observed, suggesting that the artefacts may remain on the ground surface in this area but were not visible during the survey due to lack of surface visibility.

**Figure 46: Location of AHIMS 45-5-4599 based on site card coordinates, north-western aspect**

### 6.1.7 AIF-05 (AHIMS ID 45-5-4605)

**Site type:** Isolated Find
**Centroid:** [redacted]

AIF-05 (AHIMS ID 45-5-4605) was originally recorded by Artefact Heritage in 2015 as an isolated find within a vehicle access track. The artefact was assessed as yellow silcrete distal flake which appeared to have been utilised as a core with one complete flake scar visible on the dorsal side.

The recorded site location was covered by dense grasses during reinspection of the area (Figure 47). Due to the limited surface visibility, no evidence of the recorded artefact was identified. No evidence of surface disturbance since the original site recording was observed, suggesting that the artefact may remain on the ground surface in this area but were not visible during the survey due to lack of surface visibility.

**Figure 47: Location of AHIMS ID 45-5-4605**

## 6.2 Newly identified sites

### 6.2.1 RCAS 09 (AHIMS ID 45-5-5355)

**Site type:** Artefact Scatter, PAD
**Centroid:** [redacted]
**Site length:** 120 metres
**Site width:** 50 metres

RCAS 09 (AHIMS ID 45-5-5355) is comprised of an artefact scatter and area of PAD. The artefact scatter associated with this site was identified within a wide exposure associated with a large vehicle track running parallel to Ropes Creek (Figure 48 – Figure 49). The surface exposure is located within a very gently sloped landform which includes a localised crest area within the southern portion of the artefact scatter. The localised crest landform was identified as an area of PAD due to the high number of surface artefacts identified within the vehicle exposure and the identification of the area as a localised spur crest landform.

The exposure includes substantial ironstone gravels with small amounts of scattered rubbish throughout the site extent likely associated with the unauthorised use of the proposal site for off-roading and as a construction vehicle access track associated with works for the St Marys Wastewater System Augmentation Project. Artefacts observed across the vehicle track are considered likely to have been subject to some level of post depositional movement through vehicle use of the track and surface water erosion across exposed areas of the ground surface. Soils across the remainder of the site extent including the area of PAD appeared to be largely intact.

The site is comprised of eight artefacts and an area of PAD (Figure 50 – Figure 51). Characteristics of the identified artefacts area detailed in Table 7. The location of the area of PAD and the identified artefacts are shown in Figure 52.

**Table 7: Summary of artefacts identified at RCAS 09**

| Material | Colour | Artefact type | Length (mm) | Width (mm) | Thickness (mm) |
|---|---|---|---|---|---|
| Silcrete | Red | Complete flake | 29 | 25 | 6 |
| Silcrete | Yellow | Retouched utilised piece | 25 | 32 | 4 |
| Silcrete | Red | Marginal flake fragment | 22 | 20 | 6 |
| Silcrete | Red | Marginal flake fragment | 12 | 10 | 3 |
| Indurated Mudstone /Tuff (IMT) | Cream | Marginal flake fragment | 18 | 15 | 7 |
| Petrified wood | Grey | Proximal flake fragment | 24 | 20 | 3 |
| IMT | Cream | Multi platform core | 28 | 28 | 15 |
| IMT | Cream | Flaked piece | 22 | 10 | 5 |

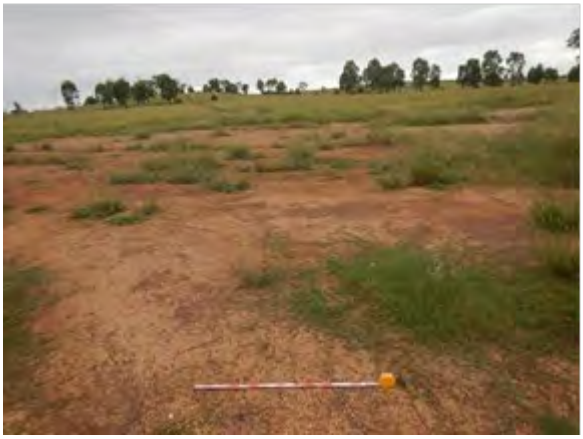

Figure 48: Exposure in which RCAS 09 was identified

Figure 49:Access track exposure in which the majority of surface artefacts were identified

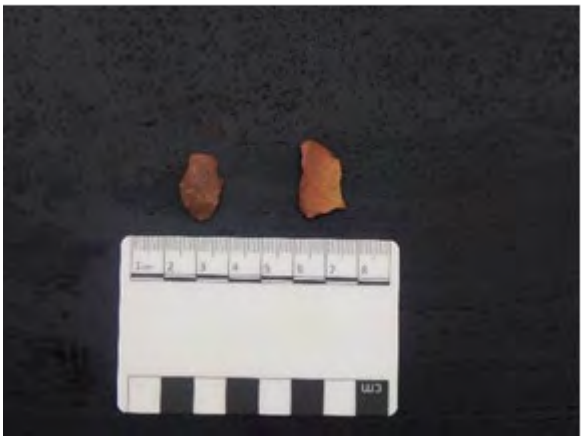

Figure 50: Silcrete artefacts, RCAS 09

Figure 51: Petrified wood artefact, RCAS 09

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**Figure 52: Site features associated with RC AS 09**

### 6.2.2 RCAS 10 (AHIMS ID 45-5-5354)

**Site type:** Artefact Scatter
**Centroid:** [redacted]
**Site length:** 15 metres
**Site width:** 5 metres

RCAS 10 (AHIMS ID 45-5-5354) is comprised of an artefact scatter located within a vehicle track exposure running perpendicular to Ropes Creek (Figure 53 – Figure 54). The site extent is located across a gentle slope landform which includes evidence of erosion associated with water runoff and unauthorised use of the proposal site for off roading.

A total of three silcrete artefacts were located within the site extent over a 15 metre length of the vehicle track (Figure 55 – Figure 56). Artefacts present included a single platform core, a complete flake and a proximal flake fragment. Characteristics for the identified artefacts are recorded in Table 8.

**Table 8: Summary of artefacts identified at RCAS 10**

| Material | Colour | Artefact type | Length (mm) | Width (mm) | Thickness (mm) |
|---|---|---|---|---|---|
| Silcrete | Red | Single platform core | 35 | 35 | 20 |
| Silcrete | Red | Complete flake | 30 | 20 | 5 |
| Silcrete | Red | Proximal flake fragment | 35 | 12 | 10 |

**Figure 53:View west across RCAS 10 towards Ropes Creek**

**Figure 54:View east across RCAS 10**

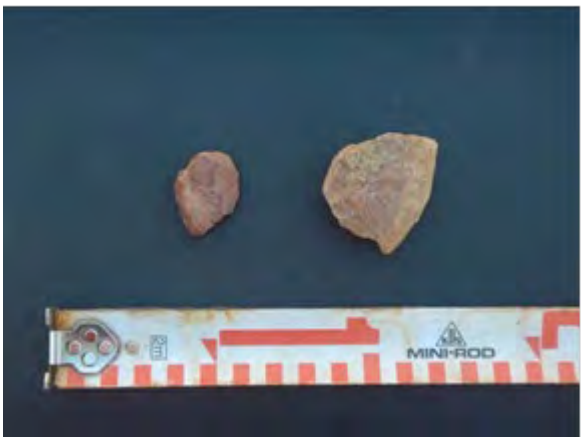


**Figure 55: Silcrete artefacts identified within site extent of RCAS 10**


**Figure 56: Silcrete artefacts identified within site extent of RCAS 10**

### 6.2.3 RCAS 11 (AHIMS ID 45-5-5353)

**Site type:** Artefact Scatter
**Centroid:** [redacted]
**Site length:**15 metres
**Site width:** 5 metres

RCAS 11 (AHIMS ID 45-5-5353) is comprised of an artefact scatter within an exposure associated with an unauthorised trail bike track (Figure 57). The artefact site is located within the vicinity of the turn in the trail which is associated with a deeper erosion scour then the surrounding areas of tracks. The exposure includes substantial areas of exposed gravels consistent with the natural B horizon of the underlying soil profile. Some evidence of fill associated with the presence of blue metal gravels were also noted.

A total of three artefacts were located within the site extent over a 10 metre length of the trail bike track. Artefacts present included an IMT proximal flake fragment, a silcrete distal flake fragment and a silcrete proximal flake fragment (Figure 58 – Figure 59). A large silcrete cobble was also identified within the wider site extent although as it was partially buried it could not be fully examined for evidence of knapping during the site inspection (Figure 60). Characteristics of the identified artefacts are located in Table 9.

**Table 9: Summary of artefacts identified at RCAS 11**

| Material | Colour | Artefact type | Length (mm) | Width (mm) | Thickness (mm) |
|---|---|---|---|---|---|
| IMT | Red | Proximal flake fragment | 16 | 16 | 2 |
| Silcrete | Red | Distal flake fragment | 9 | 9 | 4 |
| Silcrete | Red | Proximal flake fragment | 8 | 4 | 2 |

**Figure 57: Site location RCAS 11**

**Figure 58: Silcrete artefact, RCAS 11**

**Figure 59: Silcrete artefacts, RCAS 11**

**Figure 60: Silcrete cobble identified within site extent of RCAS 11**

# 7.0 ANALYSIS AND DISCUSSION

## 7.1 Analysis of archaeological potential

The archaeological potential of an area is determined by its landform, its location and the level of disturbance. Certain landforms, such as gentle slopes are more conducive to the survival of archaeological material while others such as steep slopes are not. Additionally, different landform types are likely to have been utilised differently resulting in a different archaeological signature. The proximity of a landform to natural resources, in particular, permanent water sources is also a determining factor in assessing archaeological potential. Correlations between site location and proximity to a water source have been demonstrated in previous archaeological investigations where the number of sites and their densities is highest in close proximity to a water source.

In areas where there is a high level of disturbance however, the archaeological potential is lowered. It is unlikely that surface finds in these contexts are in their original context, and it is unlikely that subsurface archaeological deposits are intact.

## 7.2 Identified Aboriginal surface sites

Seven previously recorded sites were visited during the April 2020 site survey conducted for this report. Of the seven, only two were able to be relocated, RCIF 2 (AHIMS ID 45-5-3159) and Blacktown Southwest 7 (AHIMS ID 45-5-0559) which were both partially harmed under AHIP C0000501. It is possible that these artefacts have been redeposited in their current locations following partial impact to these sites under AHIP C0000501.

The remaining previously recorded AHIMS surface sites within the proposal site were comprised of isolated artefacts or low density artefact scatters located in areas of exposure which have since been obscured by heavy grasses. These sites were largely located within vehicle tracks or in the banks of modified drainage gullies suggesting that the sites have been subject to some level of movement through surface disturbance. The movement associated with these impacts are considered to be relatively minor in nature and the sites are considered likely to be located generally within the vicinity of their original deposition.

The recorded site coordinates of two previously recorded surface sites (Blacktown Southwest 11 [AHIMS ID 45-5-0563] and RCAS 5 [AHIMS ID 45-5-3163]) were reassessed as part of the current assessment with new site locations identified utilising historical aerials and descriptions provided in each site card. The reassessed site location of these sites is shown in Figure 61.

Three newly identified surface sites were located within the proposal site. These sites were identified within heavily eroded vehicle and trail bike tracks. Of these, one site, RCAS 09 (AHIMS ID 45-5-5355) included the identification of an area of PAD associated with an intact localised crest landform surrounding the vehicle track exposure which included the identified surface artefacts. The remaining two sites were located across gently slope landforms which were not identified as containing subsurface archaeological potential.

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**Figure 61: Summary of survey results**

## 7.3 Areas of subsurface archaeological potential

Two previously recorded sites within the proposal site (RCIF 2 [AHIMS ID 45-5-3159] and Blacktown Southwest 7 [AHIMS ID 45-5-0559]) are comprised in part of subsurface archaeological remains. Both of these sites were identified on raised landforms in direct proximity to Ropes Creek which has since been subject to partial salvage under AHIP C0000501.

The proposal site is largely comprised of a broad gently sloping raised terrace landform transitioning to basal slopes in the eastern portion of the proposal site. Two intermittent drainage lines are also present across the proposal site.

Test excavation previously completed for Navin Officer (2007) across similar landforms to the south-west of the proposal site identified high densities of artefacts across two areas of PAD located across the basal mid slope and crest landform associated with a crest of a north-south running spur line in close proximity to Ropes Creek. Areas of PAD were also investigated further from Ropes Creek in proximity to first order drainage lines which recovered comparatively lower artefact densities.

Salvage excavation completed by ENSure JV (2015) across portions of Blacktown Southwest 7 (AHIMS ID 45-5-0559) and RCIF 2 (AHIMS ID 45-5-3159) have also identified high densities of artefacts across raised landforms within 100 metres of Ropes Creek. Both of these sites are also located directly adjacent to first order tributaries.

The northern first order tributary has been modified to form a large dam located on the northern boundary of the proposal site. Blacktown Southwest 7 (AHIMS ID 45-5-0559) has been previously assessed as relating to a distinct crescent shaped landform directly south-west of the dam feature. Reassessment of the site extent during the June 2020 survey identified that land to the east of the recorded site extent included a localised spur crest landform which was an extension of the landform associated with Blacktown Southwest 7 (AHIMS ID 45-5-0559). Inspection of exposed areas within the spur crest landform confirmed that the soil profile within this portion of the proposal site remained relatively intact. Consequently, the current assessment has adjusted the identified site extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) to include this portion of the landform.

The southern first order tributary has been subject to modification including the creation of two small dams as well as the construction of a raised compound area across the southern boundary of the study area which obscured portions of the former waterway. These impacts are however considered to have largely been limited to the southern side of the tributary with land on the northern side of the tributary considered to be relatively intact. RCIF 2 (AHIMS ID 45-5-3159) is identified along this tributary with the site extent identified as being located on a low rise in close proximity to Ropes Creek.

Reassessment of the area immediately surrounding RCIF 2 (AHIMS ID 45-5-3159) identified minimal landform variation between the registered site extent and the area extending along the bank of the tributary running east/west directly adjacent to the registered site extent. In addition, several previously recorded surface artefact sites have been identified within close proximity to the tributary at substantially further distances from Ropes Creek, including one site in which artefacts were identified within the wall of a water hole (Blacktown Southwest 11 [AHIMS ID 45-5-0563]). The current assessment has consequently adjusted the identified site extent of AHIMS ID 45-5-3159 to include an area of PAD to the east and west of the existing site extent (see Figure 61).

One newly identified area of PAD was identified associated with newly identified site RCAS 09 (AHIMS ID 45-5-5355). Survey of the surface components of this site identified a total of eight artefacts along a heavily eroded access track. Survey identified that the access track crossed a localised spur crest landform feature which with exception of the eroded area of the access track remained relatively intact. Assessment considered it likely that the artefacts associated with the

surface scatter was indicative of a wider subsurface artefact scatter within this portion of the proposal site.

Identified areas of PAD have been located across several low lying crest landforms including two located adjacent to tributaries of Ropes Creek and one crest landform which is not located within the vicinity of existing watercourses. Predictive modelling and previous subsurface investigation have identified land adjacent to Ropes Creek and the tributaries of Ropes Creek as well as crest landforms as archaeologically sensitive. Test excavation of these landforms would allow for further investigation into the nature of the archaeological resource across landforms with varying proximity to Ropes Creek and its tributaries across the proposal site. This approach is consistent with the recommendation of Ecological (2016) that further archaeological investigation should be undertaken across all landforms within the proposal site.

# 8.0 SIGNIFICANCE ASSESSMENT

## 8.1 Significance assessment criteria

An assessment of the cultural heritage significance of an item or place is required in order to form the basis of its management. *The Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011) provides guidelines for heritage assessment with reference to the Burra Charter (Australia ICOMOS, 2013) and the Heritage Office (2001) guidelines. *The Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011) requires consideration of the following:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

It is important to note that heritage significance is a dynamic value.

## 8.2 Archaeological significance assessment

A summary of archaeological significance for Aboriginal sites within the proposal site is provided in Table 10.

Assessment of the previously identified sites was based on significance assessments on AHIMS site cards and observations from the April 2020 and June 2020 surveys.

**Table 10: Summary of archaeological significance**

| Site name/ AHIMS ID | Research potential | Representative value | Rarity | Education potential | Overall archaeological significance |
|---|---|---|---|---|---|
| Blacktown Southwest 11, (AHIMS ID 45-5-0563) | Moderate | Low | Low | Low | Low |
| Blacktown Southwest 7, (AHIMS ID 45-5-0559) | Moderate-high | High | High | High | High |
| RCIF 2, (AHIMS ID 45-5-3159) | Moderate-high | High | High | High | High |
| RCAS 4, (AHIMS ID 45-5-3162) | Moderate | Low | Low | Low | Low |
| RCAS 5, (AHIMS ID 45-5-3163) | Moderate | Low | Low | Low | Low |

| Site name/ AHIMS ID | Research potential | Representative value | Rarity | Education potential | Overall archaeological significance |
|---|---|---|---|---|---|
| AIF-06, (AHIMS ID 45-5-4599) | Low | Low | Low | Low | Low |
| AIF-05, (AHIMS ID 45-5-4605) | Low | Low | Low | Low | Low |
| RCAS 09 (AHIMS ID 45-5-5355) | Moderate | Moderate | Low | Low | Moderate |
| RCAS 10 (AHIMS ID 45-5-5354) | Low | Low | Low | Low | Low |
| RCAS 11 (AHIMS ID 45-5-5353) | Low | Low | Low | Low | Low |

### 8.2.1 Blacktown Southwest 11 (AHIMS ID 45-5-0563)

Blacktown Southwest 11 (AHIMS ID 45-5-0563) is comprised of a quartzite flake, quartzite pebble and a chert flake identified within an erosion scour associated with a dam feature. The site card identifies the site as being located within a grossly disturbed context associated with the construction of the dam. While the site card assesses the area as heavily disturbed, the current assessment identifies the site as being located with a wider area of subsurface archaeological potential which is considered to demonstrate moderate research potential as a wider landscape. The site card identifies quartzite as a relatively common raw material across the Cumberland Plain and subsequently the site is considered to have low rarity values. While limited detail is available in the site card regarding the nature of the flakes and quartzite pebble within the site card, as a low density artefact scatter the site is considered to contain low representativeness and low education potential. The overall archaeological significance of Blacktown Southwest 11 is considered to be low.

### 8.2.2 Blacktown Southwest 7 (AHIMS ID 45-5-0559)

Blacktown Southwest 7 (AHIMS ID 45-5-0559) is a dense artefact scatter recovered during salvage excavation on spur crest located within a raised terrace landform adjacent to the Ropes Creek flood plain. Assessment during the salvage excavation undertaken as part of the St Marys Wastewater System Augmentation project identified Blacktown Southwest 7 as being of high significance as a large number of uncommon artefacts were recovered during the salvage. The salvage report (ENSure JV 2015) assessed the site as demonstrating a moderate-high level of integrity and subsequently research potential. The salvage report (ENSure JV 2015) assessed the site to have high representative and rarity values associated with the variety of artefacts identified across the salvage excavation including some relatively uncommon artefacts. The site is considered to have high education values associated with the variety of artefacts present. The overall archaeological significance of Blacktown Southwest 7 is considered to be high.

### 8.2.3 RCIF 2 (AHIMS ID 45-5-3159)

RCIF 2 (AHIMS ID 45-5-3159) is a surface artefact as well as a dense subsurface artefact scatter recovered during salvage excavation. Assessment during the salvage excavation undertaken as part of the St Marys Wastewater System Augmentation project (ENSure JV 2015) identified RCIF 2 as demonstrating high rarity values due to the large variety of tool types identified. The salvage report (ENSure JV 2015) assessed the site as demonstrating moderate-high intactness (research potential), in conjunction with highly representative artefact types, which is considered to represent moderate-

high research potential and educational value. Survey undertaken for the current assessment confirmed the relatively intact nature of the site. The overall archaeological significance of RCIF 2 is considered to be high.

### 8.2.4 RCAS 4 (AHIMS ID 45-5-3162)

RCAS 4 (AHIMS ID 45-5-3162) was originally recorded as a low density artefact scatter located within an eroded vehicle track. The site was not able to be relocated during the April 2020 survey and the significance assessment is based on the original site recording. Artefact scatters dominated by silcrete are considered to be common within the local region and the site exhibits low rarity values. While limited information is available about the artefacts from the site card, they do not appear to be representative of a specific artefact type or use and are considered to have low education values. While disturbed to some extent by vehicle and livestock movements the extent of the disturbance across the site is unclear from the current survey and the site is considered to demonstrate a moderate level of site integrity and research potential. The overall archaeological significance of RCAS 4 is considered to be low.

### 8.2.5 RCAS 5 (AHIMS ID 45-5-3163)

RCAS 5 (AHIMS ID 45-5-3163) was originally recorded as three silcrete artefacts eroding from the margins of a water pool. The site was not able to be relocated during the April 2020 survey and the significance assessment is based on the original site recording. The site card identifies the site as being located within the bank of a modified water pool which was assessed as a highly disturbed context. Based on this the site is not considered to be representative of former land use by Aboriginal people when compared to areas of the Cumberland Plain with higher preserved integrity including the area immediately west of Ropes Creek (which would not be impacted by the proposal). Silcrete artefact scatters are relatively common in the region and considered to demonstrate low rarity values. While the site card does not provide any information regarding the specific nature of the silcrete artefacts it is considered unlikely that they would provide significant educational values. Despite the level of disturbance associated with the construction of the water pool, the site card identifies that the surrounding area contain subsurface potential. This is supported by the current assessment which identifies the surrounding area as an area of potential. Based on the assessed subsurface potential, the site is considered to have moderate research potential. The overall archaeological significance of RCAS 5 is considered to be low.

### 8.2.6 AIF-06 (AHIMS ID 45-5-4599)

AIF 06 is an isolated silcrete artefact located on a vehicle access track. Isolated silcrete artefacts are considered to be common both within the proposal site and the wider Cumberland Plain. As the isolated find was identified within a disturbed context it is considered to contain low research potential and is not considered to be representative of a specific example of past land use by Aboriginal people. As an isolated find of a common artefact type in the region, the site is considered to demonstrate low representative and education values. The overall archaeological significance of AIF-06 is considered to be low.

### 8.2.7 AIF-05 (AHIMS ID 45-5-4605)

AIF 05 is an isolated silcrete artefact located on a vehicle access track. Isolated silcrete artefacts are considered to be common both within the proposal site and the wider Cumberland Plain. As an isolated artefact the site is considered to have limited research potential. As a distal flake fragment the artefact is not considered to be a good representation of artefacts of its type and considered to have low educational value. The overall archaeological significance of AIF-05 is considered to be low.

### 8.2.8 RCAS 09 (AHIMS ID 45-5-5355)

RCAS 09 is a low density artefact scatter and area of PAD. While the significance of the area of PAD is at present unknown, the identified surface artefacts identified a substantial variation in artefact types with a variety of raw materials types and artefact morphologies represented within the assemblage. Based on the variety of artefacts identified within the surface exposure the site is considered to demonstrate moderate representativeness and when combined with the area of PAD, moderate research potential. The surface artefacts are comprised of a low density artefact scatter located in a disturbed context which are considered to be common within the proposal site and wider Cumberland Plain. In isolation from the area of PAD the artefact scatter is considered to demonstrate low rarity values and low education values. The significance of this site would be updated following the completion of archaeological test excavation across the area of PAD.

### 8.2.9 RCAS 10 (AHIMS ID 45-5-5354)

RCAS 10 is a low density artefact scatter located in a heavily utilised vehicle track. Low density artefact scatters in disturbed contexts are considered to be common within the proposal site and wider Cumberland Plain. The site is located within a disturbed context associated with high levels of erosion identified across the site, consequently the site is considered to demonstrate low research potential. As the artefacts are located on a vehicle track, they are considered to have been subject to movement from vehicle use and surface water erosion and are therefore not considered to be representative of a specific land use by Aboriginal people. As silcrete flakes, the artefacts are considered to be relatively common artefact types. The artefacts are therefore considered to demonstrate low rarity and educational values. The overall archaeological significance of RCAS 10 is considered to be low.

### 8.2.10 RCAS 11 (AHIMS ID 45-5-5353)

RCAS 11 is a low density artefact scatter located in a heavily utilised trail bike track. Low density artefact scatters in disturbed contexts are considered to be common within the proposal site and wider Cumberland Plain. The wider site context was identified as heavily eroded based on the presence of substantial gravels consistent with the A2 horizon within the Blacktown soil landscape suggesting low research potential associated with the site. As the artefacts are located on a vehicle track, they are considered to have been subject to movement from vehicle use and surface water erosion and are therefore not considered to be representative of a specific land use by Aboriginal people. As silcrete and IMT flakes, the artefacts are considered to be relatively common artefact types. The artefacts are therefore considered to demonstrate low rarity and educational values. The overall archaeological significance of RCAS 11 is considered to be low.

## 8.3 Cultural significance

No specific areas of cultural significance were identified during site survey with a representative of Deerubbin LALC. No comments on the archaeological significance of the identified sites were received during the site inspection. In their report (Appendix 2), Deerubbin LALC noted that further investigation through test excavation should be undertaken prior to development.

Further assessment of the cultural significance of proposal site will be undertaken during preparation of the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the proposal.

# 9.0 IMPACT ASSESSMENT

## 9.1 Proposed works

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support construction of the proposed tunnelling for Sydney Metro West (Figure 62). The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels.

The proposal would comprise the following key features:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate and adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
    - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
    - Boiler, aggregate bins and consumables
    - Office facilities
    - On-site parking for up to 60 light vehicles
- Internal roads with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

A portion of the proposal site in the south-west would be conserved as an environmental protection area associated with the presence of Cumberland Plain Woodland. Vegetation within this area would be retained and protected during works.

## 9.2 Identified impacts

Earthworks across the proposal site would result in total impact to the ground surface with exception of the environmental protection zone associated with the area of Cumberland Plain Woodland located in the south-western portion of the proposal site. The proposal will result in partial to total removal of Aboriginal sites within the proposal site.

As a portion of RCIF 2 (AHIMS ID 45-5-3159) extends across the environmental protection area a portion of the site would be preserved. Further, as the site extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) extends past the proposal site boundary, a portion of this site would also be preserved.

Aboriginal site AIF-06 (AHIMS ID 45-5-4599) is within the works boundary of the planned Archbold Road upgrade and extension. The Archbold Road Upgrade and Extension ACHAR (KNC, 2017a: 21) identified a total direct impact to AIF-06 as part of the planned Archbold Road upgrade and extension. The site is located within the proposed AHIP application area extent as identified in the Archbold Road Upgrade and Extension ACHAR (KNC 2017: 23). The intention of that AHIP application, as outlined in the Archbold Road Upgrade and Extension ACHAR (KNC 2017: 21), will be to permit direct harm to that site with a consequence of total loss of value.

However, the AHIP application for the planned Archbold Road upgrade and extension had not been submitted to Heritage NSW at the time this report was prepared. As that AHIP application has not yet been submitted, AHIMS ID 45-5-4599 is included in the impact assessment for the proposal. Sydney Metro and other relevant parts of Transport for NSW would coordinate any future Aboriginal Cultural Heritage Assessment Report(s) (ACHAR) and AHIP application(s).

A summary of identified impacts is outlined in Table 11 and shown in Figure 63.

**Table 11: Summary of impacts associated with proposed works**

| Name / AHIMS ID | Type of harm | Degree of harm | Consequence of harm |
|---|---|---|---|
| Blacktown Southwest 11, (AHIMS ID 45-5-0563) | Direct | Total | Total loss of value |
| Blacktown Southwest 7, (AHIMS ID 45-5-0559) | Direct | Partial | Partial loss of value |
| RCIF 2, (AHIMS ID 45-5-3159) | Direct | Partial | Partial loss of value |
| RCAS 4, (AHIMS ID 45-5-3162) | Direct | Total | Total loss of value |
| RCAS 5, (AHIMS ID 45-5-3163) | Direct | Total | Total loss of value |
| AIF-06, (AHIMS ID 45-5-4599) | Direct | Total | Total loss of value |
| AIF-05, (AHIMS ID 45-5-4605) | Direct | Total | Total loss of value |
| RCAS 09 (AHIMS ID 45-5-5355) | Direct | Total | Total loss of value |
| RCAS 10 (AHIMS ID 45-5-5354) | Direct | Total | Total loss of value |
| RCAS 11 (AHIMS ID 45-5-5353) | Direct | Total | Total loss of value |

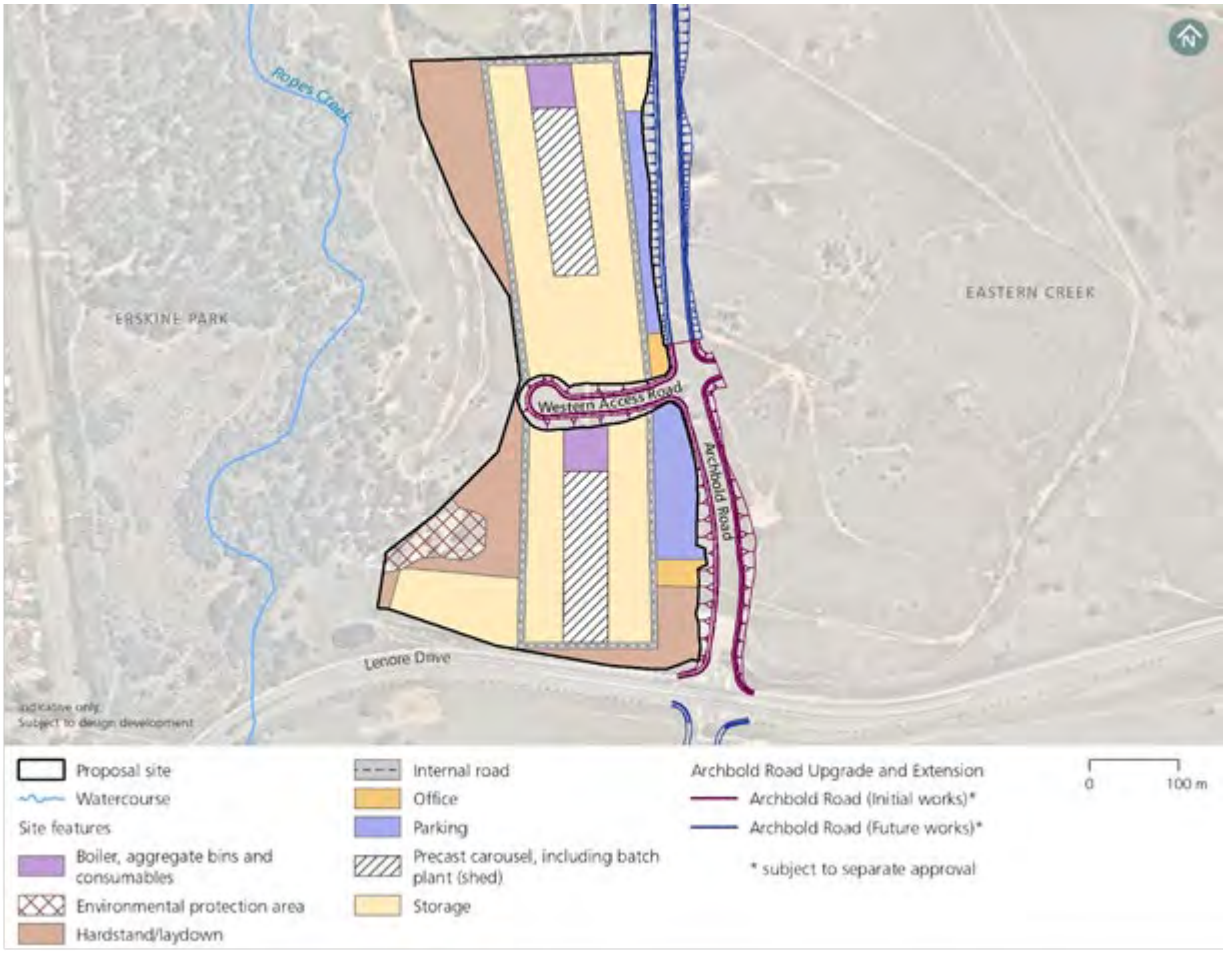


**Figure 62: Overview of proposed works**

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**Figure 63: Sites subject to impact by the proposed works**

# 10.0 MANAGEMENT AND MITIGATION MEASURES

## 10.1 Guiding principles

The overall guiding principle for cultural heritage management is that Aboriginal sites should be conserved. If conservation is not practicable, measures should be taken to mitigate impacts. The nature of the mitigation measures recommended is based on the assessed significance of the sites and the impact assessment.

## 10.2 Conservation

Those portions of site RCIF 2 (AHIMS ID 45-5-3159) and Blacktown Southwest 7 (AHIMS ID 45-5-0559) outside the proposal site would not be subject to impact. The location of these sites should be marked on construction drawings or Environmental Control Maps to ensure that the portions of each site outside the construction footprint are not impacted. Further heritage assessment would be required prior to any works outside the proposal site.

## 10.3 Comprehensive consultation

Further heritage investigation must include comprehensive consultation with Aboriginal stakeholders in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents (*Department of Environment, Climate Change and Water, 2010b). This includes ongoing consultation regarding Aboriginal cultural values as well as throughout the archaeological test excavation process, during preparation of an ACHAR and when submitting an AHIP application to the Heritage NSW for the proposed works.

## 10.4 Test excavation

The archaeological significance of the areas of PAD identified within the extended site extent of RCIF 2 (AHIMS ID 45-5-3159) and Blacktown Southwest 7 (AHIMS ID 45-5-0559) as well as its relationship to the formerly investigated portion of these sites is at present unknown. Similarly, the significance of the identified area of PAD associated with RCAS 09 (AHIMS ID 45-5-5355) and the relationship of the area of PAD to the identified surface artefacts within RCAS 09 is unknown. Further investigation of these areas of PAD would be required to confirm the nature of proposed impact to the identified site, as well as identify appropriate mitigation measures for proposed impacts.

Test excavation under the *Code of Practice for Archaeological Investigation of Aboriginal objects in New South Wales* (Department of Environment, Climate Change and Water, 2010a) would be required in order to determine whether subsurface Aboriginal objects are present within the expanded site extent of RCIF 2 (AHIMS ID 45-5-3159). The purpose of the excavations would be to confirm the extent of subsurface artefacts, their association with other sites in the area and their significance. Further information regarding the nature, extent and significance of this site will subsequently assist in the identification of appropriate mitigation measures for proposed impacts to the site. Archaeological test excavation is not conducted to mitigate against impacts.

Prior to the commencement of test excavation, a test excavation methodology must be prepared and circulated to registered Aboriginal parties for a 28 day review and comment period. Test excavation would be limited to relevant areas of the impact footprint of the proposal.

## 10.5 Artefact reburial location

There is potentially one existing artefact reburial location within the proposal site associated with AHIP C0000501 (see Figure 2). Further clarification of the location of the reburial location in relation to the proposed works would be required to determine appropriate management and mitigation measures.

Potential management of the existing artefact reburial sites would be discussed with registered stakeholders for the project as part of consultation completed for the ACHAR.

## 10.6 Aboriginal Heritage Impact Permit application

As Aboriginal objects that are not currently subject to an AHIP are present within the proposal site, an AHIP would need to be obtained to allow impacts to the following sites:

- Blacktown Southwest 11 (AHIMS ID 45-5-0563)
- Blacktown Southwest 7 (AHIMS ID 45-5-0559)
- RCIF 2 (AHIMS ID 45-5-3159)
- RCAS 4 (AHIMS ID 45-5-3162)
- RCAS 5 (AHIMS ID 45-5-3163)
- AIF-06 (AHIMS ID 45-5-4599)
- AIF-05 (AHIMS ID 45-5-4605)
- RCAS 09 (AHIMS ID 45-5-5355)
- RCAS 10 (AHIMS ID 45-5-5354)
- RCAS 11 (AHIMS ID 45-5-5353)

The application for an AHIP for the above sites would require the completion of an ACHAR in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011). The preparation of an ACHAR would involve comprehensive Aboriginal stakeholder consultation in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (Department of Environment, Climate Change and Water, 2010b), an assessment of Aboriginal cultural heritage values and an assessment of the potential harm to those values from the proposed works.

Results from this assessment and the results of the test excavation will be used as a basis of the ACHAR. Mitigation measures developed during the ACHAR would address potential impacts caused by the proposal and form the basis of proposed mitigation to be assessed as part of the AHIP application. Conditions of the AHIP (once issued), would be in addition to management measures proposed for the current ASR and the project REF.

### 10.6.1 AHIMS ID 45-5-4599

AIF-06 (AHIMS ID 45-5-4599) would also be subject to potential impacts from the planned Archbold Road upgrade and extension project. Sydney Metro and other relevant parts of Transport for NSW would coordinate any future Aboriginal Cultural Heritage Assessment Report(s) (ACHAR) and AHIP application(s).

# 11.0 RECOMMENDATIONS

The following recommendations regarding Aboriginal heritage are based on consideration of:

- Statutory requirements under the *National Parks and Wildlife Act 1974*
- The requirements of the relevant guidelines: *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Department of Environment, Climate Change and Water, 2010a) and the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (Department of Environment, Climate Change and Water, 2010b)
- The results of the background research, site surveys and sensitivity assessment
- The likely impacts of the proposed development.

It was found that:

- Ten Aboriginal sites are located within the study area
  - Blacktown Southwest 11 (AHIMS ID 45-5-0563)
  - Blacktown Southwest 7 (AHIMS ID 45-5-0559)
  - RCIF 2 (AHIMS ID 45-5-3159)
  - RCAS 4 (AHIMS ID 45-5-3162)
  - RCAS 5 (AHIMS ID 45-5-3163)
  - AIF-06 (AHIMS ID 45-5-4599)
  - AIF-05 (AHIMS ID 45-5-4605)
  - RCAS 09 (AHIMS ID 45-5-5355)
  - RCAS 10 (AHIMS ID 45-5-5354)
  - RCAS 11 (AHIMS ID 45-5-5353)
- The current assessment has identified an area of potential archaeological deposit (PAD) associated with the wider site extent of Aboriginal sites RCIF 2 (AHIMS ID 45-5-3159) and Blacktown Southwest 11 (AHIMS ID 45-5-0559) as well as the area of PAD identified within RCAS 09 (AHIMS ID 45-5-5355)
- RCIF 2 (AHIMS ID 45-5-3159) and Blacktown Southwest 7 (AHIMS ID 45-5-0559) would be subject to partial harm as a portion of their identified site extents are located outside of the current impact area
- All remaining identified surface artefact sites within the proposal site would be subject to total harm resulting in total loss of value to all remaining sites.

The following recommendations are made:

- Archaeological test excavation would be limited to the proposal site and undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (Department of Environment, Climate Change and Water, 2010a) to confirm the geographic extent of RCIF 2 (AHIMS ID 45-5-3159), Blacktown Southwest 11 (AHIMS ID 45-5-

0559) and the area of PAD identified within Ropes Creek Artefact Scatter 09 (AHIMS ID 45-5-5355)

Test excavation would be limited to areas subject to potential impacts by the proposed works and outside the area already salvaged as part of the St Mary's Wastewater System Augmentation project. Archaeological test excavation would be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010a)

- As part of the preparation of the test excavation methodology and ACHAR, comprehensive Aboriginal stakeholder consultation would be carried out in accordance with the *Aboriginal cultural heritage consultation requirements for proponents* (Department of Environment, Climate Change and Water, 2010b) and the National Parks and Wildlife Regulation 2019
- An AHIP would be submitted to the Department of Premier and Cabinet NSW (DPC) for those portions of the proposal site subject to impacts once test excavation is completed. The AHIP application would be supported by an ACHAR and test excavation report. An AHIP would be issued for the proposal prior to construction works commencing in areas where known Aboriginal sites and areas of PAD are located
- Sydney Metro would liaise with Transport for NSW regarding overlapping impacts to Aboriginal site AIF-06 (AHIMS ID 45-5-4599) and coordinating further assessment and management
- In the event that suspected Aboriginal ancestral remains are exposed during construction, the requirements of Section 3.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010) would be implemented.

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Department of Environment, Climate Change and Water 2010b. *Aboriginal cultural heritage consultation requirements for proponents.*

Office of Environment and Heritage 2011 *Guide to Investigating, assessing and reporting on Aboriginal cultural heritage in NSW: Part 6 National Parks and Wildlife Act 1974.*

# APPENDIX 1 – EXTENSIVE AHIMS SEARCH

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APPENDIX 2 – DEERUBBIN LALC REPORT

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artefact

Artefact Heritage

ABN 73 144 973 526
Level 4, Building B
35 Saunders Street
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au
www.artefact.net.au

# Appendix H

## Biodiversity Assessment Report

# Sydney Metro Precast Facilities

## Biodiversity Assessment Report

v05 | Final

22 October 2020

**Sydney Metro Authority**

# Sydney Metro Precast Facilities

| | |
|---|---|
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| Document Title: | Biodiversity Assessment Report |
| Document No.: | v05 |
| Revision: | Final |
| Date: | 22 October 2020 |
| Client Name: | Sydney Metro Authority |
| Client No: | Client Reference |
| Project Manager: | Katrina Smallwood |
| Author: | Brenton Hays |
| File Name: | Biodiversity Assessment_Precast facility_v04_SMA_20201020_comments and tracked changes BH edit |

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.jacobs.com



## Document history and status

| Revision | Date | Description | Author | Reviewed | Approved |
|---|---|---|---|---|---|
| 01 | 30/04/20 | Draft report | B. Hays | C. Thomson | C. Thomson |
| 02 | 16/06/20 | Second draft report | B. Hays | C. Thomson | C. Thomson |
| 03 | 31/08/20 | Third and final draft report | B. Hays | | |
| 04 | 14/09/20 | Fourth and final report | B. Hays | | |
| 05 | 22/10/20 | Fifth and final report | B. Hays | | |
| | | | | | |

## Contents

## Glossary of terms

### *Definitions*

| | |
|---|---|
| Cumulative impact | The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements. |
| Direct impact | Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf). |
| Habitat | An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014). |
| Indirect impact | Where an event or circumstance is a direct consequence of the action (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf). |
| Matters of NES | A matter of national environmental significance (NES) protected by a provision of Part 3 of the EPBC Act |
| NSW landscape | Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2014). |
| Mitigation | Action to reduce the severity of an impact (OEH 2014). |
| Mitigation measure | Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality. |
| Population | All the individuals that interbreed within a given area. |
| Proposal site | The area of land that is directly impacted on by the proposal. |
| Ecological study area | The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014). This has been defined as the proposal site with an approximate 50 metre buffer. |
| Target species | A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure. |

### *Abbreviations*

| | |
|---|---|
| BC Act | *Biodiversity Conservation Act 2016* |
| CEEC | Critically Endangered Ecological Community |
| CEMP | Construction Environmental Management Plan |
| DPI | Department of Primary Industries |
| DPIE | Department of Planning, Industry and the Environment |
| EEC | Endangered ecological community |
| EIS | Environmental Impact Statement |
| EPBC Act | *Environmental Protection and Biodiversity Conservation Act 1999* (Federal). |
| FM Act | *Fisheries Management Act 1994* (NSW) |
| GDE | Groundwater dependent ecosystems |

| | |
|---|---|
| IBRA | Interim Biogeographically Regionalisation of Australia |
| MNES | Matters of National Environmental Significance |
| OEH | Office of Environment and Heritage |
| PCT | Plant Community Type |
| REF | Review of Environmental Factors |
| TEC | Threatened Ecological Community |
| TBDC | Threatened Biodiversity Data Collection |

# Executive Summary

Sydney Metro propose to establish two precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. This report details the methods and results of a biodiversity survey and assessment of the distribution and abundance of threatened species, populations and ecological communities, and the extent and magnitude of ecological impacts associated with the proposal.

An ecological survey was undertaken within the ecological study area on 9 and 16 April 2020. While on site, a habitat assessment was undertaken to assess the likelihood of threatened biodiversity existing in the ecological study area. The field survey aimed to ground-truth the results of the background research and desktop habitat assessment. All threatened species, populations and communities that were considered likely to occur within the ecological study area were targeted during the field surveys and habitat assessment. Vegetation surveys were completed in line with the Biodiversity Assessment Method (BAM). Targeted surveys were completed for threatened plant species and the Cumberland Plain Land Snail. The habitat value of the waterways and dams were characterised in accordance with NSW Department of Primary Industries (Fisheries) document *Policy and Guidelines for fish habitat conservation and management (2013 update).* This assessment also considers the outcomes of the Biodiversity technical paper prepared as part of the Archbold Road upgrade and extension Review of Environmental Factors (REF) (WSP | Parsons Brinckerhoff 2017).

Three Plant Community Types (PCTs) were identified in the ecological study area based on floristic composition, geology, and landscape position with regard to relevant regional vegetation classifications:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849).
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).
- Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

These PCTs are mostly in poor condition, existing as regenerating canopy over exotic dominated grasses. Two patches of grassland with a high abundance of Kangaroo Grass were mapped as a derived grassland condition of PCT 849. The highest quality vegetation is moderate condition PCT 849 in the west of the ecological study area (<0.001 hectares within the proposal site), which is part of the Ropes Creek riparian corridor and mapped as both Priority Investment Land and a biodiversity corridor of regional significance (BIO Map). Areas of planted native / exotic vegetation that cannot be matched to a PCT were also present. The remainder of the vegetated areas are classed as exotic grassland.

Two threatened ecological communities (TECs) listed under the *Biodiversity Conservation Act 2016* (BC Act) were identified in the ecological study area:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as critically endangered).
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered).

One threatened ecological community as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was identified outside the proposal site, though within the ecological study area:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (listed as critically endangered).

One threatened plant species was recorded in the ecological study area during the field survey undertaken for the proposal: *Grevillea juniperina* subsp. *juniperina*. Four plants were identified growing from the southern bank of the large dam in the north of the ecological study area outside of the proposal site. A further 30 plants were identified outside the south west of the ecological study area. These individuals are part of the Ropes Creek

population. None of these individuals would be directly impacted by the proposal. No other threatened fauna species are considered likely to occur in the ecological study area based on the results of the targeted survey and lack of suitable habitat.

Live Cumberland Plain Land Snails were found in leaf litter and under rubbish in moderate condition woodland in the west of the ecological study area. This is expected to be the best quality habitat for this species in the ecological study area, which would be avoided by the proposal.

The following fauna species are either known to occur in adjacent habitat and/or are considered at least moderately likely to occur in the proposal site based on the presence of suitable habitat:

- Green and Golden Bell Frog (*Litoria aurea*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Southern Myotis (*Myotis macropus*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Swift Parrot (*Lathamus discolor*)
- Little Eagle (*Hieraaetus morphnoides*)
- Square-tailed Kite (*Lophoictinia isura*)
- Powerful Owl (*Ninox strenua*)
- Masked Owl (*Tyto novaehollandiae*).

The key impacts of the proposal include the removal of 1.92 hectares of native vegetation, a subset of which includes the following threatened ecological communities:

- 1.74 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered)
- 0.07 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)
- <0.001 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 ha of the associated BC Act listed Cumberland Plain Woodland community.

The native vegetation to be removed provides habitat (or potential habitat) for the species listed above. No *Grevillea juniperina* subsp. *juniperina* plants would be directly impacted, however 0.06 hectares of potential habitat for this species would be removed.

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur, and the extent of this impact would be proportionate to the extent of vegetation that is cleared. Indirect operational impacts would include a minor increase in habitat isolation. Invasion and spread of weeds, invasion and spread of pests, and invasion and spread of pathogens and disease are a risk with a proposal of this type due

to the potential for vehicles and machinery to introduce and spread contaminated soil during clearing. Noise, light and vibration would be increased during construction and operation. Significant impacts to aquatic ecosystems are unlikely to occur as a result of the proposal.

The ecological study area is situated in an over-cleared landscape due to historic activities. In the context of historic vegetation removal, any future vegetation clearing no matter how small would result in incremental cumulative impact that would detrimentally affect biodiversity. In combination with other projects in the area the proposal would contribute to cumulative biodiversity impacts (refer to REF for full cumulative impact assessment).

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts from the proposal, some residual impacts would occur. Management measures would be implemented during the construction and operational phases to mitigate the potential ecological impacts of the proposal. This assessment has identified a range of mitigation techniques to be implemented during construction and operation (see **Section 8.2**). Due to the presence of the critically endangered ecological communities and threatened fauna habitat, exclusion zones would be established to delineate the works limit boundary to ensure no accidental impacts occur.

The overall outcome of the BC Act tests of significance and EPBC Act assessments of significance indicate that there is a high level of certainty that the impacts to threatened biodiversity are unlikely to be significant.

# 1. Introduction

## 1.1 The proposal

Sydney Metro propose to establish two precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. Key components of the proposal are shown in **Figure 1-2** and would include:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate adjacent precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
  - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
  - Boiler, aggregate bins and consumables
  - Office facilities
  - On-site parking for up to 60 light vehicles
- Internal roads entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The northern and southern precast facilities would operate concurrently, 24 hours a day, seven days a week for the majority of the lifespan of the project.

The proposal would be temporary, operating for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West.

## 1.2 Purpose and scope of this report

This report details the methods and results of a biodiversity survey and assessment to identify the distribution and abundance of threatened species, populations and ecological communities in the area of the proposal to assess the extent and magnitude of ecological impacts associated with the proposal. The report addresses the requirements for assessment of significance under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Mitigation measures to ameliorate ecological impacts arising from the proposal are also provided. The aims of the biodiversity assessment are to:

- Describe the characteristics and ecological condition of the vegetation communities and habitats within the ecological study area
- Determine the occurrence, or likelihood of occurrence of threatened species, populations and communities listed under the *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act within the ecological study area
- Describe the potential impacts on biodiversity in the ecological study area because of the proposal
- Undertake a test of significance for threatened species and communities that are confirmed or considered likely to occur within the ecological study area in accordance with section 7.3 of the BC Act to determine whether the proposal is likely to significantly affect threatened species
- Undertake assessments in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (Department of

Environment, 2013) to consider impacts to nationally listed threatened species, ecological communities and migratory species

- Propose measures to mitigate impacts on ecological values.

## 1.3 Ecological study area

The ecological study area for the purposes of this biodiversity assessment (see **Figure 1-2**) includes the proposal site plus a 50-metre buffer to account for the area that would be directly and indirectly impacted by construction and operation of the proposal.

The following areas are discussed throughout the report and are defined as:

- Proposal site: the boundary of the northern and southern precast sites (see **Figure 1-2**)
- Ecological study area: includes the proposal site and surrounding 50-metre buffer (see **Figure 1-2**)
- Locality: defined as the area within a 10-kilometre radius surrounding the proposal site (see **Figure 1-1**)
- Bioregion: The ecological study area is in the Sydney Basin bioregion (Thackway and Cresswell, 1995) and within Cumberland sub-region (see **Figure 1-1**).

Figure 1-1 Proposal context

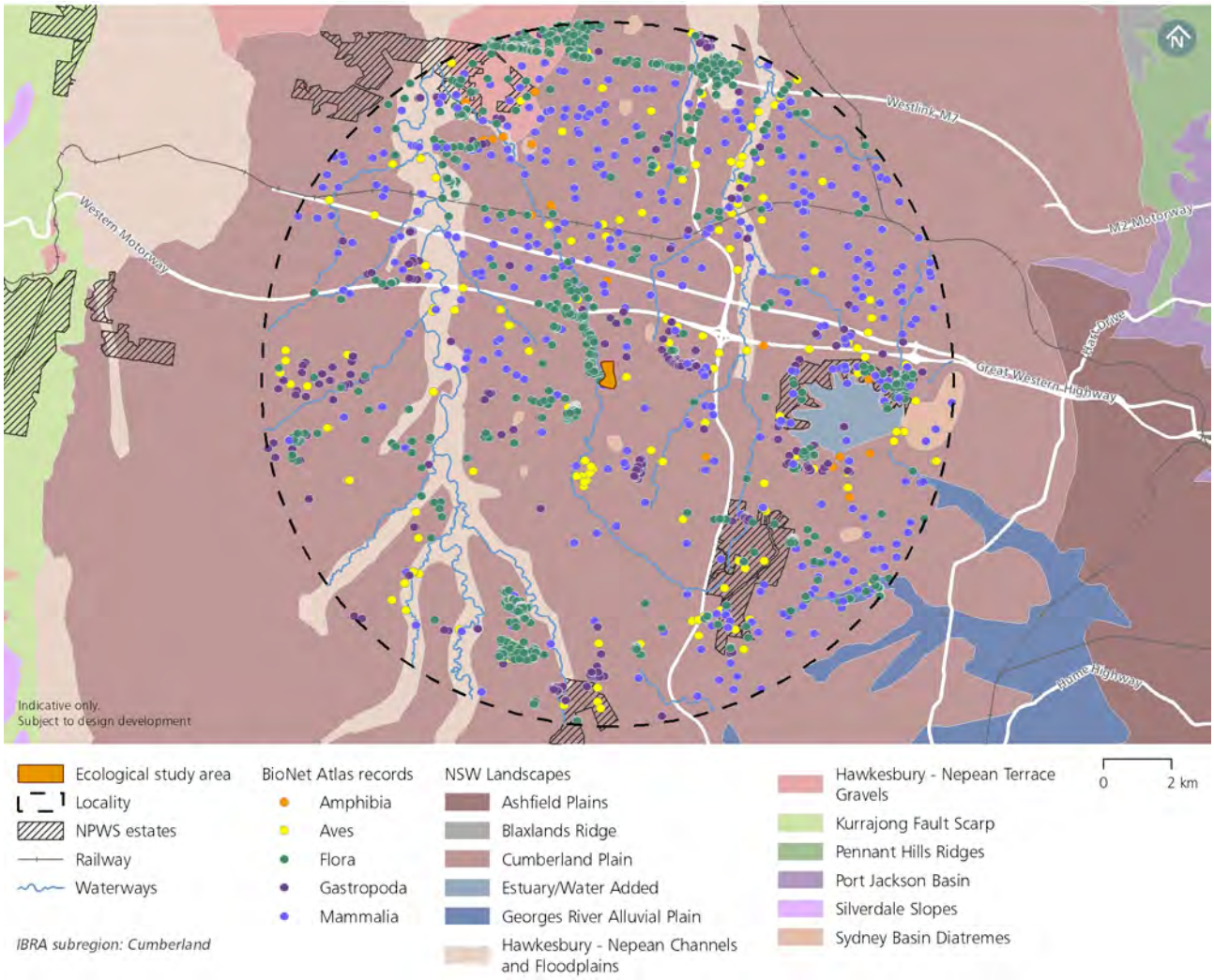
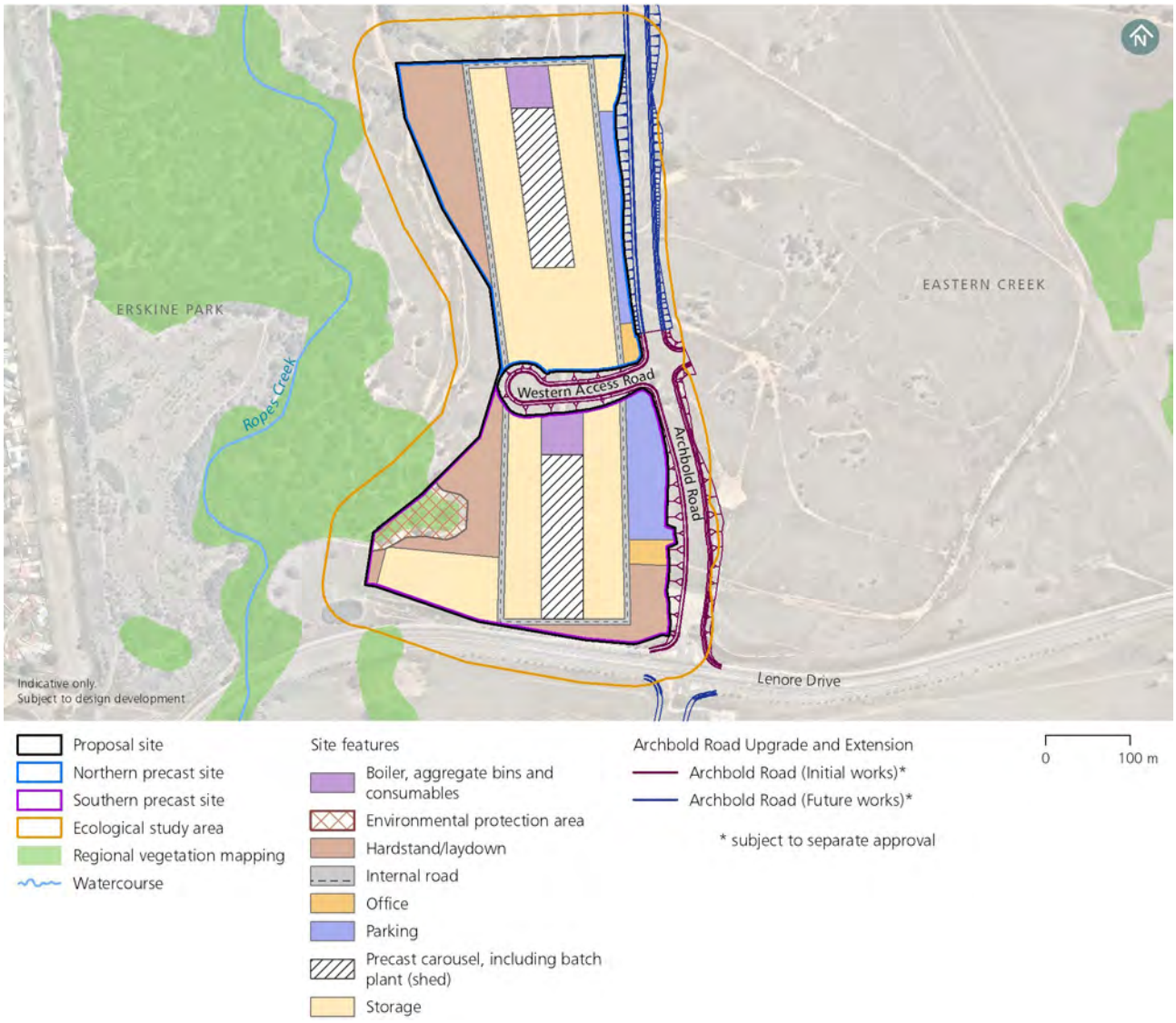


Figure 1-2 The proposal



# 2. Legislative and policy framework

A Review of Environmental Factors (REF) has been prepared to fulfil Sydney Metro's obligations in accordance with Division 5.1, Section 5.5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and Section 5.7 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF prepared for the Sydney Metro West Precast Facility (incorporating the northern and southern precast facilities) and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

The *Biodiversity Conservation Act 2016* (BC Act) sets out the environmental impact assessment framework for threatened species, threatened ecological communities and Areas of Outstanding Biodiversity Value (formerly critical habitat) for Division 5.1 activities (amongst other types of development). The BC Act lists a number of threatened species, populations or ecological communities to be considered in deciding whether a development or activity is "likely to significantly affect threatened species". A development or an activity is likely to significantly affect threatened species if:

(a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in Section 7.3 (of the BC Act), or

(b) the development exceeds the biodiversity offset scheme (BOS) threshold if the BOS applies to the impacts of the development on biodiversity values, or

(c) it is carried out in a declared Area of Outstanding Biodiversity Value (AOBV).

The BOS does not apply to development that is an activity subject to environmental impact assessment under Division 5.1 of the EP&A Act unless the proponent chooses to opt in to the BOS. The proponent has not opted into the BOS for this proposal. As such, the test of significance detailed in Section 7.3 of the BC Act must be used to determine whether the proposal is likely to significantly affect threatened species.

Sydney Metro must consider impacts to nationally listed threatened species, ecological communities and migratory species as part of the approval process under the strategic assessment. To assist with this, assessments are required in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

# 3. Assessment methodology

## 3.1 Personnel

This biodiversity assessment was undertaken and prepared by appropriately qualified and experienced ecologists (refer to **Table 3-1**).

Table 3-1 Personnel, role and qualifications

| Name | Role | Qualifications |
|---|---|---|
| Brenton Hays | Ecologist - Technical lead, ecology surveys, reporting, GIS analysis | Bachelor of Environmental Science and Management (Hons)<br>Accredited under section 6.10 of the Biodiversity Conservation Act 2016 as a Biodiversity Assessment Method Assessor (No. BAAS19068) |
| Tim Maher | Ecologist - Field survey assistant | Bachelor of Advanced Science (Biology)<br>Master of Research (Plant Ecology) |
| Chris Thomson | Principal Ecologist - Technical review | Graduate Certificate in Natural Resources<br>Bachelor of Applied Science (Environmental Management)<br>Accredited under section 6.10 of the Biodiversity Conservation Act 2016 as a Biodiversity Assessment Method Assessor (No. BAAS18058) |

## 3.2 Background research

A background review of existing information was undertaken to identify the existing environment of the proposal within a search area of 10 kilometres. The review focussed on database searches, relevant ecological reports pertaining to the ecological study area, particularly the Biodiversity technical paper prepared as part of the Archbold Road Upgrade and Extension Review of Environmental Factors (REF) (WSP | Parsons Brinckerhoff 2017), property boundaries, and relevant GIS layers. The review was used to prepare a list of threatened species, populations and communities as well as important habitat for migratory species with a likelihood of occurrence in the ecological study area and locality. The searches were also undertaken to identify if any Areas of Outstanding Biodiversity Value were present.

The following database searches were performed:

- BioNet - the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection – 24 March 2020
- NSW Department of Primary Industries (DPI) Fisheries Spatial Data Portal – 22 April 2020
- The federal Department of Environment's Protected Matters Search Tool – 23 March 2020
- BioNet Vegetation Classification Database – 15 April 2020
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE) – 21 April 2020
- Department of Environment's Directory of Important Wetlands in Australia – 21 April 2020
- Department of Planning and Environment's SEPP (Coastal Management) 2018 maps – 21 April 2020

Regional vegetation mapping projects including the Southeast NSW Native Vegetation Classification and Mapping – SCIVI (VIS_ID 2230), (State Government of NSW and Office of Environment and Heritage, 2010) and the Remnant Vegetation of the western Cumberland subregion, 2013 Update (VIS_ID 4207) (State Government of NSW and Office of Environment and Heritage, 2015). Vegetation mapping from the Archbold Road upgrade

and extension Archbold Road Upgrade and Extension Biodiversity Assessment Report (WSP | Parsons Brinckerhoff 2017) was also examined.

Preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act was viewed on the OEH NSW Threatened Species Scientific Committee website (Department of Planning, Industry and Environment 2020). There were no preliminary or provisional listings of relevance to the proposal.

The annual Final Priority Assessment List of nominated species and ecological communities that have been approved for assessment by the Minister responsible for the EPBC Act was reviewed (period commencing 1 October 2019) (Threatened Species Scientific Committee, 2019). None of the nominated species and ecological communities are of relevance to the proposal.

## 3.3 Habitat assessment

A habitat assessment was undertaken within the ecological study area on the identified list of threatened flora and fauna species known or predicted to occur in the Cumberland IBRA subregion that have been recorded within a 10-kilometre radius of the proposal (see **Appendix B** for the habitat assessment results). This list was identified from databases and literature as well as past surveys. The habitat assessment compared the preferred habitat features for these species with the type and quality of the habitats identified in the ecological study area. This habitat assessment was completed to assess the likelihood of the species being present in the ecological study area (i.e. subject species). The habitat assessment formed the basis for targeted surveys within the ecological study area.

The criteria used in the habitat assessment are detailed in **Table 3-2**. The results of the habitat assessment are provided in **Appendix B**.

Table 3-2 Likelihood of occurrence classification and criteria

| Likelihood | Criteria |
|---|---|
| Recorded | The species was observed in the ecological study area during the current survey. |
| High | It is highly likely that a species inhabits the ecological study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10 km) and is known or likely to maintain resident populations in the ecological study area. Also includes species known or likely to visit the ecological study area during regular seasonal movements or migration. |
| Moderate | Potential habitat is present in the ecological study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the ecological study area opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the ecological study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded. |
| Low | It is unlikely that the species inhabits the ecological study area and has not been recorded recently in the locality (10 km). It may be an occasional visitor, but habitat similar to the ecological study area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the ecological study area or the species are non-cryptic perennial flora species that were specifically targeted by surveys and not recorded. |
| None | Suitable habitat is absent from the ecological study area. |

## 3.4 Field survey

Two separate field surveys were undertaken within the ecological study area on the 9th and 16th of April 2020 to ground-truth the results of the background research and habitat assessment.

### 3.4.1 Vegetation surveys

The vegetation survey was completed using field survey methods in line with Chapter 5 of the Biodiversity Assessment Method (BAM) (Office of Environment and Heritage, 2017a). A plot-based vegetation survey of the ecological study area was undertaken. The survey was stratified and targeted to assess the expected environmental variation and address any areas with gaps in existing mapping and site information.

The broad scale vegetation mapping and aerial photography reviewed during the desktop assessment was used to initially identify vegetation extent. The initial vegetation mapping was then ground-truthed and where possible assigned to Plant Community Types (PCTs) according to those described in the BioNet Vegetation Classification Database (Department of Planning, Industry and Environment 2020a). Surveys assessed the environmental variation within the ecological study area and any areas with gaps in existing mapping and site information to determine vegetation zones.

A vegetation integrity assessment was then undertaken in each vegetation zone in accordance with Chapter 5 of the BAM. The plot-based floristic survey used a series of 400 square metre plots around a central 50 metre transect to assess vegetation structure and composition attributes (species richness and foliage cover). Function attributes (number of large trees, tree stem size class, tree regeneration and length of fallen logs) were recorded within the larger 1000 square metre plot. Litter cover was assessed as the average percentage ground cover of litter recorded from five 1 metre x 1 metre plots evenly located along the central transect. The number of trees with hollows was determined by counting the number of trees with hollows that are visible from the ground in the 1000 square metre plot. All data was collected according to the methods described in Chapter 5 of the BAM.

Areas of exotic vegetation and landscape plantings were inspected and mapped within the ecological study area. These areas were not surveyed using the above method and not assigned vegetation zones as they are not naturally occurring and cannot be matched to a PCT.

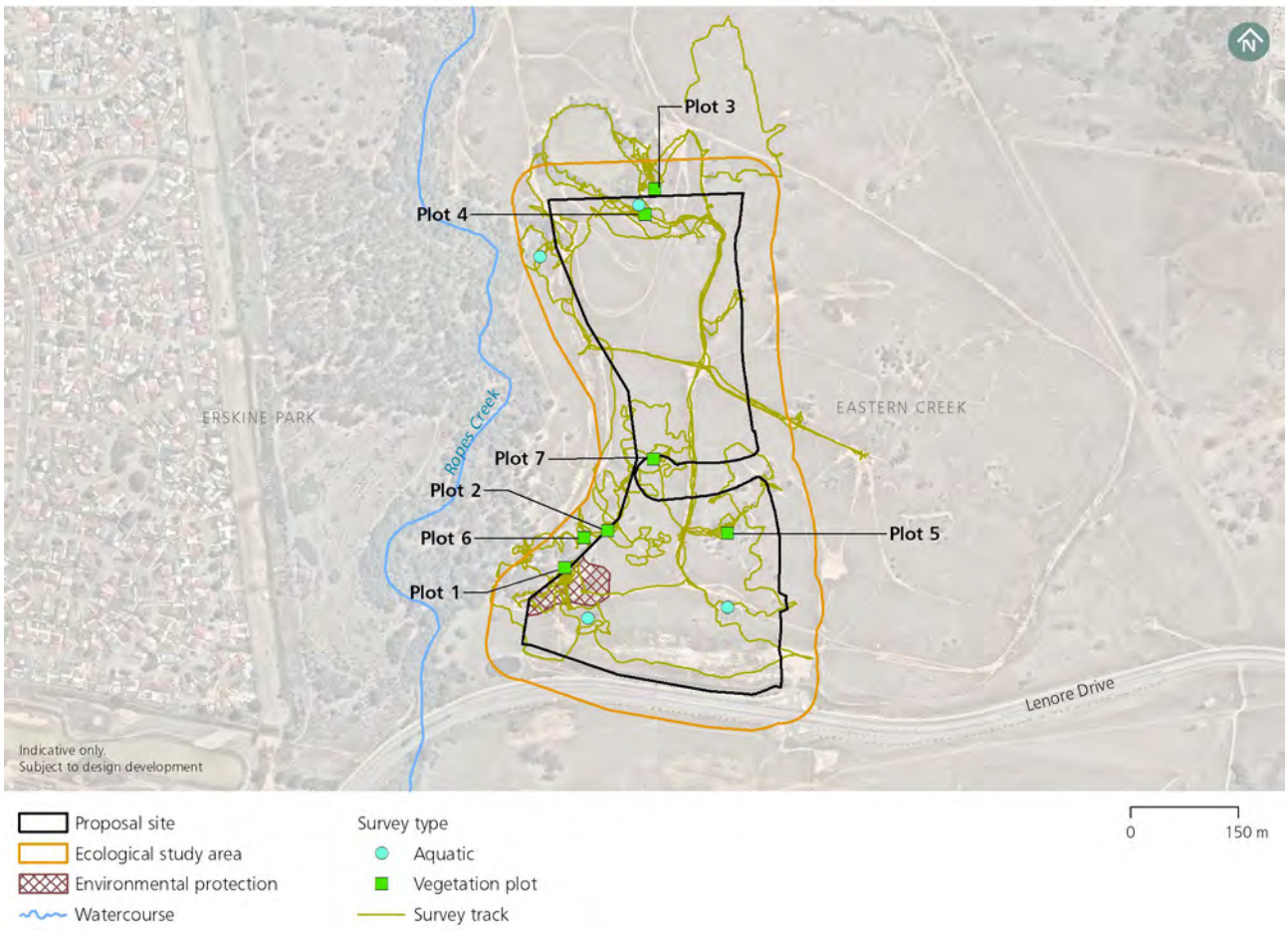
A summary of vegetation survey effort, outlining the number of vegetation zones and respective number of floristic plots / transects sampled in the field is presented in **Table 3-3**. The location of each plot / transect is shown in **Figure 3-1**.

Table 3-3 Summary of PCT / vegetation zones survey effort

| Vegetation Zone Number | Plant Community Type (PCT) | Condition | Area in proposal site (ha) | No. plots/transects required | No. plots/transects sampled |
|---|---|---|---|---|---|
| 1 | Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) | Moderate | <0.001 | 1 | 1 (Plot 1) |
| 2 | | Poor | 1.13 | 1 | 2 (Plot 5 and 6) |
| 3 | | Derived Grassland | 0.61 | 1 | 2 (Plot 2 and 7) |

| Vegetation Zone Number | Plant Community Type (PCT) | Condition | Area in proposal site (ha) | No. plots/transects required | No. plots/transects sampled |
|---|---|---|---|---|---|
| 4 | Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) | Poor | 0.07 | 1 | 1 (Plot 3) |
| 5 | Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) | Poor | 0.11 | 1 | 1 (Plot 4) |

Figure 3-1 Vegetation survey locations



### 3.4.2 Targeted flora surveys

Targeted searches were undertaken for all identified candidate flora species initially considered moderately likely to occur within the ecological study area (see **Table 3-2**). The surveys followed the methods described in the *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage, 2016) with random meander surveys through the habitat undertaken using paired parallel transects. The floristic plot surveys also provided opportunity to record threatened species in discreet areas if they were present.

Targeted surveys for threatened flora species have been previously undertaken for the Archbold Road Upgrade and Extension REF Biodiversity Assessment Report (WSP | Parsons Brinckerhoff 2017). The surveys undertaken for this assessment builds on the previous surveys from the Archbold Road Upgrade and Extension REF with a focused effort on the western edge of the ecological study area. The habitats on the western edge are in higher quality vegetation and the most suitable for threatened plant species out of the habitats present within the ecological study area.

The threatened flora species targeted, and details of the surveys undertaken are outlined in **Table 3-4**. The location of transects is shown on **Figure 3-1**.

Table 3-4 Targeted species survey techniques for threatened flora species and survey effort (V = Vulnerable species, E = Endangered species)

| Threatened flora species | Status | | Recommended survey technique, effort and timing (OEH 2016) | Survey completed |
|---|---|---|---|---|
| | BC Act | EPBC Act | | |
| *Acacia pubescens* | V | V | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the ecological study area is 20 m. With approximately 3.5 ha of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 1 to 5 km. The recommended survey time is estimated between 0.25 and 1.25 hours.<br><br>Surveys for *Acacia pubescens* can be undertaken year-round. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hour (3-person hour of survey and total around 6 km).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was not identified in the work undertaken for the Archbold Road Upgrade and Extension REF or during the survey undertaken for this proposal. |

| Threatened flora species | Status | | Recommended survey technique, effort and timing (OEH 2016) | Survey completed |
|---|---|---|---|---|
| | BC Act | EPBC Act | | |
| *Dillwynia tenuifolia* | V | - | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the ecological study area is 20 m. With approximately 3.5 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 1 to 5 km. The recommended survey time is estimated between 0.25 and 1.25 hours.<br><br>Surveys for *Dillwynia tenuifolia* can be undertaken year-round. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hour (3-person hour of survey and total around 6 km).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was not identified in the work undertaken for the Archbold Road Upgrade and Extension REF or during the survey undertaken for this proposal. |
| *Grevillea juniperina* subsp. *juniperina* | V | - | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the ecological study area is 20 m. With approximately 3.5 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 1 to 5 km. The recommended survey time is estimated between 0.25 and 1.25 hours.<br><br>Surveys for *Grevillea juniperina* subsp. *juniperina* can be undertaken year-round. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hour (3-person hour of survey and total around 6 km).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was identified at several locations in the ecological study area during surveys undertaken for this proposal. This species was not identified in the work undertaken for the Archbold Road Upgrade and Extension REF. |

| Threatened flora species | Status | | Recommended survey technique, effort and timing (OEH 2016) | Survey completed |
|---|---|---|---|---|
| | BC Act | EPBC Act | | |
| *Pultenaea parviflora* | E | V | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the ecological study area is 20 m. With approximately 3.5 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 1 to 5 km. The recommended survey time is estimated between 0.25 and 1.25 hours.<br><br>Surveys for *Pultenaea parviflora* can be undertaken year-round. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hours (this equates to a total of 3-person hours of survey time and around 6 km of transects).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was not identified in the work undertaken for the Archbold Road Upgrade and Extension REF or during the survey undertaken for this proposal. |
| *Persoonia nutans* | E | E | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the ecological study area is 20 m. With approximately 3.5 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 1 to 5 km. The recommended survey time is estimated between 0.25 and 1.25 hours.<br><br>Surveys for *Persoonia nutans* can be undertaken year-round. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hours (this equates to a total of 3-person hours of survey time and around 6 km of transects).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was not identified during the survey undertaken for this proposal. This species was not targeted during surveys for the Archbold Road Upgrade and Extension REF. |

| Threatened flora species | Status | | Recommended survey technique, effort and timing (OEH 2016) | Survey completed |
|---|---|---|---|---|
| | BC Act | EPBC Act | | |
| *Pilularia novae-hollandiae* | E | - | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat, however this was limited to wet areas fringing dams and depressions.<br>As a semi-aquatic fern, the maximum distance between transects in open vegetation such as that in the ecological study area is 10 m. With approximately 0.3 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is less than 1 km. The recommended survey time is about 0.25 hours.<br><br>Surveys for *Pilularia novae-hollandiae* should be undertaken October to December in drying mud after inundation. | Approximately 0.75 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (this equates to a total of 1-person hour of survey time and around 1 km of transects).<br><br>The survey was not undertaken in an appropriate season to detect this species, however previous rain had filled the dams. Fringing areas of dams and wet depressions were surveyed.<br><br>This species was not identified during the survey undertaken for this proposal. This species was not targeted during surveys for the Archbold Road Upgrade and Extension REF. |
| *Pimelea curviflora var. curviflora* | V | V | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As an herb the maximum distance between transects in open vegetation such as that in the ecological study area is 10 m. With approximately 3.5 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 2 to 10 km. The recommended survey time is estimated between 0.5 and 2.5 hours.<br><br>Surveys for *Pimelea curviflora var. curviflora* can be undertaken year-round, though easiest when this species is flowering from September to March. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hours (this equates to a total of 3-person hours of survey time and around 6 km of transects).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was identified in the work undertaken for the Archbold Road Upgrade and Extension REF north of the ecological study area. This species has not been previously identified in the ecological study area or during the survey undertaken for this proposal. |

| Threatened flora species | Status | | Recommended survey technique, effort and timing (OEH 2016) | Survey completed |
|---|---|---|---|---|
| | BC Act | EPBC Act | | |
| *Pimelea spicata* | E | E | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As an herb the maximum distance between transects in open vegetation such as that in the ecological study area is 10 m. With approximately 3.5 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 2 to 10 km. The recommended survey time is estimated between 0.5 and 2.5 hours.<br><br>Surveys for *Pimelea spicata* can be undertaken year-round. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hours (this equates to a total of 3-person hours of survey time and around 6 km of transects).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was not identified in the work undertaken for the Archbold Road Upgrade and Extension REF or during the survey undertaken for this proposal. |
| *Marsdenia viridiflora* subsp. *viridiflora* endangered population | E | - | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As a climber the maximum distance between transects in open vegetation such as that in the ecological study area is 10 m. With approximately 3.5 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 2 to 10 km. The recommended survey time is estimated between 0.5 and 2.5 hours.<br><br>Surveys for *Marsdenia viridiflora* subsp. *viridiflora* can be undertaken year-round. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hours (this equates to a total of 3-person hours of survey time and around 6 km of transects).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was not identified in the work undertaken for the Archbold Road Upgrade and Extension REF or during the survey undertaken for this proposal. |

| Threatened flora species | Status | | Recommended survey technique, effort and timing (OEH 2016) | Survey completed |
|---|---|---|---|---|
| | BC Act | EPBC Act | | |
| *Thesium australe* | V | V | A parallel field traverse (i.e. parallel transects) was undertaken in areas of potential habitat. As an herb the maximum distance between transects in open vegetation such as that in the ecological study area is 10 m. With approximately 3.5 hectares of potential habitat in the ecological study area, in open vegetation, the recommended field traverse length is 2 to 10 km. The recommended survey time is estimated between 0.5 and 2.5 hours.<br><br>Surveys for *Thesium australe* can be undertaken November to February. | Approximately 3 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 1.5 hours (this equates to a total of 3-person hours of survey time and around 6 km of transects).<br><br>The survey was undertaken in an appropriate season to detect this species.<br><br>This species was not identified in the work undertaken for the Archbold Road Upgrade and Extension REF or during the survey undertaken for this proposal. |

### 3.4.3 Targeted fauna surveys

Targeted surveys for the Cumberland Plain Land Snail were undertaken throughout areas of suitable habitat during the survey. The habitats in the west of the ecological study area around Ropes Creek are the most suitable for the Cumberland Plain Land Snail out of the habitats present within the ecological study area. The location of Cumberland Plain Land Snail survey sites is shown by the survey tracks on **Figure 3-1**.

Searches for Cumberland Plain Land Snail involved looking for active specimens on the base of tree trunks, turning over suitable ground shelter including fallen timber, sheets of iron and exposed rocks and rubble, raking back bark, litter and debris from the ground, and searching in dense grass clumps.

Other fauna surveys were not undertaken during the field work for this proposal. Extensive targeted fauna surveys (diurnal and nocturnal surveys for large forest owls, Grey-headed Flying Fox, Green and Golden Bell Frog, woodland birds and Cumberland Plain Land Snail) were previously undertaken in and around the ecological study area for the Archbold Road Upgrade and Extension REF (WSP | Parsons Brinckerhoff 2017) and this data has been used to inform the assessment for this proposal. Where a species has not been surveyed, the habitat assessment has been used to determine the likelihood of occurrence.

### 3.4.4 Aquatic surveys

An aquatic habitat assessment was conducted to assess the dams and depressions along the drainage lines against the NSW DPI (Fisheries) document *Policy and Guidelines for fish habitat conservation and management (2013 update)* (NSW Department of Primary Industries, 2013) and *Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). These guidelines provide information for waterway classification and describe ways to minimise potential impacts of road projects on fish and other aquatic wildlife by protecting aquatic habitat and maintaining fish passage. The habitat assessment was visual only and no fish surveys or macroinvertebrate surveys were conducted; nor was water quality sampling undertaken. The aim of the habitat assessment was to identify the presence of 'key fish habitat'.

Habitat assessment for threatened aquatic species was undertaken for the dams along the two drainage lines and around the Ropes Creek offshoot drain in the west. Aquatic habitats were assessed by examining characteristics such as the structure and floristics of aquatic vegetation, channel width, the presence of surface water, water flow, water depth, turbidity, visible pollutants, erosion, the presence of shelter (rocks, submerged vegetation and woody debris), and channel substrate.

There is no mapped indicative threatened fish habitat in or around the ecological study area. The habitat characteristics observed did not match the habitat characteristics of any threatened aquatic species known or predicted to occur in the locality hence targeted surveys for aquatic species were not undertaken.

## 3.5 Limitations

The vegetation field survey was able to provide adequate spatial coverage and survey effort for the entire ecological study area. This was achievable in the timeframe given the small size of the ecological study area. Detailed floristic survey was undertaken to provide a list of flora species for that point in time. Additional flora species may appear in other times of the year, particularly cryptic orchids. A period of several seasons or years is often needed to identify all the species present in an area, and specific weather conditions are required for optimum detection (e.g. breeding and flowering periods). The conclusions of this report are therefore based upon available data and limited field survey and are indicative of the environmental condition of the ecological study area at the time of the survey. It should be recognised that site conditions, including the presence of threatened species, can change with time. To address this limitation, the assessment has aimed to identify the presence and suitability of the habitat for threatened species.

Data and results from the ecological surveys undertaken for the Archbold Road Upgrade and Extension REF (WSP | Parsons Brinckerhoff 2017) have been relied upon and are assumed to be accurate.

The mapping included in this report shows the inferred distribution of plant community types and habitat within the ecological study area. Any vegetation mapping shown outside the ecological study area has been taken from available resources (VIS_ID 4207 and WSP | Parsons Brinckerhoff 2017) and was not verified as part of this assessment. In many cases, the boundaries between plant community types and habitats are not well-defined and the mapping provides an approximation of on-ground conditions. The maps represent a snapshot in time.

# 4. Existing environment

## 4.1 Environmental context

The ecological study area is located within the Cumberland sub-region of the Sydney Basin Bioregion as defined by Thackway and Cresswell (1995) and the Cumberland Plain Mitchell Landscape as mapped by the NSW National Parks and Wildlife Service (2002a) and described by the NSW Department of Environment and Climate Change (2008). The Cumberland Plain Mitchell Landscape is an over cleared landscape with 89 per cent of native vegetation having been cleared. Only 11 per cent of the original native vegetation remains.

The landscape is predominantly low rolling hills and wide valleys in a rain shadow area below the Blue Mountains (Morgan, 2001). Geology is dominated by undifferentiated middle Triassic Wianamatta group shales (Bringelly Shale) (Clarke and Jones, 1991). Soils overlying the Wianamatta Shale are of the residual Blacktown soil landscape (Hazelton et al., 1989, Morgan, 2001, Department of Environment and Climate Change, 2008).

The ecological study area is situated in a landscape that has been extensively cleared and modified, where remaining intact vegetation is concentrated along waterways and small fragmented bushland remnants and isolated trees. The riparian vegetation and grassy woodland around Ropes Creek forms one of the largest contiguous areas of native vegetation surrounding the ecological study area. The PCTs within the ecological study area are described in **Section 4.2**.

The proposal site has been historically cleared and modified for agricultural practices and was partly modified by the construction of Lenore Drive in 2012. Historical imagery shows the proposal site being primarily used for agriculture up until around 2006, when vehicle tracks begin to appear. Recently the proposal site has been used by the public for unauthorised recreational off-road driving and motorcycling, as evidenced by the extensive network of tracks and observations of motorcycles on the proposal site during field surveys.

The aquatic environment includes two artificial dams, the largest being located on a mapped unnamed first order stream in the north of the proposal site and the other on an unmapped drainage line in the south of the ecological study area. The proposal site only includes the southern section of the large dam. These drainage lines are likely naturally formed, though have been highly influenced over time by clearing of woodland vegetation and increasing run-off. Both drainage lines are highly ephemeral, only draining water from the immediate surrounds into Ropes Creek to the west of the proposal site. The habitat quality for fish is poor (discussed in **Section 3.4.4**). There are no wetlands of significance (*State Environmental Protection Policy Coastal Management 2018* or wetlands listed in the Directory of Important Wetlands (Department of Agriculture, Water and Environment 2020) in or adjacent to the ecological study area.

Vegetation in the west of the ecological study area around Ropes Creek has been mapped by the Department of Planning, Industry and Environment as Cumberland Plains Priority Conservation Lands (see **Figure 4-2**) and also a biodiversity corridor of regional significance (see **Figure 4-5**) as identified by the Biodiversity Investment Opportunities Map (BIO Map).

## 4.2 Plant community types

The proposal site is mostly cleared and dominated by exotic grassland, however native vegetation is scattered across the proposal site varying from small intact woodland patches to isolated trees (see **Figure 4-1**). Remnant woodland exists around Ropes Creek to the west, which occurs within the proposal site along the western boundary at two locations. Most of the vegetation on the proposal site is in poor condition, lacking a shrub layer and containing a high prevalence of exotic grasses. Past and present land use activities such as land clearing, weed and pest invasion, rubbish dumping, and human interaction have modified the extent and condition of native vegetation in the ecological study area and locality.

There were three PCTs identified in the ecological study area based on floristic composition, geological substrate, and landscape position with regard to relevant regional vegetation classifications:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849).
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).
- Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

Small areas of exotic vegetation (potential historic planting of shrub species such as *Lagerstroemia indica*, *Cupressus* sp.) and planted native trees along Lenore Drive that cannot be matched to a PCT were also present. The remainder of vegetated areas are classed as exotic grassland.

The PCTs and other vegetation identified within the ecological study area are outlined in **Table 4-1** and illustrated in **Figure 4-1**.

Table 4-1 Plant community types

| Plant community type (PCT) | Condition class | Vegetation formation | Percent cleared in major catchment area | Threatened ecological community? | Area (ha) in proposal site* | Area (ha) in ecological study area |
|---|---|---|---|---|---|---|
| Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) | Moderate | Grassy Woodlands | 93 | BC Act:<br>Cumberland Plain Woodland in the Sydney Basin Bioregion CEEC<br><br>EPBC Act:<br>Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest CEEC (in part) | <0.001 | 0.89 |
| | Poor | | | | 1.13 | 1.7 |
| | Derived grassland | | | | 0.61 | 0.81 |
| Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (835) | Moderate | Forested Wetlands | 93 | BC Act:<br>River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions endangered ecological community (EEC) | 0 | 0.001 |
| | Poor | | | | 0.07 | 0.55 |
| Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (1071) | Poor | Freshwater Wetlands | 75 | No.<br>This PCT occurs a result of altered drainage caused by agricultural practices and is not a naturally occurring wetland. | 0.11 | 0.44 |
| | | | | **Sub-total** | 1.92 | 4.39 |
| Exotic vegetation | NA | NA | NA | No | 0.07 | 0.15 |
| Blackberry infestation | NA | NA | NA | No | 0 | 0.03 |
| Planted native vegetation | NA | NA | NA | No | 0.002 | 0.03 |
| | | | | **Totals** | **1.98** | **4.6** |

*Excludes environmental protection zone

# Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) - Moderate

**Vegetation formation:** Grassy Woodlands

**Vegetation class:** Coastal Valley Grassy Woodlands

**Conservation status:** Critically Endangered Ecological Community (BC Act): Cumberland Plain Woodland in the Sydney Basin Bioregion. Critically Endangered Ecological Community (EPBC Act): Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

**Estimate of percent cleared:** 93 per cent

**Condition:** Moderate

**Extent in the ecological study area:** 0.89 hectares

**Plots completed in vegetation zone:** 1 (Plot 1)

| Structure | Height range (m) | Foliage cover estimate (%) | Typical species |
|---|---|---|---|
| Upper | 10 – 20 m | 17 | *Eucalyptus moluccana, Eucalyptus tereticornis* |
| Middle | - | - | - |
| Ground | 0 – 1 m | 30 | *Paspalum dilatatum*, Microlaena stipoides, Eragrostis curvula*, Setaria parviflora*, Cynodon dactylon, Aristida vagans, Fimbristylis dichotoma, Solanum pseudocapsicum*, Themeda triandra, Eragrostis leptostachya, Paspalidium distans, Solanum nigrum*, Bothriochloa macra, Sporobolus creber, Cheilanthes sieberi.* |

**Description:**

The gentle topography associated with the shale plains of Western Sydney carries an open grassy woodland dominated by *Eucalyptus moluccana, Eucalyptus tereticornis* and *Eucalyptus crebra/Eucalyptus fibrosa*. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) (Office of Environment and Heritage, 2017b). Tozer et al. (2006) define the primary habitat for the community as occurring at elevations less than 150 metres above sea level with some sites occurring at higher elevations where the landscape remains gently inclined (Office of Environment and Heritage, 2017b).

Within the ecological study area, PCT 849 - Moderate is limited to the south-western corner, where a small amount occurs within the proposal site (<0.001 hectares). The vegetation is contiguous with riparian vegetation associated with Ropes Creek. The canopy contains *Eucalyptus moluccana* and *Eucalyptus tereticornis*. No midstorey species were recorded in the plot, however further into this patch *Bursaria spinosa*, *Acacia parramattensis*, *Dillwynia sieberi* and *Grevillea juniperina* subsp. *juniperina* are present. The groundcover is moderately dense, with about 50 per cent of cover being native grasses (notably *Microlaena stipoides*) but there is also high invasion by weeds on the edge where the plot was undertaken. The cover of native grasses is higher further into this patch.

Fauna habitat values are moderate. The vegetation surveyed is the edge of a larger patch that is contiguous with riparian vegetation along Ropes Creek. The vegetation has been historically disturbed and consists of a low number of large remnant trees with dense midstorey of regrowth canopy species. No hollow bearing trees or large trees above 50 centimetres (diameter at breast height) were present in the plot which limits the habitat suitability for nesting and roosting, however these trees were present in the wider patch in low abundance. The canopy provides foraging opportunities for insectivorous and nectarivorous birds and mammals. A low abundance of large woody debris was recorded in the ground layer which limits sheltering and foraging opportunities for some fauna groups. The habitat does still provide some good sheltering and foraging value with leaf litter layer (average cover of 19 per cent) and dumped refuse providing opportunity for ground dwelling species, including the threatened Cumberland Plain Land Snail, to find shelter sites.

The Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) - Moderate as it occurs in the ecological study area is shown in Photograph 1.

*Photograph 1: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – Moderate (photograph is of Plot 1 transect looking south west).*

# Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) - Poor

**Vegetation formation:** Grassy Woodlands

**Vegetation class:** Coastal Valley Grassy Woodlands

**Conservation status:** Critically Endangered Ecological Community (BC Act): Cumberland Plain Woodland in the Sydney Basin Bioregion. This vegetation does not meet the condition threshold for listing under the EPBC Act.

**Estimate of percent cleared:** 93 per cent

**Condition:** Poor

**Extent in the ecological study area:** 1.7 hectares

**Plots completed in vegetation zone:** 2 (Plots 5 and 6)

| Structure | Height range (m) | Foliage cover estimate (%) | Typical species |
|---|---|---|---|
| Upper | 10 – 20 m | 5 | *Eucalyptus moluccana, Eucalyptus tereticornis* |
| Middle | 1 – 10 m | 10 | *Eucalyptus moluccana, Eucalyptus tereticornis* |
| Ground | 0 – 1 m | 30 | *Paspalum dilatatum*, Microlaena stipoides, Eragrostis curvula*, Setaria parviflora*, Chloris truncata, Bothriochloa macra, Cynodon dactylon, Aristida vagans, Fimbristylis dichotoma, Themeda triandra, Eragrostis leptostachya, Sporobolus creber, Paspalidium distans, Wahlenbergia gracilis, Cyperus gracilis, Hypoxis hygrometrica* |

**Description:**

Within the ecological study area, PCT 849 - Poor is the most abundant vegetation type, occurring as scattered remnant paddock trees and patches of natural regeneration. The canopy contains *Eucalyptus moluccana* and *Eucalyptus tereticornis*. Both larger patches within the proposal site contain scattered young trees (one to 10 metres) surrounding one mature tree (>80 centimetres). No midstorey species were recorded in the plot, except for canopy regeneration. The groundcover is highly variable in composition. Some areas, particularly underneath a large tree or denser patches of small trees, have a high cover of native species (notably *Microlaena stipoides*). A moderate to high richness of native grasses was recorded (eight species in both plots). There is high invasion by weeds, particularly *Paspalum dilatatum* (up to 50 per cent), *Setaria parviflora* and *Eragrostis curvula*.

Fauna habitat values are low to moderate. The vegetation is mostly regenerating, though some remnant mature trees with hollows are present that provide roosting and nesting opportunities. Rainbow Lorikeets and Red-rumped Parrots were observed using the hollows in several large remnants. Trees also present perching habitat and open areas hunting habitat for predatory birds. A Kestrel and Black-shouldered Kite were observed hunting and perching. The canopy provides foraging opportunities for insectivorous and nectarivorous birds and mammals, however the connectivity is low. A low abundance of large woody debris was recorded in the ground layer which limits sheltering and foraging opportunities for some fauna groups. The leaf litter layer is absent from these areas and the ground layer very dry, limiting opportunity for ground dwelling species, including the threatened Cumberland Plain Land Snail, to find shelter sites.

The Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) - Poor as it occurs in the ecological study area is shown in Photograph 2.

*Photograph 2: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – Poor (photograph is of Plot 5 transect looking north east).*

# Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) – Derived grasslands

**Vegetation formation:** Grassy Woodlands

**Vegetation class:** Coastal Valley Grassy Woodlands

**Conservation status:** Critically Endangered Ecological Community (BC Act): Cumberland Plain Woodland in the Sydney Basin Bioregion. This vegetation does not meet the condition threshold for listing under the EPBC Act.

**Estimate of percent cleared:** 93 per cent

**Condition:** Derived grasslands

**Extent in the ecological study area:** 0.81 hectares

**Plots completed in vegetation zone:** 2 (Plot 2 and 7)

| Structure | Height range (m) | Foliage cover estimate (%) | Typical species |
|---|---|---|---|
| Upper | - | - | - |
| Middle | 0.5 – 1.5 m | 2 | *Eucalyptus tereticornis* |
| Ground | 0 – 1 m | 60 | *Themeda triandra, Cynodon dactylon, Paspalum dilatatum*, Setaria parviflora*, Microlaena stipoides, Hypochaeris radicata*, Bothriochloa macra, Sporobolus fertilis, Eragrostis curvula*, Eragrostis brownii,* |

**Description:**

Within the ecological study area, PCT 849 – Derived grasslands is limited to three discrete patches mixed within exotic grassland in the central and southern parts of the proposal site. The vegetation adjoins patches of PCT 849 – Poor.

This vegetation does not have an intact canopy, though canopy species *Eucalyptus tereticornis* are present in the midstorey as regenerating seedlings. The groundcover is dense with a variable, though high and often dominating cover of native grasses (notably *Themeda triandra* and *Microlaena stipoides* with approximately 40 per cent cover). Cover of exotic grasses is also high, including *Paspalum dilatatum* and *Setaria parviflora*.

Fauna habitat values are low. These grasslands may provide hunting habitat for predatory birds. Most of the regenerating trees are currently unlikely to be mature enough to produce flowers.

The Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – Derived grassland as it occurs in the ecological study area is shown in Photograph 3.

*Photograph 3: The Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – Derived grassland (photograph is of Plot 2 transect looking east).*

# Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (835) - Poor

**Vegetation formation:** Forested Wetlands

**Vegetation class:** Coastal Floodplain Wetlands

**Conservation status:** Endangered Ecological Community (BC Act): River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

**Estimate of percent cleared:** 93 per cent

**Condition:** Poor

**Extent in the ecological study area:** 0.55 hectares

**Plots completed in vegetation zone:** 1 (Plot 3)

| Structure | Height range (m) | Foliage cover estimate (%) | Typical species |
|---|---|---|---|
| Upper | 10 – 15 m | 35 | *Eucalyptus tereticornis, Angophora subvelutina* |
| Middle | 2 – 4 m | 5 | *Eucalyptus tereticornis, Lycium ferocissimum** |
| Ground | 0 – 1.5 m | 65 | *Paspalum dilatatum*, Microlaena stipoides, Setaria parviflora*, Eragrostis leptostachya, Sida rhombifolia*, Axonopus fissifolius*, Cynodon dactylon, Eragrostis curvula*, Paspalum dilatatum*, Bidens pilosa*, Sporobolus creber, Senecio madagascariensis*, Fimbristylis dichotoma, Solanum pseudocapsicum*, Commelina cyanea, Phyllanthus virgatus* |

**Description:**

PCT 835 is an open eucalypt forest situated on alluvial flats of the Hawkesbury and Nepean river systems which also forms narrow ribbons along streams and creeks that drain the Cumberland Plain (Office of Environment and Heritage, 2017b). The canopy typically includes one of either *Angophora floribunda* or *Angophora subvelutina* and one or both of *Eucalyptus tereticornis* and *Eucalyptus amplifolia* however there are a wide variety of other eucalypts also present (Office of Environment and Heritage, 2017b). In its natural state, the community has an understorey characterised by a generally sparse small tree stratum and sparse lower shrub layer that features *Bursaria spinosa* at most sites (Office of Environment and Heritage, 2017b). The ground layer is characterised by an abundant cover of grasses with small herbs and ferns (Office of Environment and Heritage, 2017b).

Within the ecological study area, PCT 835 – Poor occurs around Ropes Creek and the two drainage lines. Around Ropes Creek, this vegetation borders higher quality patches that have had less clearing, though contain a higher cover of exotic shrubs. The vegetation where Plot 3 was undertaken is located around the larger dam in the north of the proposal site, and is a relatively dry version of this PCT. The canopy contains *Eucalyptus tereticornis* and *Angophora subvelutina.* The midstorey in this location is absent apart from regenerating *Eucalyptus tereticornis* and scattered *Lycium ferocissimum,* a Priority Weed in the Greater Sydney Region and Weed of National Significance (WoNS). However elsewhere this vegetation contains *Casuarina glauca* and *Melaleuca styphelioides*, particularly on the edge of Ropes Creek where the occurrence of this vegetation is only regeneration of midstorey. The groundcover is highly variable in composition. Some areas, particularly underneath a large tree or denser patches of small trees, have a high cover of native species (notably *Microlaena stipoides*). A moderate to high richness of native grasses was recorded (seven species). There is high invasion by weeds, particularly *Paspalum dilatatum* (up to 40 per cent) and *Setaria parviflora*.

Fauna habitat values are low to moderate. The vegetation is mostly regenerating, though some remnant mature trees with hollows are present around the dam that provide roosting and nesting opportunities. The canopy provides foraging opportunities for insectivorous and nectarivorous birds and mammals. The connectivity is low among the scattered patches and single trees along the drainage lines, however beside Ropes Creek this

vegetation may provide some resources for dispersing animals. A low abundance of large woody debris was recorded in the ground layer which limits sheltering and foraging opportunities for some fauna groups. The leaf litter layer is mostly absent along the drainage lines and the ground layer very dry, however next to Ropes Creek, vegetation may provide shelter opportunities for ground dwelling species, including the threatened Cumberland Plain Land Snail.

Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (835) - Low as it occurs in the ecological study area is shown in Photograph 4.

*Photograph 4: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (835) - Low (photograph is of Plot 2 transect looking north).*

# Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) - Poor

**Vegetation formation:** Freshwater Wetlands

**Vegetation class:** Coastal Freshwater Lagoons

**Conservation status: Endangered Ecological Community (BC Act):** Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (only applies to small naturally occurring patch of PCT 1071 in the north west of the ecological study area, outside of the proposal site)

**Estimate of percent cleared:** 75 per cent

**Condition:** Poor

**Extent in the ecological study area:** 0.44 hectares

**Plots completed in vegetation zone:** 1 (Plot 4)

| Structure | Height range (m) | Foliage cover estimate (%) | Typical species |
|---|---|---|---|
| Upper | NA | 0% | None |
| Middle | 2 – 5 m | 0.5% | *Casuarina glauca* |
| Ground | 0 – 2 m | 25% | *Typha orientalis, Salvinia molesta*, Persicaria lapathifolia, Cladium procerum, Ludwigia peruviana*, Ludwigia peploides, Triglochin spp.* |

**Description:**

The Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) consists of wetlands located on coastal plains, valleys, lagoons and other sites of poor drainage (Office of Environment and Heritage, 2017b). This PCT also includes man-made water bodies, drainage lines and depressions across a wide variety of environments (Office of Environment and Heritage, 2017b) where wetland vegetation has established. This is the case with much of the occurrence of this PCT in the ecological study area. The vegetation has established in two artificial farm dams and one constructed basin beside Lenore Drive. These areas would not have originally supported a naturally occurring wetland. A small offshoot depression line from Ropes Creek is the only likely natural occurrence of PCT 1071 within the north-west of the ecological study area, however this is outside of the proposal site.

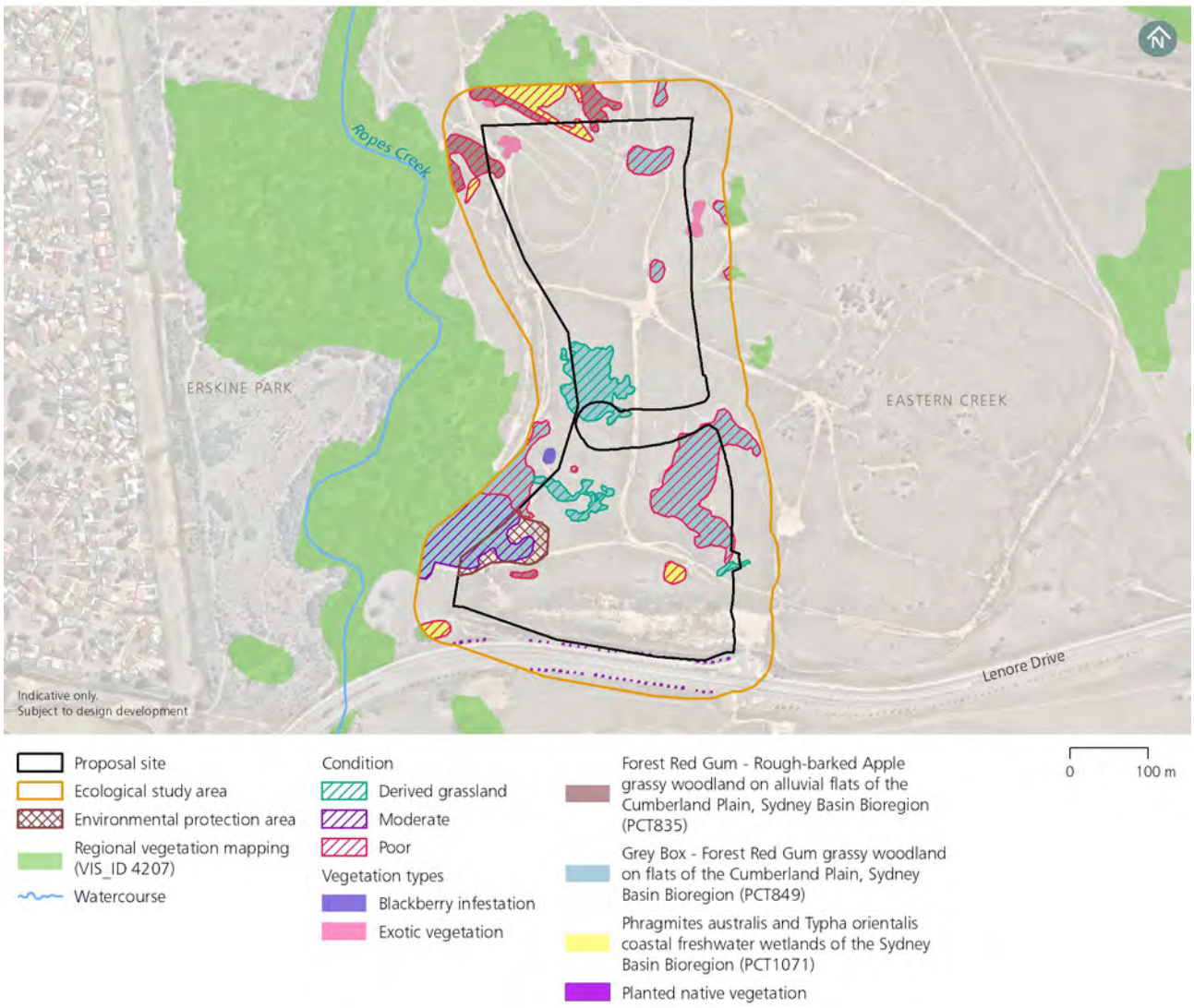
As is commonly found on the Cumberland Plain, this PCT consists of a dense stand of *Typha orientalis* with *Cladium procerum* and *Persicaria lapathifolia* and a range of exotic grass and herbaceous species on the fringes. The dam in the north has a very high abundance of *Salvinia molesta* over areas of open water, a Priority Weed in the Great Sydney Region and Weed of National Significance (WoNS).

Fauna habitats are in moderate condition. There are areas of open water present around this PCT on the larger northern dam and several common waterbird species were observed, however habitat is limited by the high cover of *Salvinia molesta*. The dense *Typha orientalis* stand provides suitable habitat for small birds that frequent thick rush beds, though only the common Superb Fairy Wren was observed. The absence of extensive shallow edges or mudflats limits the habitat suitability for waders or other wetland bird species. The dense cover of *Typha orientalis* is suitable for a range of common frog species, with several heard calling including *Crinia signifera*, *Limnodynastes peronii* and *L. tasmaniensis*. It may also be suitable for the threatened Green and Golden Bell Frog (*Litoria aurea*). However, the habitat is not considered to be optimal and there are only three records of this species from the locality since 2000, all around Ropes Crossing and Tregear. The most recent of these records is from 2012 on Ropes Creek about eight kilometres north of the proposal site. Records have not been made at other former habitats in the locality since the 1970s so it is unlikely that this species remains in the ecological study area.

The Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) – Poor as it occurs in the ecological study area is shown in Photograph 5.

*Photograph 5: Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) – Low (photograph is of Plot 2 transect looking north west).*

**Figure 4-1 Plant community types**



## 4.3 Threatened ecological communities

Three TECs listed under the BC Act were identified in the ecological study area:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as critically endangered).
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered).
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered).

A brief description of each TEC is provided in **Table 4-2** and the distribution of TECs is mapped in **Figure 4-2**.

The Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) within the ecological study area mostly occurs because of artificial damming of the two drainage lines on the proposal site and one sediment basin next to Lenore Drive and are not a naturally occurring wetlands, except for a small area next to Ropes Creek. The two dams/wetlands are man-made, and a freshwater wetland may not have naturally occurred in these locations considering the ephemeral nature of the drainage lines. Artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management and farm production (such as the case with the PCT in the ecological study area), are not regarded as part of the Freshwater Wetlands on Coastal Floodplains TEC (NSW Scientific Committee, 2004). As such, the extent of this PCT in the two dams and sediment basin is not considered to form part of the Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC. However, the small area near Ropes Creek does meet the EEC definition considering the natural waterway likely contributed to its occurrence. This area is outside the proposal site and unlikely to be directly impacted.

Table 4-2 Threatened ecological communities present in the ecological study area

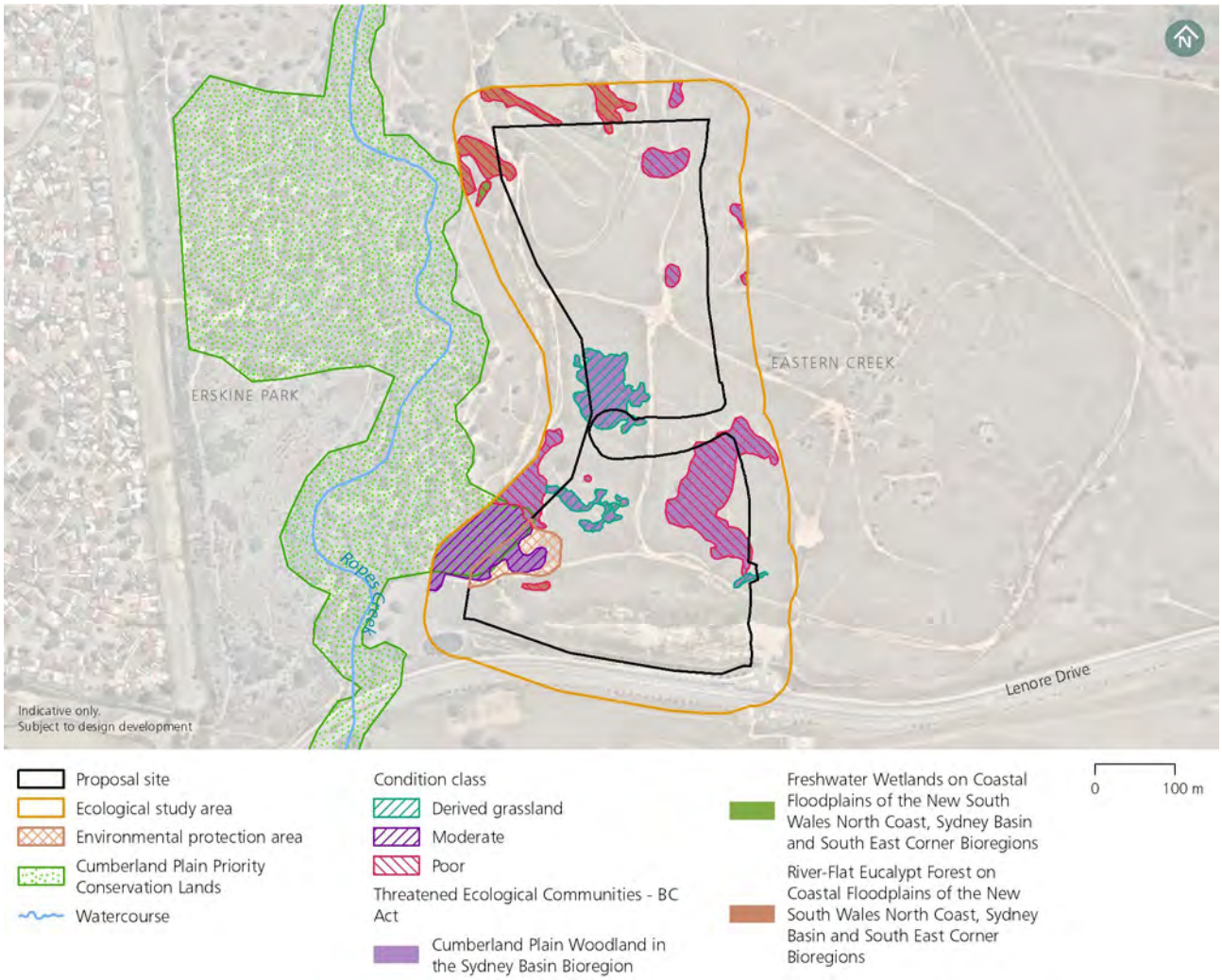
| Threatened ecological community | Listing advice description | Description of TEC in the ecological study area | Area in proposal site (ha)* | Area in ecological study area (ha) |
|---|---|---|---|---|
| Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered, BC Act) | Cumberland Plain Woodland is the name given to the ecological community in the Sydney Basin bioregion associated with clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates, on the Cumberland Plain.<br><br>Cumberland Plain Woodland is characterised by an upper-storey that is usually dominated by *Eucalyptus moluccana* and *Eucalyptus tereticornis*, often with *Eucalyptus crebra*, *Eucalyptus eugenioides*, *Corymbia maculata* or other less frequently occurring eucalypts, including *Angophora floribunda*, *Angophora subvelutina*, *Eucalyptus amplifolia* and *Eucalyptus fibrosa*. | Located on the Cumberland Plain in the Sydney Basin Bioregion on clay soils derived from Wianamatta Group geology. Occurs on proposal site as disturbed remnant around Ropes Creek, natural regeneration around isolated remnants and also derived gresslands dominated by Kangaroo Grass. Characterised by an upper-storey that is dominated by *Eucalyptus moluccana* and occasional *Eucalyptus tereticornis.*<br><br>The Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) PCT corresponds directly to this TEC. | 1.74 | 3.46 |

| Threatened ecological community | Listing advice description | Description of TEC in the ecological study area | Area in proposal site (ha)* | Area in ecological study area (ha) |
|---|---|---|---|---|
| River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered, BC Act) | River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains.<br><br>The composition of River-Flat Eucalypt Forest on Coastal Floodplains is primarily determined by the frequency and duration of waterlogging and the texture, nutrient and moisture content of the soil. It has a tall open tree layer of eucalypts and the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis, Eucalyptus amplifolia, Angophora floribunda* and *Angophora subvelutina*. A layer of small trees may be present, including *Melaleuca decora*, *Melaleuca styphelioides*, *Backhousia myrtifolia, Melia azaderach, Casuarina cunninghamiana* subsp. *cunninghamiana* and *Casuarina glauca*. | Located in the Sydney Basin Bioregion on clay-loam soils on a drainage line and dam and around Ropes Creek. It has a tree layer dominated by *Eucalyptus tereticornis* and *Angophora subvelutina,* with *Melaleuca stypheloides* and *Casuarina glauca* in adjacent areas.<br><br>The Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (835) PCT corresponds directly to this TEC. | 0.07 | 0.55 |
| Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered, BC Act) | Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands.<br><br>Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South | Located in the Sydney Basin Bioregion located in a natural drainage offshoot associated with Ropes Creek. Dominant species include *Typha orientalis* and *Carex appressa*. The wetland is outside the proposal site and not expected to be direcly impacted.<br><br>The Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion | 0 | 0.27 |

| Threatened ecological community | Listing advice description | Description of TEC in the ecological study area | Area in proposal site (ha)* | Area in ecological study area (ha) |
|---|---|---|---|---|
| | East Corner bioregions is dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime. Artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management and farm production, are not regarded as part of this community, although they may provide habitat for threatened species. | (1071) PCT corresponds to this TEC, except around artifical waterbodies (e.g. dams and basins). | | |

*Excludes environmental protection area

**Figure 4-2 Threatened ecological communities**



## 4.4 Groundwater dependent ecosystems

The level of groundwater dependence of vegetation communities in the ecological study area has been identified using the Atlas of Groundwater Dependent Ecosystems (GDEs) (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* released by the NSW DPI (Kuginis et al., 2012). The Atlas of GDEs (Bureau of Meteorology, 2017) identifies Ropes Creek riparian corridor as containing groundwater dependent terrestrial vegetation (phreatophytes) in the form of Cumberland Shale Plains Woodland (PCT 849). The ecological study area contains some of this vegetation in the south of the proposal site. There are no aquatic GDEs in the ecological study area or immediate surrounds and the ecological study area is not located within a floodplain alluvial groundwater source. The Atlas of GDEs dataset uses the same polygons as the *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (VIS_ID 2230) (State Government of NSW and Office of Environment and Heritage, 2010) and does not provide a fine scale map of GDEs so must be used as a guide only.

While PCT 849 and PCT 835 are considered with a high likelihood to be GDEs (Kuginis et al., 2012), these two PCTs are not obligate GDEs (i.e. they are not entirely dependent on groundwater). These PCTs are not restricted to locations of groundwater discharge and are not located within aquifers. These two PCTs are likely to be opportunistic facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function (Kuginis et al., 2012). The plants within these PCTs would use shallow soil water before seeking deeper soil water or groundwater. The trees may take up groundwater from the capillary fringe when necessary (e.g. during dry seasons or in extended drought). The drainage line within the ecological study area is a losing stream reach and is not a baseflow stream that would have vegetation highly dependent on groundwater.

PCT 1071 mostly occurs in the ecological study area as a consequence of agricultural activities (i.e. dams) and stormwater management works (i.e. sediment basin) and these are not naturally occurring wetlands. These wetlands are man-made and exist due to damming of a small catchment of rain and ponding of stormwater next to Lenore Drive. A freshwater wetland would not have naturally occurred in these locations. These occurrences of PCT 1071 in the ecological study area are rain fed and is not likely to be a GDE. A small area of ponded water in an offshoot of Ropes Creek may qualify as a GDE as discussed above.

## 4.5 Threatened species and populations

### 4.5.1 Threatened flora species

Twenty-five threatened flora species and one endangered population have been previously recorded or modelled as having potential to occur in the locality (see **Appendix B**). Many of these species favour habitats that are not represented in the ecological study area or are only known to exist in populations restricted to specific localities or are presumed extinct. Ten threatened flora species were initially considered moderately likely to occur within the ecological study area and targeted during the field survey of the proposal site.

One threatened flora species, *Grevillea juniperina* subsp. *juniperina* (vulnerable species: BC Act) was recorded outside of the proposal site, though in the ecological study area, during the field survey undertaken for the proposal. This species has been previously recorded at numerous locations along Ropes Creek and in the south west of the ecological study area as shown by the presence of BioNet Atlas records, of which there are 1095 records in the locality. *Grevillea juniperina* subsp. *juniperina* plants were identified at this location just outside of the ecological study area and along the southern bank of the larger dam in the north of the proposal site. Four individuals were identified within the ecological study area along the dam bank, outside of the proposal site (see Photo 6 and 7). Over 30 plants were also identified to the west of the ecological study area on the edge of Ropes Creek. Considering these observations, the Ropes Creek population size is likely quite high.

**Photo 6. *Grevillea juniperina* subsp. *juniperina* along the northern dam bank. Photo is facing west along the southern bank of the large dam.**

**Photo 7. *Grevillea juniperina* subsp. *juniperina* (close up of plant shown in Photo 6)**

Surveys undertaken for the Archbold Road Upgrade and Extension REF (WSP | Parsons Brinckerhoff 2017) identified *Pimelea curviflora* var. *curviflora* north of the ecological study area in woodland north and south of the Western Motorway around Archbold Road. This species was not identified during surveys for this assessment. *Pimelea curviflora* var. *curviflora* is known to occur on shale/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Although the vegetation type in the ecological study area is similar to where it has been identified to the north, the soil observed was heavy clay and around Ropes Creek is likely more alluvium influenced. Therefore, *Pimelea curviflora* var. *curviflora* is considered to have a low likelihood of occurring in ecological study area.

The highest quality habitat is in disturbed remnant woodland around Ropes Creek. A small section of moderate quality woodland extends into the south western part of the proposal site, which was targeted during surveys. Most of the ten species originally flagged for survey can be confidently assumed to be absent as they are easily identifiable, and the area of potential habitat is small. The habitats in the ecological study area are either not considered suitable (e.g. vegetation type, soil type, landscape position) or optimal for any of the remaining threatened flora species listed in Table B-1 in **Appendix B** due to the degraded nature of the vegetation, disturbance to the soil and dominance of exotic species. Overall, except for the *Grevillea juniperina* subsp. *juniperina* identified, the remaining locally recorded threatened flora species are considered to have a low likelihood of occurrence or are unlikely to occur on the proposal site (see Table B-1 in **Appendix B**).

### 4.5.2 Threatened fauna species

Based on regional records and the presence of suitable habitat, 65 threatened fauna species have been identified in the locality (see **Appendix B**) or have modelled habitat. This includes 14 mammals, 44 birds, three frogs, two invertebrates, and two fish. The ecological study area does not contain suitable habitat for some species listed in **Appendix B**. The habitats within the ecological study area are generally poor quality and do not possess the features required for many of the threatened species listed in **Appendix B** to complete their life cycles. No suitable habitat for threatened fish is present in the ecological study area.

**Cumberland Plain Land Snail**

The Cumberland Plain Land Snail (see Photo 8) was found in the ecological study area in Plot 1 during the surveys undertaken for the proposal (see **Figure 4-3**). This species was also identified at numerous locations to the north of the ecological study area during surveys undertaken for the Archbold Road Upgrade and Extension REF (WSP | Parsons Brinckerhoff 2017). This species requires a groundcover of thick and moist leaf litter and large woody debris for shelter and foraging. These habitat features are present in moderate quality woodland (PCT 849) in the south west of the ecological study area, however the rest of the vegetation on the proposal site is likely too disturbed and unsuitable for this species. There are numerous piles of dumped building and house-hold rubbish around the ecological study area that may provide sheltering habitat for this species (see Photo 9).

**Photo 8. Cumberland Plain Land Snail found in the south west of the ecological study area outside of the proposal site (refer to Figure 4-3 for location).**

**Photo 9. Dumped rubbish may provide sheltering habitat. Photo taken in the south east of the proposal site (refer to Figure 4-3 for location).**

**Green and Golden Bell Frog**

The dense cover of *Typha orientalis* in the dams and small offshoot drain from Ropes Creek is suitable for a range of common frog species and may also be suitable for the threatened Green and Golden Bell Frog. Four sites were identified within the ecological study area (refer Photos 10 to 13) as containing potential habitat and are discussed in **Table 4-3** in relation to some of the known habitat requirements of the species as reported by Pyke and White (1996):

- Site 1 – Larger northern dam
- Site 2 – Offshoot drain from Ropes Creek
- Site 3 – Smaller southern dam
- Site 4 – Small depression along unmapped drain in the south of the proposal site.

These four sites are shown in **Figure 4-3** and Photos 5-8. As discussed in **Table 4-3**, the four sites meet eight of the ten habitat requirements and are very similar in their habitat characteristics, differing mainly in size. In terms of available habitat, Site 1 is probably the best quality habitat for the Green and Golden Bell Frog in the ecological study area.

The distribution of the Green and Golden Bell Frog has become very disjunct in the Cumberland Plain region. There are just three records of this species from the locality since 2000, all around Ropes Crossing and Tregear. The most recent and viable of these records is from 2012 on Ropes Creek about eight kilometres north of the proposal site, which may be evidence that a low-density population is active in the locality. Targeted surveys were unsuccessful at identifying the Green and Golden Bell Frog for the Archbold Road Upgrade and Extension REF (WSP | Parsons Brinckerhoff 2017), which may have included the southern dam in the ecological study area (Site 3) though it is not clear what locations were surveyed. The key population at Mount Druitt was reported to have gone extinct in the late 1990s (Pyke and White 2001). The closest key population of Green and Golden Bell Frog is in Parramatta. Although these records and the current known location of populations suggest that the Green and Golden Bell Frog is not likely to occur in the ecological study area, this species is highly mobile and may possibly disperse as far as 10 kilometres (White & Pyke 2008). Therefore, Ropes Creek may provide a movement corridor for this species and hence it is considered moderately likely to occur in the habitats within the ecological study area.

Table 4-3 Habitat requirements of the Green and Golden Bell Frog (green cell = meets requirement)

| **Habitat requirement (Pyke and White 1996)** | **Site 1** | **Site 2** | **Site 3** | **Site 4** |
|---|---|---|---|---|
| Ephemeral or fluctuating water level, with still or slow-moving water | Large dam that does not flow and will fluctuate with rain and evaporation | Filled during sutiable rainfall when Ropes Creek overflows though mostly pooled | Small dam that does not flow and will fluctuate with rain and evaporation | Would flow during heavy rainfall though typically pooled water |
| Shallow water depth <50 cm | On edges yes, though likely much deeper in centre | Likely | On edges yes, though likely deeper in centre | Likely |
| No visible signs/sources of water pollution | None visible | None visible | None visible | None visible |
| Absence of shaded cover | Small amount of canopy cover from adjacent woodland though mostly unshaded | Small amount of canopy cover from adjacent woodland though mostly unshaded | No shaded cover | Small amount of canopy cover from adjacent woodland though mostly unshaded |
| *Crinia signifera* or *Limnodynastes peronii* present | Both present | *Crinia signifera* present | *Crinia signifera* present | *Crinia signifera* present |
| Absence of predatory fish (in particular *Gambusia* sp.) | *Gambusia holbrooki* observed | *Gambusia holbrooki* observed | *Gambusia holbrooki* observed | *Gambusia holbrooki* observed |
| Pond substrate is sand or rock | Substrate clay/silt | Substrate clay/silt | Substrate clay/silt | Substrate clay/silt |
| Presence of emergent aquatic vegetation or rocks for diurnal shelter | Northern end of dam contains *Typha orientalis*. Southern end in theproposal site is less vegetated | Moderate cover of *Typha orientalis* | Dense cover of *Typha orientalis* | Moderate cover of *Typha orientalis* |
| Adjacent to grassy area | Extensive areas of grass surrounding | Extensive areas of grass surrounding | Extensive areas of grass surrounding | Extensive areas of grass surrounding |

| Habitat requirement (Pyke and White 1996) | Site 1 | Site 2 | Site 3 | Site 4 |
|---|---|---|---|---|
| Adjacent vegetation is no higher than woodland | Low regenerating woodland surrounds two sides of dam | Ropes Creek vegetation tall woodland | No adjacent vegetation | Only several trees |

**Photo 10. Site 1 – Northern dam**

**Photo 11. Site 2 – Ropes Creek offshoot drainage line**

**Photo 12. Site 3 – Southern dam**

**Photo 13. Site 4 – Drain depression**

**Other threatened fauna**

The ecological study area also provides suitable habitat features for a range of threatened species that have been previously recorded in the locality (refer to **Figure 4-3**), including insectivorous bats, woodland birds, nectarivorous birds the Grey-headed Flying Fox and large predatory birds. All species considered at least moderately likely to occur in habitats within the proposal site are listed in **Table 4-4**.

Potential habitat is present for species of threatened insectivorous bat: Little Bent-winged Bat, Large Bent-winged Bat, Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle, Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat and the Southern Myotis (all listed as vulnerable under the BC Act). These species have been recorded widely from the locality and are likely to forage in the habitats. Tree hollows are moderately abundant in the large remnant trees in the ecological study area and may provide roosting opportunities for hollow-dependant species.

The Grey-headed Flying-fox (listed as vulnerable under the BC Act and EPBC Act) is considered moderately likely to forage in the trees within the ecological study area, particularly *Eucalyptus moluccana* and *Eucalyptus tereticornis*. No roost camps are present in the ecological study area but the bats from the Nationally Important Parramatta Park camp and/or the intermittent Ropes Creek camp are likely to forage in the ecological study area.

The Swift Parrot (listed as endangered under the BC Act and critically endangered EPBC Act) has been recorded in the locality (notably three records on Eastern Creek in 2019) and sporadically occurs in the urbanised areas of Western Sydney during winter. This species may pass through the ecological study area during movements between larger foraging habitats (e.g. from Prospect Nature Reserve to Whalan Reserve and Wianamatta Regional Park and Nature Reserve) where it may rest and forage. A range of hollow sizes are present in large remnant trees in the ecological study area and were observed being used by common parrot species. Although no significant areas of foraging habitat are present, the Swift Parrot is considered moderately likely to occur in the ecological study area on occasion. Likewise, the Little Lorikeet is also likely to use the trees in the ecological study area in a similar manner as foraging habitat. The Regent Honeyeater is also a sporadic visitor to the region, however the recorded sightings are very few with the last in 1995, therefore this species is deemed to have a low likelihood of occurring.

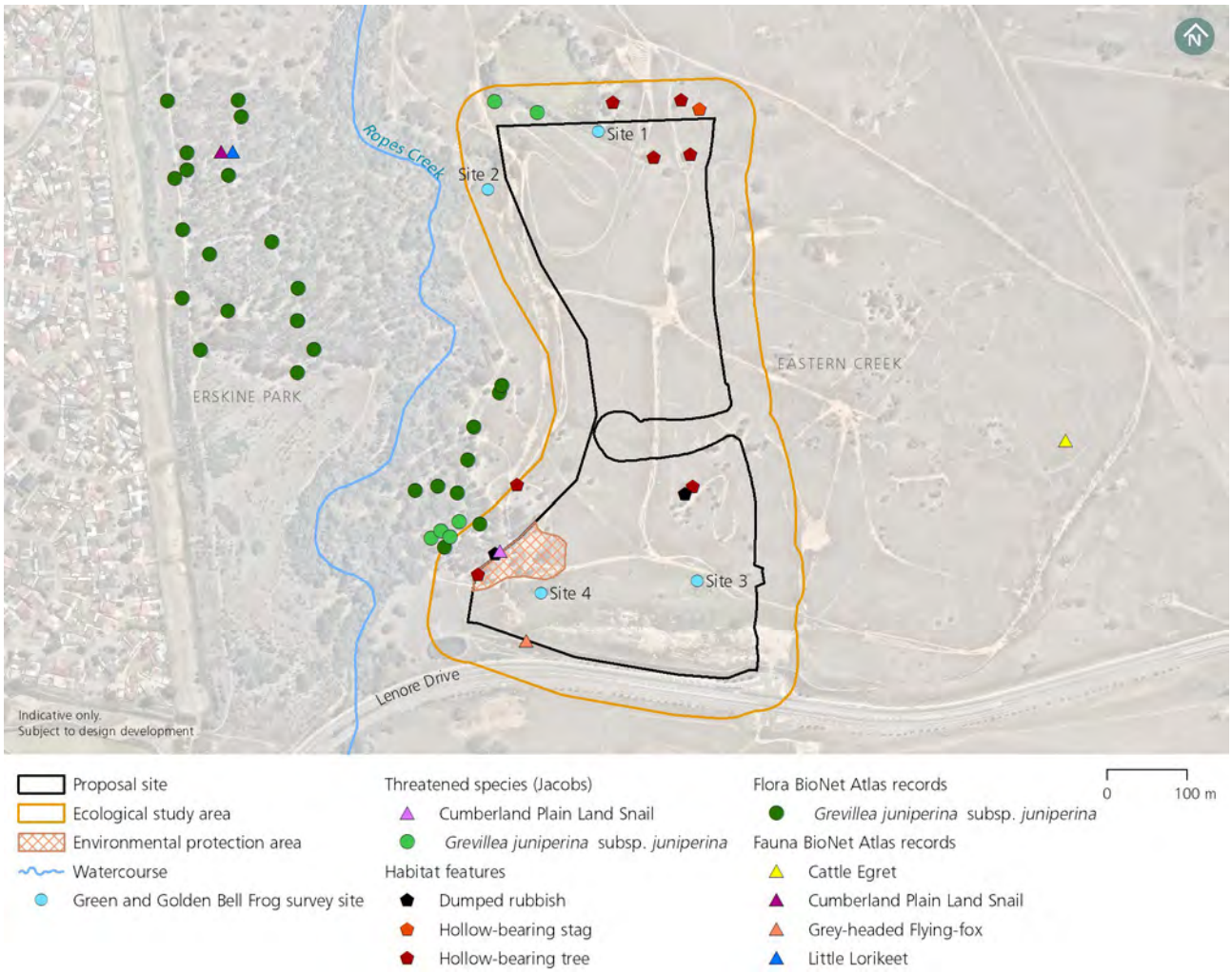
Other threatened birds including the Dusky Woodswallow, Varied Sittella, Little Eagle, Square-tailed Kite and Powerful Owl are known to utilise highly modified and partially-cleared habitats and are likely to pass through the ecological study area on occasion. No stick nests or large hollows were observed. The ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to occasional foraging use.

Table 4-4 Threatened fauna

| Species | BC Act | EPBC Act | Habitat in ecological study area (ha) | Habitat in proposal site (ha) |
|---|---|---|---|---|
| Cumberland Plain Land Snail (*Meridolum corneovirens*) | E | - | 0.89 | <0.001 |
| Green and Golden Bell Frog (*Litoria aurea*) | E | E | 0.44 (non-breeding habitat) | 0.11 (non-breeding habitat) |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | V | V | 3.1 (foraging habitat) | 1.2 (foraging habitat) |
| **Insectivorous bats (cave-roosting)** | | | | |
| Little Bent-winged Bat (*Miniopterus australis*) | V | - | 4.4 (foraging habitat) | 1.92 (foraging habitat) |
| Large Bent-winged Bat (*Miniopterus orianae oceanensis*) | V | - | | |
| Southern Myotis (*Myotis macropus*) | V | - | | |
| **Insectivorous bats (hollow-roosting)** | | | | |
| Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) | V | - | 4.4 (foraging habitat) and 8 hollow-bearing trees | 1.92 (foraging habitat) and 4 hollow-bearing trees |
| Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) | V | - | | |
| Greater Broad-nosed Bat (*Scoteanax rueppellii*) | V | - | | |
| Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) | V | - | | |
| **Woodland birds** | | | | |
| Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) | V | - | 3.1 (foraging habitat) | 1.2 (foraging habitat) |
| Varied Sittella (*Daphoenositta chrysoptera*) | V | - | | |

| Species | BC Act | EPBC Act | Habitat in ecological study area (ha) | Habitat in proposal site (ha) |
|---|---|---|---|---|
| **Nectarivorous birds** | | | | |
| Little Lorikeet (*Glossopsitta pusilla*) | V | - | 3.1 (foraging habitat) and 8 hollow-bearing trees | 1.2 (foraging habitat) and 4 hollow-bearing trees |
| Swift Parrot (*Lathamus discolor*) | E | CE | | |
| **Large predatory birds** | | | | |
| Little Eagle (*Hieraaetus morphnoides*) | V | - | 3.1 (foraging habitat) | 1.2 (foraging habitat) |
| Square-tailed Kite (*Lophoictinia isura*) | V | - | | |
| Powerful Owl (*Ninox strenua*) | V | - | | |
| Masked Owl (*Tyto novaehollandiae*) | V | - | | |

**Figure 4-3 Recorded threatened species**



### 4.5.3 Aquatic results

The proposal site lies within the Hawkesbury catchment area. The aquatic environment includes two artificial dams, the largest being located on a mapped unnamed first-order stream in the north of the ecological study area and the other on an unmapped drainage line in the south of the ecological study area. These drainage lines are likely naturally formed, though have been highly influenced over time by clearing of woodland vegetation and increasing run-off. Both drainage lines are highly ephemeral, only draining water from the immediate surrounds into Ropes Creek to the west of the proposal site. Ropes Creek is a third-order stream that flows generally north before reaching its confluence with South Creek in Ropes Crossing, which then flows into the Hawkesbury River. Ropes Creek is mapped as 'Key Fish Habitat' by the NSW DPI. A constructed sediment basin is also within the ecological study area in the south west of the proposal site, however it was not included in the aquatic habitat assessment as it is an artificial structure constructed for the purpose of stormwater management.

Two threatened species, the Macquarie Perch and Australian Grayling have been recorded within the Hawkesbury-Nepean Catchment; however, habitat for these species is not present within the ecological study area. The Australian Grayling inhabits clear, flowing waters. The habitat and water quality in the ecological study area is degraded and not suitable for this species. The ecological study area is also to the north of its known distribution. The Macquarie Perch is now considered isolated to the upper reaches of catchments and is not present in the ecological study area. The nearest known population is in Cataract Dam. The degraded waterways in the ecological study area are not suitable for this species.

Habitat quality was assessed at four locations in the ecological study area (see **Figure 4-4**), which includes the two dams along the two drainage lines, a small depression along the southern drainage line and a small offshoot drain beside Ropes Creek. An assessment of the aquatic habitat against the basic 'Class' system (Fairfull and Witheridge et al. 2003) is provided in **Table 4-5**.

Table 4-5 Fish habitat classification

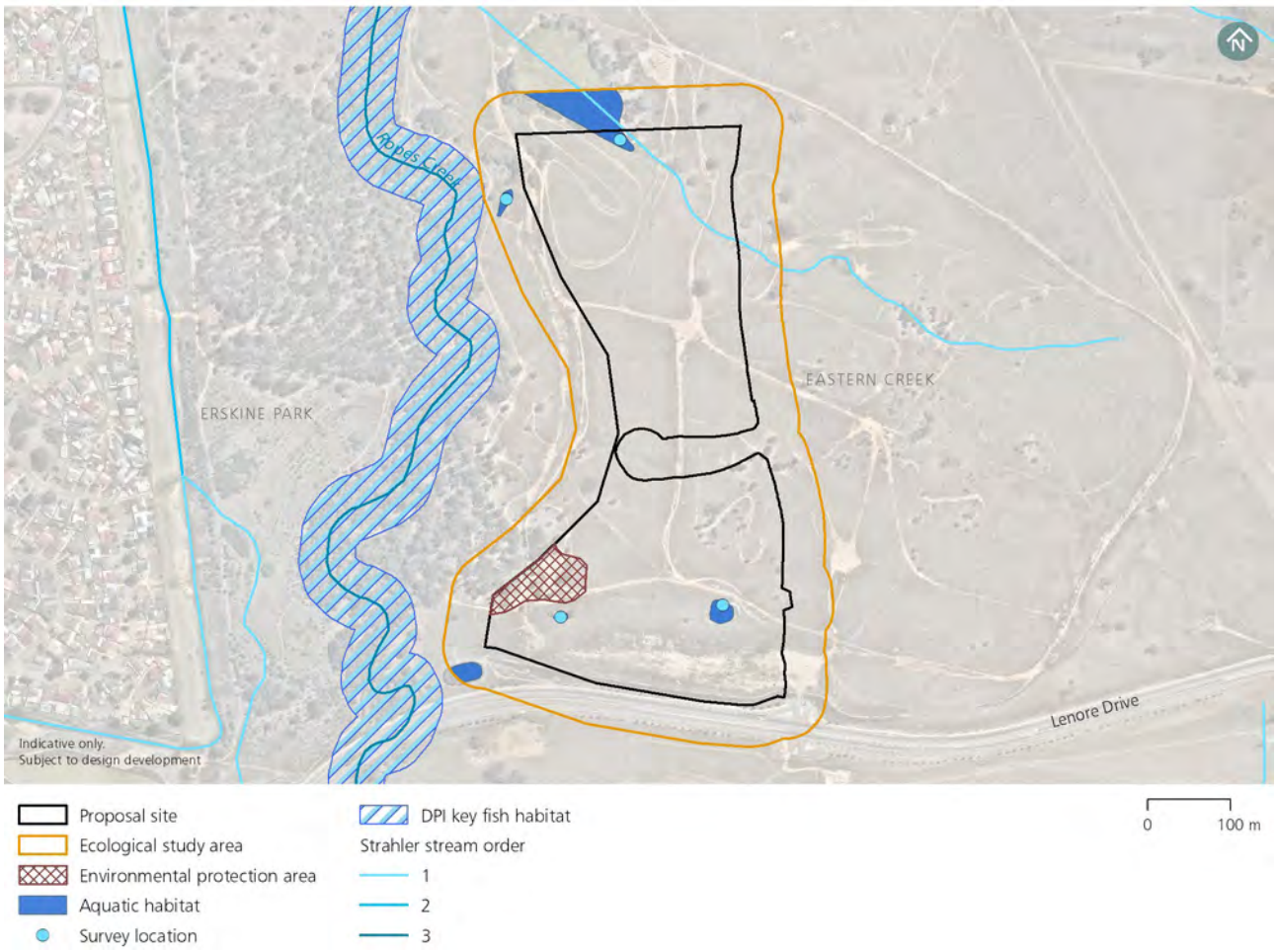
| Class | Characteristics | Habitat in the ecological study area |
|---|---|---|
| Class 1<br><br>Major fish habitat | Major permanently or intermittently flowing waterway (e.g. river or major creek); habitat of a threatened fish species. | Not present in the proposal site or ecological study area.<br><br>The closest Class 1 waterway to the ecological study area would be the Nepean River. |
| Class 2<br><br>Moderate fish habitat | Named permanent or intermittent stream, creek or waterway with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present. Known fish habitat and/or fish observed inhabiting the area. | Not present in the proposal site or ecological study area.<br><br>Ropes Creek (to the west of the ecological study area) qualifies as a Class 2 waterway. |
| Class 3<br><br>Minimal fish habitat | Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi- permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats. | Not present in the proposal site. Present at the offshoot drain from Ropes Creek within the ecological study area. This area contains a shallow ponded overflow from the creek with macrophyte and regrowth riparian vegetation. |
| Class 4<br><br>Unlikely fish habitat | Named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free-standing water or pools after rain events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present). | Present in the mapped unnamed first order stream in the north of the proposal site and the unmapped (likely first order stream) in the south of the proposal site. |

The ponded overflow from Ropes Creek is the best quality waterway in the ecological study area and likely to provide 'minimal fish habitat' (Class 3). This waterway is likely a result of land modification to build the large dam, however macrophyte and riparian vegetation has regenerated and there is a shallow area of ponded water that likely gets flushed during high flows of Ropes Creek. It may contain area of refuge, feeding and breeding for non-threatened fish species.

The mapped unnamed first order stream in the north of the proposal site and the unmapped (likely first order stream) in the south of the proposal site are considered to be 'unlikely fish habitat' (Class 4) as available habitat is really only represented by the dams. The drainage lines have no defined banks or channel and only flow under high rainfall. The dams may be occupied by common fish and invertebrate species though habitat for threatened species is unlikely.

There is a lack of permanent flow, weed proliferation, and evidence of physical disturbance. As such, the aquatic habitats in the ecological study area are considered to be in moderately to highly degraded condition. The drainage lines and dams do not have characteristics suitable for any of the threatened aquatic species known or predicted to occur in the locality as shown in Table B-2 in **Appendix B**.

**Figure 4-4 Aquatic survey results**



#### 4.5.4 Areas of Outstanding Biodiversity Value

Areas of Outstanding Biodiversity Value (AOBV) are listed under the BC Act as special areas with irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. This includes areas formerly declared as critical habitat under the *Threatened Species Conservation Act 1995*. Information about AOBV in New South Wales, including declarations and maps, can be found in the Register of Declared AOBV and Biodiversity Values Map. There are no AOBV within or near the ecological study area.

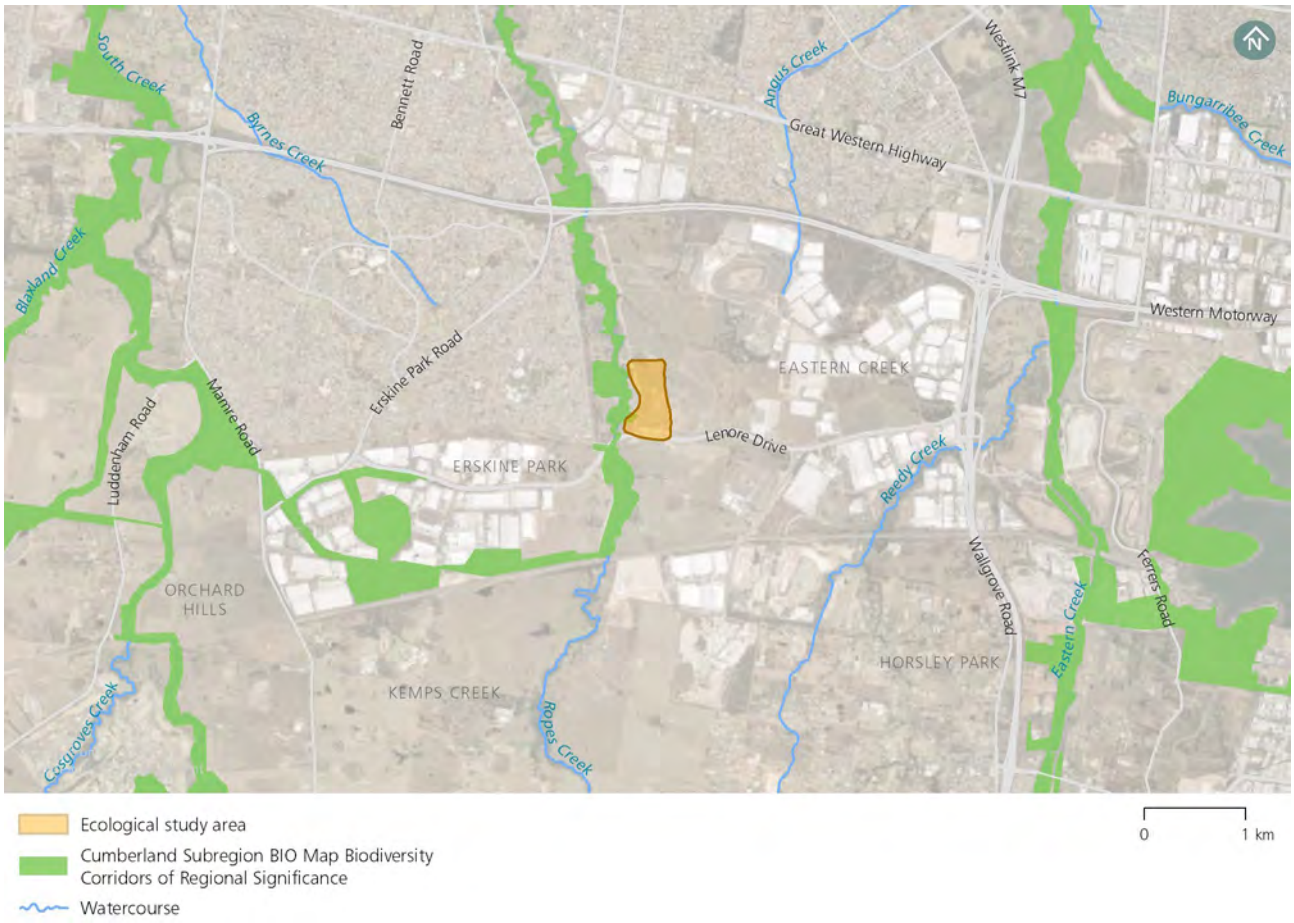
## 4.6 Wildlife connectivity corridors

Despite the barrier posed by the M4 Motorway, the habitats in the ecological study area retain some form of functional north-south connectivity along the Ropes Creek riparian corridor, which is mapped as a biodiversity corridor of regional significance (see **Figure 4-5**) as identified by the Biodiversity Investment Opportunities Map (BIO Map) (Office of Environment and Heritage 2015). Depending on the mobility of the species, some may be able to maintain connectivity to other riparian corridors to the east (Eastern Creek, Prospect Nature Reserve and Western Sydney Parklands) and to the west (South Creek). There is likely to be some movement of species and genetic material between the ecological study area and these adjacent habitats.

The barriers posed by the M4 Motorway and the generally cleared landscape serve to restrict fauna movements between the habitat patches for most terrestrial and arboreal species. However, the permeability of landscapes for different fauna species varies and habitat connectivity for more mobile species (e.g. birds, flying-foxes, insectivorous bats, insects, plants) remains. The connectivity for sedentary species and smaller species such as the Cumberland Plain Land Snail, frogs and reptiles is likely to be minimal. The Green and Golden Bell Frog is highly mobile and may possibly disperse as far as 10 kilometres (White & Pyke 2008) using the Ropes Creek corridor.

The roadways and urban areas do not totally prevent fauna movement between habitat fragments. Fauna can, and likely do, cross the road and disturbed areas of habitat but would do so less frequently than in natural habitats and would be at greater risk of mortality during movements. It is likely that highly mobile animals move between the ecological study area and habitats to the east and west by the estimated movement corridor shown in **Figure 4-5**. It is also likely that plant pollinators and seed dispersers move pollen and seed (or other vegetative reproductive material) between the ecological study area and adjacent habitats. The M4 Motorway contains vegetated areas along its margins that may allow movement for some highly mobile species. Functional connectivity for many species would exist between the ecological study area and habitats to the east and west despite the level of fragmentation that has occurred across the landscape.

Figure 4-5 Wildlife connectivity corridors



## 4.7 Matters of National Environmental Significance

### 4.7.1 Threatened ecological communities

One TEC as listed under the EPBC Act was identified within the ecological study area during the field survey undertaken for the proposal: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, listed as a critically endangered ecological community (CEEC).

The critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community corresponds to the Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849). However, the *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest listing advice* (Threatened Species Scientific Committee, 2009) outlines condition thresholds that vegetation must meet in order to be included in the EPBC Act listed community.

The vegetation within the ecological study area was analysed against this condition criteria, using the diagnostic flowchart provided in *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest: A guide to identifying and protecting the nationally threatened ecological community* (Department of the Environment, Water, Heritage and the Arts 2010) (refer to **Figure 4-6**).

Most of the occurrence of PCT 849 in the ecological study area is isolated small patches in poor condition, which includes some large remnant *Eucalyptus tereticornis* trees with natural canopy regeneration around the base. Most of these patches are less than 0.5 hectares in size and therefore do not qualify as the CEEC listing. However, there are two patches of poor condition 849 in the ecological study area that do meet this size criteria (see Plots 5 and 6 in **Figure 4-7**). These two patches answer yes to some of the criteria questions, though suffer from high cover of exotic grasses (primarily *Paspalum dilatatum*, *Setaria parviflora* and *Eragrostis curvula*) and therefore have less than 30 percent native perennial understorey, which does not meet the CEEC condition criteria for listing. Confidence in the recorded cover of native grasses at each plot is high, as up to eight species were identified in flower due to the suitable climatic conditions preceding the survey. Additionally, a previous assessment of vegetation against the condition criteria in the east of the ecological study area around Plot 5 as part of the Archbold Road Upgrade and Extension REF (WSP | Parsons Brinckerhoff 2017), found this patch also did not meet the condition threshold.

Areas of grassland dominated by *Themeda triandra* were also assessed against the listing criteria. The listing advice (Threatened Species Scientific Committee, 2009) states that "*Derived grasslands and shrublands are not included in the EPBC-listed ecological community, but if they are contiguous with the ecological community they may be considered under Condition category C in Table 1*". The southern patch of derived grassland (see Plot 2 in **Figure 4-7**) is immediately disqualified from listing as it is less than 0.5 hectares in size. The northern patch (see Plot 7 in **Figure 4-7**) does meet the size (≥0.5 hectares) and native understorey cover (≥30 percent) criteria, however it is separated from the poor condition patch by around 40 metres, which is less than five hectares in size and also does not meet the definition of a native vegetation remnant (i.e. any native vegetation where cover in each layer present is dominated by native species). Therefore, the derived grasslands in the ecological study area do not meet the CEEC condition criteria for listing.

The only area that qualified as the CEEC is the moderate condition vegetation that is contiguous with the Ropes Creek riparian corridor, as the patch size is greater than 5 hectares and greater than 30 percent of the perennial understorey cover is made up of native species (see Table A-1 in **Appendix A** for covers recorded in Plot 1).

There is around 0.89 hectares of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community within the ecological study area and <0.001 hectares within the proposal site (refer **Figure 4-7**).

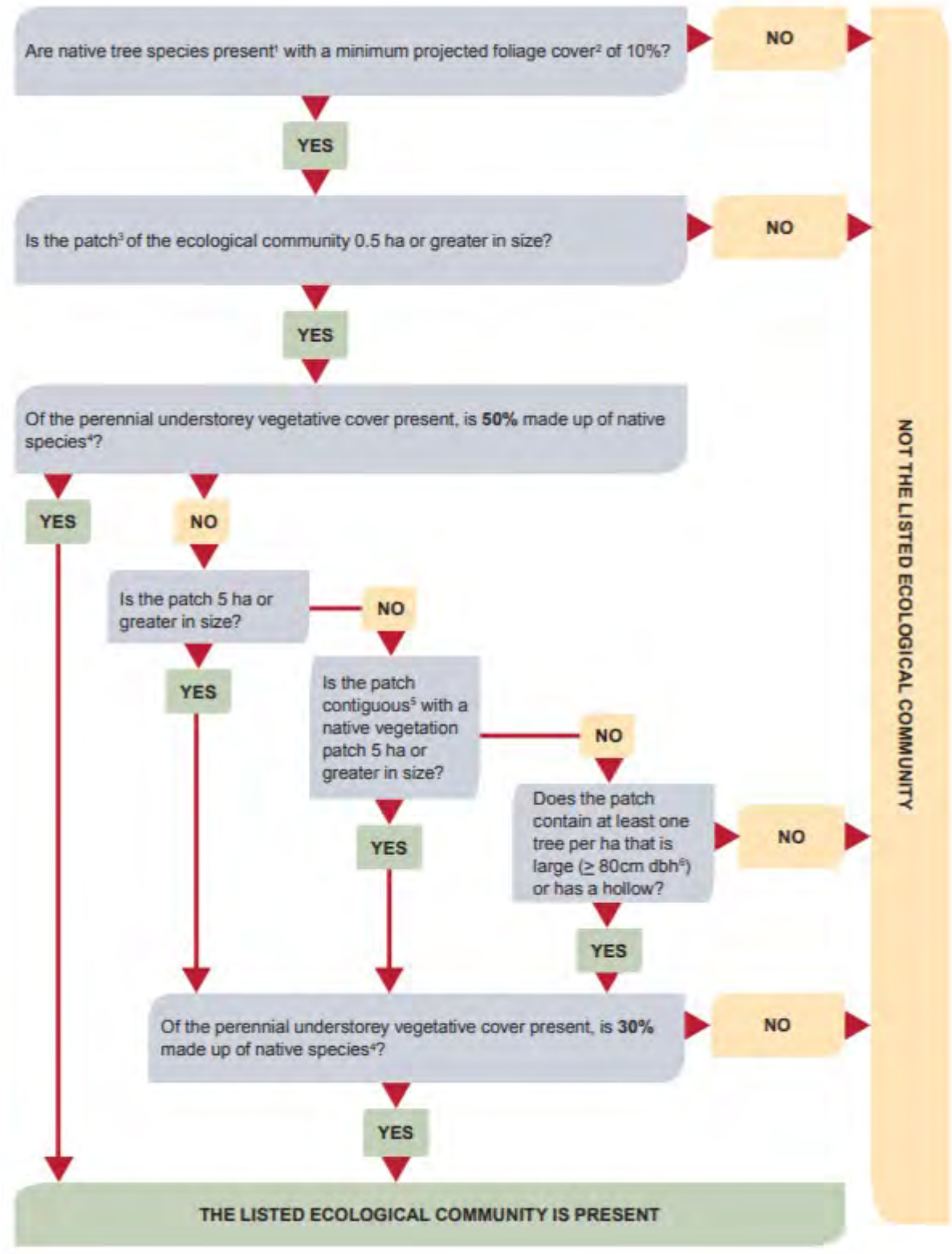



Figure 4-6 Flowchart of key diagnostic features and condition thresholds to identify the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. Figure taken from Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

### 4.7.2 Threatened species

Three threatened animal species listed under the EPBC Act are considered moderately likely to use the habitats in the ecological study area for foraging; the Green and Golden Bell Frog (listed as endangered), the Swift Parrot (listed as critically endangered) and the Grey-headed Flying-fox (listed as vulnerable). No threatened plants listed under the EPBC Act are considered to have a moderate or higher likelihood of occurring.

The dense cover of *Typha orientalis* in the dams and small offshoot drain from Ropes Creek may be suitable for the Green and Golden Bell Frog (refer **Section 4.5.2** for discussion). Although there are very few recent records of this species in the locality and no known populations, there is potential for the Green and Golden Bell Frog to disperse along the Ropes Creek riparian corridor close to the proposal site. Therefore, considering the presence of potential habitat and high mobility of this species, the Green and Golden Bell Frog is moderately likely to occur in the habitats in the ecological study area.

The Grey-headed Flying-fox (listed as vulnerable under the BC Act and EPBC Act) is considered moderately likely to forage in the trees within the ecological study area, particularly *Eucalyptus moluccana* and *Eucalyptus tereticornis*. No roost camps are present in the ecological study area but the bats from the Nationally Important Parramatta Park camp and/or the intermittent Ropes Creek camp are likely to forage in the ecological study area.

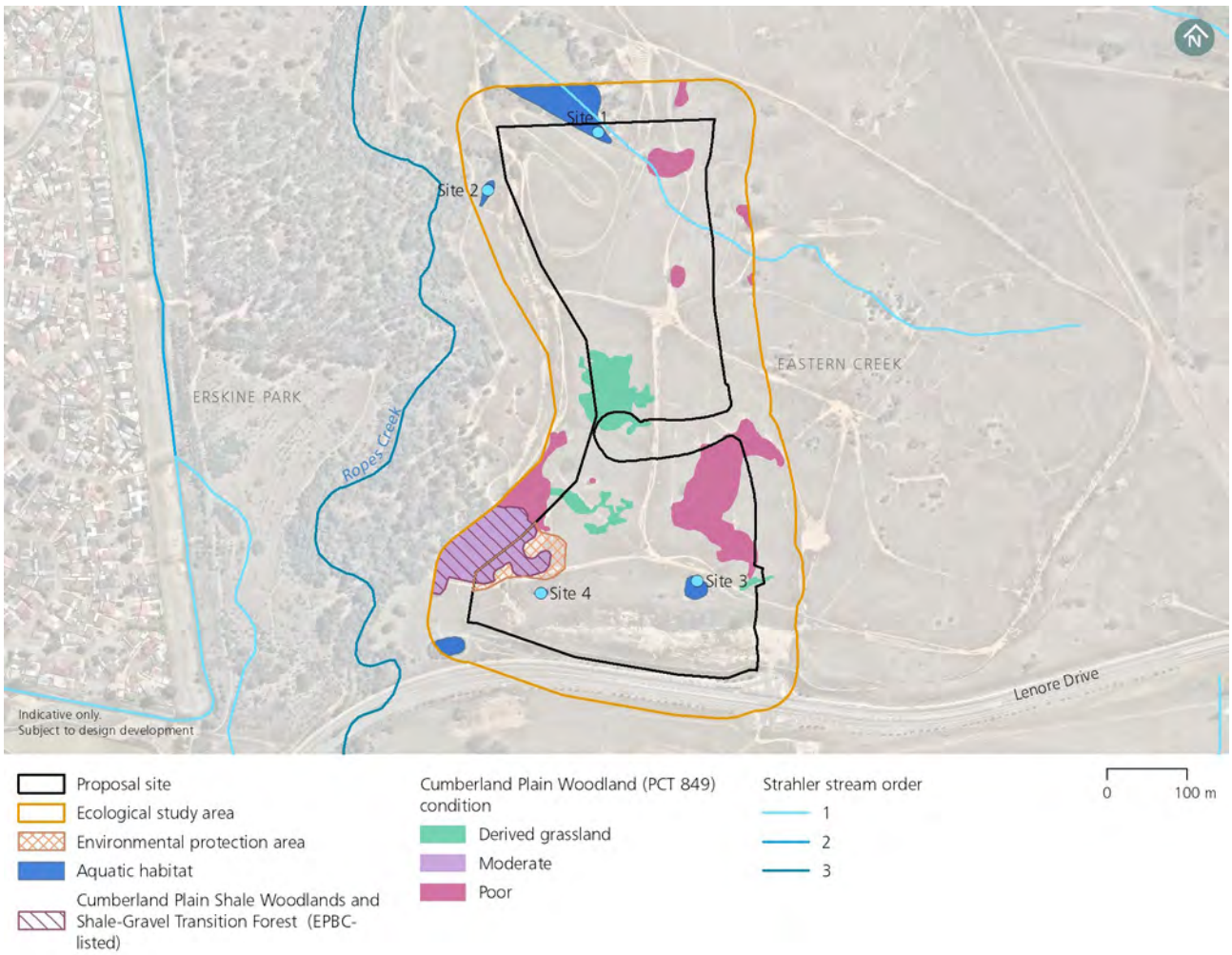
The Swift Parrot (listed as endangered under the BC Act and critically endangered EPBC Act) has been recorded in the locality (notably three records on Eastern Creek in 2019) and sporadically occurs in the urbanised areas of Western Sydney during winter. This species may pass through the ecological study area during movements between larger foraging habitats (e.g. from Prospect Nature Reserve to Whalan Reserve and Wianamatta Regional Park and Nature Reserve) where it may rest and forage. Although no significant areas of foraging habitat are present, the Swift Parrot is considered moderately likely to occur in the ecological study area on occasion.

### 4.7.3 Migratory species

Seventeen migratory bird species were identified in the EPBC Act Protected Matters Search Tool as potentially occurring in the locality based on the distributional range of the species and modelled habitat. These migratory species, along with their preferred habitat requirements and an assessment of their likely presence in the ecological study area are listed in Table B-2 in **Appendix B**. Only the Fork-tailed Swift and White-throated Needletail are considered moderately likely to fly over the ecological study area but would not use it as habitat.

While some migratory species of bird are likely use the ecological study area and locality, the ecological study area would not be classed as an 'important habitat'. A nationally significant proportion of the population would not be supported by the ecological study area, as the habitats are not large enough or high enough quality. Therefore, the proposal would not substantially modify, destroy or isolate an area of important habitat for the migratory species and it would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds and does not require further assessment.

**Figure 4-7 Matters of National Environmental Significance**



# 5. Construction assessment

The likely direct and indirect impacts of the construction of the proposal on biodiversity are summarised in this chapter. Direct impacts have been calculated using the boundary of the proposal site as the extent of construction, excluding the environmental protection area in the south west of the proposal site. The potential for indirect impacts on biodiversity values is considered low given that much of the ecological study area is highly fragmented, subject to strong edge effects, and surrounded by existing roads and barriers. However, in accordance with best-practice guidelines for assessing indirect impacts, as outlined in the BAM Operational Manual – Stage 2, a 50-metre buffer around the proposal site has been considered.

## 5.1 Key assumptions

Key assumptions of the construction assessment include:

- All vegetation within the proposal site boundary would be cleared (with the exception of the environmental protection area in the south west of the proposal site).
- There would be no direct impacts during construction outside of the proposal site boundary.
- An environmental protection area in the south western portion of the proposal site would be established to minimise impact on Cumberland Plain Woodland in the Sydney Basin Bioregion.

## 5.2 Removal of native vegetation

The proposal would have direct impacts on a range of biodiversity values during construction. Under the current design (the proposal site boundary), the estimated clearing of PCTs is about 1.92 hectares consisting of the PCTs listed in **Table 5-1**.

Table 5-1 Impacts to PCTs

| Vegetation Zone Number | Plant Community Type (PCT) | Condition | Area in proposal site (ha)* |
|---|---|---|---|
| 1 | Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) | Moderate | <0.001 |
| 2 | | Poor | 1.13 |
| 3 | | Derived Grassland | 0.61 |
| 4 | Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) | Poor | 0.07 |
| 5 | Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) | Poor | 0.11 |
| | | Total | 1.92 |

*Excludes environmental protection zone

The local occurrence of each PCT is defined as the area of the PCT that occurs within the ecological study area and adjacent areas that form part of a larger contiguous area of the PCT, in which movement of individuals and exchange of genetic material across the boundary of the ecological study area can be clearly demonstrated. Much of the native vegetation within the ecological study area is quite fragmented in nature, though is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence.

Although the PCTs in these areas are separated from the riparian corridor by a distance that does not qualify as a contiguous patch, they are considered to be connected and part of the local occurrence. Movement of individuals and exchange of genetic material from the vegetation in the ecological study area to and from vegetation along the Ropes Creek corridor can be expected.

Some of the PCTs listed in **Table 5-2** correspond to TEC listed under the BC Act and EPBC Act. Specifically, the proposal would result in the removal of around 1.74 hectares of the Cumberland Plain Woodland in the Sydney Basin Bioregion TEC (listed as critically endangered under the BC Act) and 0.07 hectares of the River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC (listed as endangered under the BC Act).

Moderate quality vegetation associated with PCT 849 meets the listing criteria for the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community, listed under the EPBC Act. An impact of <0.001 hectares has been calculated, however it is likely that this would be avoided, and the actual impact would be limited to potential indirect edge effects on retained vegetation.

The proposal sites also includes approximately 0.002 hectares (20 square metres) of planted native vegetation along Lenore Drive and approximately 0.08 hectares (800 square metres) of exotic vegetation. The remaining impacted areas consist of exotic grassland.

Table 5-2 Impacts on native vegetation

| Plant community type (PCT) | Condition class | BC Act | EPBC Act | Direct impact[1] (hectares) | Percent cleared in Catchment Management Authority (CMA)[2] |
|---|---|---|---|---|---|
| Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) | Moderate | CE | CE | <0.001 | 93 |
| | Poor | CE | - | 1.13 | |
| | Derived grassland | CE | - | 0.61 | |
| | | | Sub-total | 1.74 ha | |
| Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (835) | Poor | E | - | 0.07 | 93 |
| Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (1071) | Poor | - | - | 0.11 | 75 |
| | | | **Total** | **1.92 ha** | - |

1- Area to be cleared based on ground-truthed vegetation mapping. Excludes environmental protection zone
2- Based on the BioNet Vegetation Classification database.

## 5.3 Removal of threatened species and habitat

The extent of native vegetation clearing estimated to result from the proposal is outlined above in **Section 5.2**. This vegetation, with the addition of planted trees, provides suitable habitat for a range of threatened fauna species listed under the BC Act and EPBC Act. As such, direct impacts through loss of habitat for threatened fauna species (although it is only moderate to poor quality) would occur during construction.

Threatened plant species *Grevillea juniperina* subsp. *juniperina* would not be directly impacted, however 0.06 hectares of potential habitat for this species would be removed.

The direct impacts of the proposal to threatened plant species and habitats for threatened fauna have been estimated based on the current design. A breakdown of the direct impacts to habitat for threatened fauna species is provided in **Table 5-3**.

Table 5-3 Impacts on threatened species and fauna habitat (V = Vulnerable species, E = Endangered species)

| Species | BC Act | EPBC Act | Impact |
|---|---|---|---|
| *Grevillea juniperina* subsp. *juniperina* | V | - | 0.06 ha of potential habitat. No direct impact to individual plants |
| Cumberland Plain Land Snail (*Meridolum corneovirens*) | E | - | <0.001 ha |
| Green and Golden Bell Frog (Litoria aurea) | E | E | 0.11 ha (potential non-breeding habitat) |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | V | V | 1.2 ha (foraging habitat) |
| **Insectivorous bats (cave-roosting)** | | | |
| Little Bent-winged Bat (*Miniopterus australis*) | V | - | 1.92 ha (foraging habitat) |
| Large Bent-winged Bat (*Miniopterus orianae oceanensis*) | V | - | |
| Southern Myotis (*Myotis macropus*) | V | - | |
| **Insectivorous bats (hollow-roosting)** | | | |
| Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) | V | - | 1.92 ha (foraging habitat) and 4 hollow-bearing trees |
| Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) | V | - | |
| Greater Broad-nosed Bat (*Scoteanax rueppellii*) | V | - | |
| Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) | V | - | |
| **Woodland birds** | | | |
| Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) | V | - | 1.2 ha (foraging habitat) |
| Varied Sittella (*Daphoenositta chrysoptera*) | V | - | |
| **Nectarivorous birds** | | | |
| Little Lorikeet (*Glossopsitta pusilla*) | V | - | 1.2 ha (foraging habitat) and 4 hollow-bearing trees |
| Swift Parrot (*Lathamus discolor*) | E | CE | |
| **Large predatory birds** | | | |
| Little Eagle (*Hieraaetus morphnoides*) | V | - | 1.2 ha (foraging habitat) |
| Square-tailed Kite (*Lophoictinia isura*) | V | - | |
| Powerful Owl (*Ninox strenua*) | V | - | |
| Masked Owl (*Tyto novaehollandiae*) | V | - | |

## 5.4 Aquatic impacts

The aquatic habitat to be affected by the proposal is in poor condition due to previous development and agricultural activity within the catchment which has resulted in changes to hydrological conditions, increased input of nutrients, sedimentation and weed invasion. As shown in **Appendix B**, no threatened species listed under the FM Act are likely to occur in these streams due to their poor condition and lack of characteristic habitat features associated with threatened species.

As discussed in **Section 4.5.3** the aquatic environment includes two artificial dams, the largest being located on a mapped unnamed first-order stream in the north of the ecological study area and the other on an unmapped drainage line in the south of the ecological study area. These drainage lines are likely naturally formed, though have been highly influenced over time by clearing of woodland vegetation and increasing run-off. Both drainage lines are highly ephemeral, only draining water from the immediate surrounds into Ropes Creek to the west of the proposal site. They meet the description for Class 4 (unlikely fish habitat), with a small overflow from Ropes Creek meeting the description for Class 3 (minimal key fish habitat). Ropes Creek is mapped as 'Key Fish Habitat' by the NSW Department of Primary Industries, which is outside of the proposal site. As such, there would be no impacts to sensitive or key fish habitats.

Impacts to aquatic habitat would be of low magnitude and standard mitigation measures would be implemented to limit impacts to surrounding habitats (see **Section 8.2**).

## 5.5 Injury and mortality

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur. The extent of this impact would be proportionate to the extent of vegetation that is cleared. Less mobile species (e.g. ground dwelling reptiles), or those that are nocturnal and nest or roost in trees during the day (e.g. arboreal mammals and microchiropteran bat species), may find it difficult to rapidly move away from the clearing when disturbed. The ecological study area is only likely to contain a limited number of arboreal species (e.g. possums) and nesting birds that may be injured or killed during vegetation removal. Reptiles, frogs and invertebrates may also be injured or killed during construction as habitat is cleared.

Entrapment of wildlife in any trenches or pits that are dug is a possibility if the trenches are deep and steep sided. Wildlife may also become trapped in or may choose to shelter in machinery that is stored in the ecological study area overnight. If these animals were to remain inside the machinery, or under the wheels or tracks, they may be injured or may die once the machinery is in use.

There is a chance of fauna mortality occurring during the construction phase of the proposal through vehicle collision (i.e. roadkill). Vehicle collision is a direct impact that reduces local population numbers. Mammals, reptiles, amphibians and birds are all at risk of vehicle strike. As there are no definitive data on current rates of roadkill or fauna population densities in the ecological study area, the consequences of vehicle strike on local populations is unknown. Considering the nature of the proposal, there is not expected to be a large increase in vehicle traffic, however there would be some increase in vehicle traffic going in and out of the proposal site. A temporary haul road would be established for proposal site access prior to completion of Archbold Road works. Construction traffic would utilise the temporary haul road until the permanent road is constructed. The proposal would therefore contribute traffic on land that does not currently have any traffic. The significance of such an impact on fauna cannot be predicted. The impact on threatened species however is expected to be minimal. Based on evidence from other roadways in the locality most vehicle strike impacts can be expected to occur to common mammals such as birds and possums and exotic animals including foxes.

Security fencing would be erected around the perimeter of the proposal site during construction. Barbed wire (if used) can entangle nocturnal flying species, however considering the fencing would not be located close to foraging habitats then the potential of this impact is considered to be low.

Mitigation measures designed to reduce any injury and mortality of fauna are provided in **Section 8.2**.

## 5.6 Indirect impacts

### 5.6.1 Wildlife connectivity and habitat fragmentation

Habitat fragmentation *per se* relates to the physical dividing up of once continuous habitats into separate smaller 'fragments' (Fahrig, 2002). The habitats within the ecological study area are fragments that have formed since the initial habitat clearing that has occurred, regenerating into patches around large remnant trees. The current alignment of the Great Western Highway and M4 Motorway fragments connectivity to the north, and the ecological study area was further isolated around 2012 when Lenore Drive was built. Additionally, the upgrade and extension to Archbold Road east of the ecological study area will eventually create another road barrier to east-west movement. It is assumed that the first stage of the Archbold Road extension (i.e. connection from Lenore Drive to the proposal site) would be constructed concurrently with this proposal, with the rest of the extension to be completed in the future.

The barriers posed by the Great Western Highway and Lenore Drive serve to restrict most wildlife movements between the habitat patches. However, functional habitat connectivity for more mobile species (e.g. birds, flying-foxes, insectivorous bats, insects, plants) is still present via vegetated riparian corridors and roadside vegetation (refer **Figure 4-5**). The current roadways do not totally prevent fauna movement between habitat fragments (fauna can and likely do cross the road) but the roads do create a considerable hazard.

The proposal would not break apart continuous habitats into separate smaller 'fragments'. The proposal would however result in an increase in isolation of habitats as all the vegetation on the proposal site would be removed (with the exception of moderate quality woodland located in the environmental protection area in the south-west of the site that would be retained), which would increase the physical distance between habitat fragments. The isolation that may be caused by the proposal is not likely to have an appreciable impact on nomadic or migratory species such as birds and bats. The proposal is likely to be detrimental to the dispersal of arboreal mammals and other species including frogs and reptiles, but the effects would only be marginally greater than that which is already experienced due to the current cleared nature of the ecological study area. Additionally, planned perimeter fencing around the construction site is unlikely to impact movement of ground animals as the proposal site does not currently provide a high level of connectivity.

The predicted level of isolation from the proposal is not likely to be enough to prevent the breeding and dispersal of plant pollinators or the dispersal of plant propagules (i.e. seed or other vegetative reproductive material) between habitat patches. Functional connectivity for many species would remain in the ecological study area. However, local division of some wildlife populations, isolation of key habitat resources, loss of genetic interchange, and loss of population viability for some species may result.

This impact would be of low magnitude and mitigation measures are not deemed necessary.

### 5.6.2 Edge effects on adjacent native vegetation and habitat

The proposal would be built in an area that is currently subject to a high level of edge effects (changes to ecosystem functioning that occur as a result of sudden and artificial edges, e.g. increased light) from the existing roadways, previous agricultural land use practices and urban development. The vegetation patches are suffering from intense weed invasion and the habitats that would be impacted by the proposal are edge habitats without any undisturbed core. The highest quality vegetation in the ecological study area is on the very edge of a large contiguous riparian corridor around Ropes Creek, which is affected by weed invasion and rubbish throughout. Illegal public access to the proposal site has resulted in recreational motorbike and four-wheel-drive activity and significant rubbish dumping in this vegetation. There is unlikely to be any further impacts from edge effects resulting from the proposal as all vegetation is suffering from edge effects in the form of weed invasion, increased light levels, increased wind speeds, and greater temperature fluctuations. No new edge habitats would be created as the ecological study area does not possess large core areas of undisturbed habitat.

This impact would be of low magnitude and mitigation measures are not deemed necessary.

### 5.6.3 Invasion and spread of weeds

Native vegetation in the ecological study area is currently subject to invasion by exotic perennial grasses (notably *Eragrostis curvula*, *Paspalum dilatatum* and *Setaria parviflora*), which is recognised as a Key Threatening Process by the BC Act. Proliferation of weed and pest species is an indirect impact (i.e. not a direct result of proposal activities). Without mitigation, proliferation of weeds is likely to occur during construction, although impacts would be greatest due to vegetation clearing during the construction phase. Clearing activities may also exacerbate the key threatening process in less disturbed vegetation to the west of the proposal site. The most likely causes of weed dispersal and importation associated with the proposal include earthworks, movement of soil, and attachment of seed (and other propagules) to vehicles and machinery during all phases. Disturbance of native vegetation patch edges may also influence weed proliferation (see **Section 5.6.2**). The ecological study area contains significant weed growth and no undisturbed weed free habitat exists. As such, weeds must be managed during construction.

Mitigation measures to limit the spread and germination of weeds are provided in **Section 8.2**.

### 5.6.4 Invasion and spread of pests

The ecological study area and locality are likely occupied by a range of pest species including the European Red Fox, Rabbit and Black Rat. The Eastern Gambusia was observed in the waterbodies in the ecological study area. Proposal activities have the potential to disperse pest species out of the proposal site across the surrounding landscape (particularly dewatering the dams) but the magnitude of this impact would be low (i.e. the Eastern Gambusia was identified across the entire ecological study area, including in Ropes Creek) and mitigation measures are not deemed necessary.

### 5.6.5 Invasion and spread of pathogens and disease

Several pathogens known from NSW have potential to impact on biodiversity as a result of their movement and infection during construction. Of these, three are listed as a key threatening process under either the EPBC Act and/or BC Act including:

- Dieback caused by Phytophthora (Root Rot; EPBC Act and BC Act)
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and BC Act)
- Introduction and establishment of exotic Rust Fungi of the order Pucciniales on plants of the family Myrtaceae (BC Act).

While these pathogens were not observed or tested for in the ecological study area the potential for pathogens to occur should be treated as a risk during construction. The most likely causes of pathogen dispersal and importation associated with the proposal include earthworks, movement of soil, and attachment of plant matter to vehicles and machinery during all proposal phases (construction and operation). Pathogens would be managed within the proposal site in accordance with the *Biosecurity Act 2015*.

### 5.6.6 Noise and vibration, dust and contaminated pollution

Noise, vibration, dust, light and contaminant pollution are temporary impacts that are likely to result from proposal activities. These impacts are likely to have cumulative effects. Noise, vibration, dust, light and contaminant pollution are likely to occur during the construction of the proposal from all proposal activities, although impacts to biodiversity would be greatest where activities take place near vegetated areas (i.e. along Ropes Creek).

Edge effects can create changes in a population or a community structure that occur at the boundary of differing habitats. Using a 50-metre edge effect buffer around the proposal site, these impacts of noise, vibration, dust and contaminated pollution may result in the modification of about 2.22 hectares of native vegetation that would remain at the edge of the proposal once construction is complete (refer **Figure 4-1**). However much of this vegetation is already disturbed and modified, and the impacts of increased noise, vibration, dust and contaminated pollution is likely to be negligible.

**Noise and vibration pollution**

Anthropogenic noise can alter the behaviour of animals or interfere with their normal functioning (Bowles 1997). During the construction of the proposal there would be increased noise and vibration levels in the ecological study area and immediate surrounds due to vegetation clearing, ground disturbance, machinery and vehicle movements, and general human presence. The predicted noise and vibration created by project is outlined in Chapter 8.1 of the REF.

Construction of the proposal would be scheduled to the following standard working hours, namely:

- Monday to Friday, 7am to 6pm
- Saturday, 8am to 1pm
- Sunday and Public Holidays, no work.

Out of Hours Works may be required for the following:

- Installation of utilities
- Work determined to comply with the relevant noise management level at the nearest sensitive receiver
- The delivery of materials outside approved hours as required by the NSW Police or other authorities for safety reasons
- Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm
- Situations where agreement is reached with affected receivers.

No other out-of-hours works are anticipated as part of the proposal. The noise and vibration from activities associated with the proposal would potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours in proximity to the proposal site. The impacts from noise emissions are likely to be localised to the construction areas and are not considered likely to have a significant, long-term, impact on wildlife populations outside the area of impact. Within the area of impact, some sensitive species (e.g. woodland birds) may avoid the noise and some more tolerant species, including small mammals, would habituate over the longer-term (Byrnes *et al.* 2012).

**Dust pollution**

Elevated levels of dust may be deposited onto the foliage of vegetation adjacent to the proposal activities. This has the potential to reduce photosynthesis and transpiration and cause abrasion and radioactive heating resulting in reduced growth rates and decreases in overall health of the vegetation. Consequently, changes in the structure and composition of plant communities and consequently the grazing patterns of fauna may occur (Auerbach *et al.* 1997; Walker & Everett 1987).

An air quality assessment has been undertaken and is provided in Chapter 8 of the REF. Without mitigation, dust is likely to be generated during the construction of the proposal, although dust pollution is likely to be greatest during periods of substantial earthworks, vegetation clearing, vehicle movements for construction and during adverse weather conditions. However, deposition of dust on foliage is likely to be highly localised, intermittent, and temporary and is therefore not considered likely to be a major impact of the proposal.

**Contaminant pollution**

During the construction phase localised release of contaminants (i.e. hydraulic fluids, oils, drilling fluids, etc.) into the surrounding environment (including drainage lines) may accidentally occur. The most likely result of contaminant discharge would be the localised contamination of soil and potential direct physical trauma to flora and fauna that come into contact with contaminants. Accidental release of contaminants is likely to be localised. An assessment of soil contamination has been undertaken and is provided in Chapter 8 of the REF.

### 5.6.7 Groundwater dependent ecosystems

The PCTs within the ecological study area are likely to be opportunistic facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) when an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. The proposal would impact on the occurrence of these PCTs within the proposal site (see **Section 4.2**).

## 5.7 Cumulative construction impacts

The potential biodiversity impacts must be considered as a consequence of the construction and operation of the proposal within the existing environment. The proposal would not act alone in causing impacts to biodiversity. The incremental effects of multiple sources of impact (past, present and future) are referred to as cumulative impacts and provide an opportunity to consider the proposal within a strategic context.

The accumulating impacts of historic vegetation clearing for agriculture, urban development, and development and maintenance of infrastructure would likely include continued loss of biodiversity on the Cumberland Plain. The Cumberland Plain NSW Landscape is an over cleared landscape with 89 per cent of native vegetation having been cleared. Only 11 per cent of the original native vegetation remains. Due to the likely expansion of Western Sydney and creation of housing and associated infrastructure, further impacts to biodiversity are likely to result in this region.

An assessment of the likely cumulative biodiversity impacts from recent projects using publicly available information is provided in Chapter 8 of the REF.

## 5.8 Construction impacts summary

A summary of the predicted ecological impacts from the construction of the proposal is provided in **Table 5-4**.

**Table 5-4 Summary of impacts**

| Impact | Biodiversity values | Nature of impact | Extent of impact* | Duration | Does the proposal constitute or exacerbate a key threatening process? |
|---|---|---|---|---|---|
| Removal of native vegetation | Native vegetation | Direct | 1.92 ha | Permanent | Clearing of native vegetation |
| | Cumberland Plain Woodland in the Sydney Basin Bioregion | Direct | 1.74 ha | Permanent | Clearing of native vegetation |
| | River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | Direct | 0.07 ha | Permanent | Clearing of native vegetation |
| | Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest | Direct | <0.001 ha | Permanent | Clearing of native vegetation |
| Removal of threatened fauna habitat | Cumberland Plain Land Snail | Direct | <0.001 ha | Permanent | Clearing of native vegetation<br>Loss of hollow-bearing trees<br>Removal of dead wood and dead trees |
| | Green and Golden Bell Frog | Direct | 0.11 ha (potential non-breeding habitat) | Permanent | Clearing of native vegetation |
| | Grey-headed Flying-fox | Direct | 1.2 ha (foraging habitat) | Permanent | Clearing of native vegetation |
| | Little Bent-wing Bat, Large Bentwing-bat, Eastern False Pipistrelle, Eastern Freetail-bat, Southern Myotis, Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat | Direct | 1.92 ha (foraging habitat) and 4 hollow-bearing trees | Permanent | Clearing of native vegetation<br>Loss of hollow-bearing trees |
| | Dusky Woodswallow, Varied Sittella | Direct | 1.2 ha (foraging habitat) | Permanent | Clearing of native vegetation<br>Loss of hollow-bearing trees<br>Removal of dead wood and dead trees |

| Impact | Biodiversity values | Nature of impact | Extent of impact* | Duration | Does the proposal constitute or exacerbate a key threatening process? |
|---|---|---|---|---|---|
| | Little Lorikeet, Swift Parrot, | Direct | 1.2 ha (foraging habitat) and 4 hollow-bearing trees | Permanent | Clearing of native vegetation<br>Loss of hollow-bearing trees |
| | Little Eagle, Square-tailed Kite, Powerful Owl, Masked Owl | Direct | 1.2 ha (foraging habitat) | Permanent | Clearing of native vegetation<br>Loss of hollow-bearing trees<br>Removal of dead wood and dead trees |
| Removal of threatened flora | *Grevillea juniperina* subsp. *juniperina* | Direct | 0.06 ha of potential habitat. No individuals would be directly impacted. | Permanent | Clearing of native vegetation |
| Aquatic impacts | Aquatic fauna | Direct | Only minor habitat to be affected. | Short term | No |
| Injury and mortality of fauna | All fauna species present in the habitat | Direct | Unknown. Impact cannot be quantified. | Long term | No |
| Fragmentation of identified biodiversity links and habitat corridors | All PCTs and flora and fauna species present in the habitat | Direct/ indirect | Minimal, but local habitat isolation would be increased. | Long term | No |
| Edge effects on adjacent native vegetation and habitat | All PCTs and flora and fauna species present in the habitat | Indirect | Minimal as no core habitat is present. | Long term | No |

| Impact | Biodiversity values | Nature of impact | Extent of impact* | Duration | Does the proposal constitute or exacerbate a key threatening process? |
|---|---|---|---|---|---|
| Invasion and spread of weeds | All PCTs and flora and fauna species present in the habitat | Indirect | Without appropriate management strategies, proposal activities have the potential to disperse weeds. | Long term | Invasion and establishment of exotic vines and scramblers<br>Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata)*<br>Invasion, establishment and spread of *Lantana camara*<br>Invasion of native plant communities by exotic perennial grasses |
| Invasion and spread of pests | All PCTs and flora and fauna species present in the habitat | Indirect | The ecological study area is currently likely habitat for a range of pest species. | Long term | Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)<br>Predation by the European red fox (*Vulpes vulpes*) |
| Invasion and spread of pathogens and disease | All PCTs and flora and fauna species present in the habitat | Indirect | While pathogens were not observed or tested for in the ecological study area the potential for pathogens to occur should be treated as a risk during construction. | Long term | Infection of native plants by *Phytophthora cinnamomi*<br>Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae<br>Infection of frogs by amphibian chytrid causing the disease chytridiomycosis |

| Impact | Biodiversity values | Nature of impact | Extent of impact* | Duration | Does the proposal constitute or exacerbate a key threatening process? |
|---|---|---|---|---|---|
| Noise, light and vibration | All PCTs and flora and fauna species present in the habitat | Direct/ indirect | There would be an impact from noise, light and vibration but the level of noise, vibration and light spill into adjacent habitats cannot be quantified. | Short term | No |

*Excludes environmental protection zone

# 6. Operational assessment

## 6.1 Aquatic impacts

Impacts to aquatic habitats are discussed in **Section 5.4**. Additionally, Ropes Creek is mapped as 'Key Fish Habitat' by the NSW DPI, which is outside of both the proposal site and the ecological study area. During the operation phase localised release of contaminants (i.e. hydraulic fluids, oils, drilling fluids, etc.) into the surrounding environment (including drainage lines) may accidentally occur. The most likely result of contaminant discharge would be the localised contamination of soil and potential direct physical trauma to flora and fauna that come into contact with contaminants. Accidental release of contaminants is likely to be localised. The potential for impact to surrounding aquatic habitats can reduced by implementing standard mitigation measures (see **Section 8.2**).

## 6.2 Injury and mortality

Impacts from fauna injury or death are discussed in **Section 5.5**. The potential for impact may be slightly elevated during the operational phase as there would be more traffic going in and out of the proposal site.

Mitigation measures to reduce an injury and mortality of fauna are provided in **Section 8.2**.

## 6.3 Edge effects on adjacent native vegetation and habitat

As discussed in **Section 5.6.2**, the proposal would be built in an area that is currently subject to a high level of edge effects from the existing roadways, agricultural land use practices and urban development. No new edge habitats would be created as the ecological study area does not possess large core areas of undisturbed habitat.

This impact would be of low magnitude and mitigation measures are not deemed necessary.

## 6.4 Noise and vibration, light, dust and contaminated pollution

The potential impacts of noise and vibration, dust and contaminated pollution during construction are discussed in **Section 5.6.6**. Potential impacts are expected to be similar during the operation of the proposal and therefore considered unlikely to be a major impact. This impact would be of low magnitude and mitigation measures are not deemed necessary.

**Light pollution**

Ecological light pollution is the descriptive term for light pollution that includes direct glare, chronic or periodic increased illumination, and temporary unexpected fluctuations in lighting (including lights from a passing vehicles), that can have potentially adverse effects on wildlife (Longcore & Rich 2004).

The proposal would have 24 hours per day, seven days per week operations. As such, the immediate area surrounding the proposal site, and the roadside during operation, would be subject to artificial lighting, essentially creating permanent 'daylight' conditions. Ecological light pollution may potentially affect nocturnal fauna by interrupting their life cycle. Some species (i.e. light tolerant microchiropteran bats) may benefit from the lighting due to increased food availability (insects attracted to lights) around these areas. Due to the frequency and sustained nature of the lighting, it is unlikely that animals would habituate to the light disturbance and a long-term impact in the area of lighting is likely. This impact would be of low magnitude and mitigation measures are not deemed necessary.

## 6.5 Operational impacts summary

The proposal is not expected to result in any different impacts (from construction) during operation. The key impacts of the proposal would occur during the construction phase and have been assessed in **Section 5**.

# 7. Assessment of impact significance

An Assessment of Significance has been conducted for threatened species that have been positively identified within the ecological study area or that are considered to have a moderate or high likelihood of occurring in the ecological study area due to the presence of suitable habitat.

The proposed works would be assessed under Part 5 of the EP&A Act. Section 7.3 of the BC Act outlines the 'test of significance' that is to be undertaken to assess the likelihood of significant impact upon threatened species or ecological communities listed under the BC Act. These tests of significance have been undertaken in accordance with the *Threatened Species Test of Significance Guidelines* (Office of Environment and Heritage 2018), which outlines a set of guidelines to help applicants/proponents of a development or activity with interpreting and applying the factors of the assessment process. The guidance provided by the former Office of Environment and Heritage has been used here in preparing these tests of significance and in determining whether there is likely to be a significant impact to a threatened species, population or ecological community listed under the BC Act.

Full details of assessment of significance under the BC Act are presented in **Appendix C**. Species with similar broad habitat requirements have been grouped together for assessment. The conclusions of the assessments are provided in **Table 7-1**, which indicates that a significant impact is considered unlikely on any threatened species or threatened ecological communities listed under the BC Act.

For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

A significant impact is considered unlikely for any Matter of NES and a referral of the proposal would not be required (see **Table 7-1**). Full details of the assessment of significance for threatened species under the EPBC Act are presented in **Appendix C**.

Table 7-1 Summary findings of the BC Act test of significance

| Threatened species, or communities | Significance assessment question[1] | | | | | Likely significant impact? |
|---|---|---|---|---|---|---|
| | a | b | c | d | e | |
| Cumberland Plain Woodland in the Sydney Basin Bioregion | X | N | N | N | Y | No |
| River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | X | N | N | N | Y | No |
| *Grevillea juniperina* subsp. *juniperina* | N | X | N | N | Y | No |
| Cumberland Plain Land Snail (*Meridolum corneovirens*) | N | X | N | N | Y | No |
| Green and Golden Bell Frog (*Litoria aurea*) | N | X | N | N | Y | No |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | N | X | N | N | Y | No |
| **Insectivorous bats (cave-roosting)** | | | | | | |
| Little Bent-winged Bat (*Miniopterus australis*) | N | X | N | N | Y | No |
| Large Bent-winged Bat (*Miniopterus orianae oceanensis*) | N | X | N | N | Y | No |
| Southern Myotis (*Myotis macropus*) | N | X | N | N | Y | No |
| **Insectivorous bats (hollow-roosting)** | | | | | | |
| Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) | N | X | N | N | Y | No |
| Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) | N | X | N | N | Y | No |
| Greater Broad-nosed Bat (*Scoteanax rueppellii*) | N | X | N | N | Y | No |

| Threatened species, or communities | Significance assessment question[1] | | | | | Likely significant impact? |
|---|---|---|---|---|---|---|
| | a | b | c | d | e | |
| Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) | N | X | N | N | Y | No |
| **Woodland birds** | | | | | | |
| Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) | N | X | N | N | Y | No |
| Varied Sittella (*Daphoenositta chrysoptera*) | N | X | N | N | Y | No |
| **Nectarivorous birds** | | | | | | |
| Little Lorikeet (*Glossopsitta pusilla*) | N | X | N | N | Y | No |
| Swift Parrot (*Lathamus discolor*) | N | X | N | N | Y | No |
| **Large predatory birds** | | | | | | |
| Little Eagle (*Hieraaetus morphnoides*) | N | X | N | N | Y | No |
| Square-tailed Kite (*Lophoictinia isura*) | N | X | N | N | Y | No |
| Powerful Owl (*Ninox strenua*) | N | X | N | N | Y | No |
| Masked Owl (*Tyto novaehollandiae*) | N | X | N | N | Y | No |

Notes: Y = Yes (negative impact), N = No (no or positive impact), X = not applicable, ? = unknown impact.

1. Significance Assessment Questions as set out in the *Biodiversity Conservation Act 2016:*
   - a in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
   - b in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
     - (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
     - (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
   - c in relation to the habitat of a threatened species or ecological community:
     - (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
     - (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
     - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.
   - d whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),
   - e whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Table 7-2 Summary findings of the EPBC Act significance assessments

| Species/Ecological Community | *Assessment of significance questions (EPBC Act) | | | | | | | | | Important Population+ | Likely Significant Impact |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| **Ecological communities** | | | | | | | | | | | |
| Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest | Y | N | N | Y | N | N | Y | X | X | NA | No |
| **Vulnerable species+** | | | | | | | | | | | |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | N | N | N | N | N | N | N | N | N | Yes | No |

| Species/Ecological Community | *Assessment of significance questions (EPBC Act) | | | | | | | | | Important Population+ | Likely Significant Impact |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| **Endangered species** | | | | | | | | | | | |
| Green and Golden Bell Frog (*Litoria aurea*) | N | N | N | N | N | N | N | N | N | Yes | No |
| **Critically Endangered species** | | | | | | | | | | | |
| Swift Parrot (*Lathamus discolour*) | N | N | N | N | N | N | N | N | N | NA | No |

Notes: Y = Yes (negative impact), N = No (no or positive impact), X = not applicable, ? = unknown impact.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

1) reduce the extent of an ecological community
2) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
3) adversely affect habitat critical to the survival of an ecological community
4) modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
5) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
6) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
   - assisting invasive species, that are harmful to the listed ecological community, to become established, or
   - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
7) interfere with the recovery of an ecological community.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

1) Lead to a long-term decrease in the size of a population
2) Reduce the area of occupancy of the species
3) Fragment an existing population into two or more populations
4) Adversely affect habitat critical to the survival of a species
5) Disrupt the breeding cycle of a population
6) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
7) Result in invasive species that are harmful to a species becoming established in the species' habitat
8) Introduce disease that may cause the species to decline
9) Interfere with the recovery of the species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1) lead to a long-term decrease in the size of an important population of a species
2) reduce the area of occupancy of an important population
3) fragment an existing important population into two or more populations
4) adversely affect habitat critical to the survival of a species
5) disrupt the breeding cycle of an important population
6) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
7) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
8) introduce disease that may cause the species to decline, or
9) interfere substantially with the recovery of the species.

An important population as determined by the EPBC Act is a population of a vulnerable species that is likely to be key source populations either for breeding or dispersal, is likely to be necessary for maintaining genetic diversity, or is at or near the limit of the species range. The Grey-headed Flying-fox exists as one interconnected population along the east coast of Australia. Therefore, it is considered an important population for the purposes of this assessment.

# 8. Mitigation and management measures

This chapter outlines the steps that have been taken to avoid and minimise impacts to biodiversity and the measures recommended to manage residual impacts.

In general, biodiversity impacts would be managed in accordance with Sydney Metro's Construction Environmental Management Framework. Of relevance, the Construction Environmental Framework includes biodiversity management objectives to maximise workers' awareness of biodiversity values and avoid or minimise potential impacts to biodiversity.

## 8.1 Avoidance and minimisation

Avoiding environmental impacts as the first step is consistent with the application of the precautionary principle. This section demonstrates the efforts taken to avoid and minimise impacts on biodiversity values in accordance with section 8 of the BAM.

Avoidance can be achieved by early consideration of environmental issues from identification of constraints at proposal inception through to options analysis and selection of a preferred option, design investigation and assessment of the preferred option, detailed design, and implementation of on-ground safeguards during construction and operation and maintenance of the activity.

The primary method to avoid impacts is to locate activities away from areas of known or potential high biodiversity value. In identifying suitable work sites, the first preference is to locate existing cleared and disturbed areas that have good access, are not within immediate proximity to waterways, and that support good site management practices (for example, management of material stockpiles). The proposal has been proposed in a highly disturbed area to avoid impacts to biodiversity.

During the early stages of planning, the riparian vegetation around Ropes Creek was identified as Cumberland Plains Priority Conservation Lands mapped by the Department of Planning, Industry and Environment (see **Figure 4-2** and also a biodiversity corridor of regional significance (see **Figure 4-5**) as identified by the Biodiversity Investment Opportunities Map (BIO Map). The design of the proposal was able to avoid this area of high-value biodiversity through the establishment of an environmental protection area in the south west of the proposal site, greatly reducing the impact on threatened species, habitat and threatened ecological communities.

## 8.2 Mitigation measures

The proposed measures to mitigate and minimise ecological impacts are outlined in **Table 8-1** and should be considered in the development of the Construction Environmental Management Plan (CEMP) for the proposal. The impacts associated with the proposal will be managed in accordance with Sydney Metro's Construction Environmental Management Framework (CEMF). **Table 8-1** does not include measures already outlined in Chapter 10 of the CEMF, which includes requirements for measures such as pre-clearing surveys prior to native vegetation clearing.

Table 8-1 Recommended mitigation measures during pre-construction and construction

| No. | Potential impacts | Mitigation measure |
|---|---|---|
| B1 | Potential impact to surrounding vegetation and threatened | Prior to construction, the limits of the work zone, areas for parking and turning of vehicles and plant equipment would be accurately and clearly marked out. These areas would be located so that vegetation disturbance is minimised as much as possible and the drip-line of trees avoided. |
| B2 | | Prior to construction, exclusion zones would be established around all vegetation to be retained, such as the environmental protection area in the west of the proposal |

| No. | Potential impacts | Mitigation measure |
|---|---|---|
| | ecological communities | site. Periodic monitoring would be undertaken to ensure all controls are in place and no inadvertent impacts are occurring. |
| B3 | | Materials, plant, equipment, work vehicles and stockpiles would be placed to avoid damage to surrounding vegetation and would be outside tree drip-lines. |
| B4 | | Prior to construction, personnel would be informed of the environmentally sensitive aspects of the proposal site, including plans for impacted and adjoining areas showing vegetation communities; important flora and fauna habitat areas; and locations where threatened species, populations or ecological communities have been recorded. Construction personnel would be made aware that any native fauna species encountered must be allowed to safely leave the proposal site where possible and a local wildlife rescue organisation or appropriately experienced ecologist must be called for assistance where necessary. |
| B5 | Potential impact to native plants and animals including threatened species | Where possible, hollows would be cut out of hollow-bearing trees and re-established in large trees to the west of the proposal site to mitigate the loss of hollow habitat on fauna. |
| B6 | Potential impacts to the Cumberland Plain Land Snail | Pre-clearing surveys for the Cumberland Plan Land Snail would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing to translocate any individuals that may be inhabiting areas that would be cleared or disturbed. This includes all areas of dumped rubbish across the proposal site. |
| B7 | | Prior to construction, exclusion zones would be established around Cumberland Plain Land Snails habitat in the environmental protection area. All personnel would be inducted to understand the exclusion zone to limit the potential of trampling snails. |
| B8 | | Large woody debris cleared within the proposal site would be relocated into habitat to the west of the proposal site. |
| B9 | Potential impacts to the Green and Golden Bell Frog | Pre-clearing surveys for the Green and Golden Bell Frog would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing and dewatering of potential habitat to ensure that individuals have not inhabited the site. A suitably qualified ecologist would also be present during the dewatering of the habitat. A stop work in the immediate vicinity would be implemented if this species is identified on the proposal site, and then further consideration of approach to management of individuals on proposal site, through consultation with a Green and Golden Bell Frog expert. |
| B10 | | Any work in and around the suitable Green and Golden Bell Frog habitat during clearing would follow the Hygiene Protocol for the Control of Disease in Frogs (Department of Environment and Climate Change 2008b) to reduce the potential for introduction and spread of Chytrid fungus. |
| B11 | Potential impacts from introduction and spread of weeds | Weed control would be undertaken by suitably qualified and/or experienced personnel. This may include:<br>▪ Manual weed removal in preference to herbicides<br>▪ Replacing non-target species removed/killed as a result of weed control activities |

| No. | Potential impacts | Mitigation measure |
|---|---|---|
| | | ▪ Protecting non-target species from spray drift<br>▪ Using only herbicides registered for use within or near waterways for the specific target weed<br>▪ Applying herbicides during drier times when the waterway level is below the high-water mark<br>▪ Not applying herbicide if it is raining or if rain is expected<br>▪ Mixing and loading herbicides, and cleaning equipment away from waterways and drains |
| B12 | | During construction, weed management would be undertaken in areas affected by construction prior to any clearing works in accordance with the *Biosecurity Act 2015* to ensure they are not spread to the surrounding environment; including during transport disposal off-site to a licenced waste disposal facility. |
| B13 | | All weeds, propagules, other plant parts and/or excavated topsoil material that is likely to be infested with weed propagules that are likely to regenerate would be treated on site or bagged, removed from site and disposed of at a licensed waste disposal facility. |
| B14 | Potential impacts from introduction and spread of plant pathogens | During construction, all vehicles driving to and from site would follow a protocol to prevent the spread or introduction of phytophthora, namely vehicles would be clean, including the tyres and any equipment. |

# 9. Conclusion

The key impacts of the proposal include the removal of 1.92 hectares of native vegetation belonging to three Plant Community Types (PCTs) and three Threatened Ecological Communities (TECs) including:

- 1.74 hectares of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered)
- 0.07 hectares of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered)
- <0.001 hectares of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 1.74 hectares of the associated BC Act listed Cumberland Plain Woodland community.

Over 30 *Grevillea juniperina subsp. juniperina* plants, listed as vulnerable under the BC Act, were identified in the ecological study area (but outside of the proposal site) and around 0.06 hectares of potential habitat would be impacted. The native vegetation to be removed provides habitat (or potential habitat) for 18 threatened animal species that were either identified in the ecological study area (i.e. Cumberland Plain Land Snail) or are considered at least moderately likely to occur based on the presence of suitable habitat (e.g. Green and Golden Bell Frog, Grey-headed Flying Fox).

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur, and the extent of this impact would be proportionate to the extent of vegetation that is cleared. Indirect / operational impacts would include a minor increase in habitat isolation. Invasion and spread of weeds, invasion and spread of pests, and invasion and spread of pathogens and disease are a risk with a proposal of this type. Noise, light and vibration would be increased during construction and operation. Significant impacts to aquatic ecosystems are unlikely to occur as a result of the proposal.

The ecological study area is situated in an over-cleared landscape due to historic activities. In the context of historic vegetation removal, any future vegetation clearing no matter how small would result in incremental cumulative impact that would detrimentally affect biodiversity. In combination with other projects in the area, the proposal would contribute to cumulative biodiversity impacts and may result in detrimental impacts to biodiversity (refer to Chapter 8 of the REF for full assessment).

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts from the proposal, some residual impacts would occur. Management measures would be implemented during the construction and operational phases to mitigate the potential ecological impacts of the proposal. This assessment has identified a range of mitigation techniques to be implemented during construction and operation (see **Section 8.2**). Due to the presence of the critically endangered ecological communities and threatened fauna habitat, exclusion zones would be established to delineate the works limit boundary to ensure no accidental impacts occur.

The overall outcome of the BC Act tests of significance and EPBC Act assessments of significance (see **Appendix C**) indicate that there is a high level of certainty that the impacts to threatened biodiversity are unlikely to be significant.

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# Appendix A. Plant species recorded

**Table A-1 Recorded plants**

| Scientific Name | Growth form code* | Cover estimate (%) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 849 - Mod | 849 – Derived Grassland | | 835 – Poor | 1071 - Poor | 849 - Poor | |
| | | Plot 1 | Plot 2 | Plot 7 | Plot 3 | Plot 4 | Plot 5 | Plot 6 |
| *Angophora subvelutina* | TG | | | | 5 | | | |
| *Aristida vagans* | GG | 1 | | 0.5 | | | | 0.5 |
| *Aster subulatus* | EX | 0.1 | 0.1 | | | | | |
| *Axonopus fissifolius* | HT | | 3 | 5 | 1 | | | |
| *Bidens pilosa* | EX | 0.2 | | | 0.5 | | | |
| *Bothriochloa macra* | GG | 0.2 | 0.5 | | 0.5 | | 2 | |
| *Brassica fruticulosa* | EX | 0.1 | | | | | | |
| *Casuarina glauca* | TG | | | | | 0.3 | | |
| *Cheilanthes sieberi* | EG | | | | | | | 0.2 |
| *Chloris truncata* | GG | | | | | | 5 | |
| *Cladium procerum* | GG | | | | | 3 | | |
| *Commelina cyanea* | FG | | | | 0.1 | | | |
| *Conyza bonariensis* | EX | 0.1 | | | | | 0.1 | |
| *Cynodon dactylon* | GG | 4 | 5 | 3 | 1 | | | 1 |
| *Cyperus brevifolius* | EX | 0.1 | 0.1 | 0.2 | 0.1 | | 0.1 | 0.1 |
| *Cyperus gracilis* | GG | | | | | | 0.1 | |
| *Cyperus spp.* | GG | | | | 0.1 | | | |
| *Dichondra repens* | FG | 0.1 | | | | | | |
| *Einadia trigonos* | FG | | | | 0.1 | | | |
| *Eragrostis brownii* | GG | 0.1 | 0.5 | | | | | |
| *Eragrostis curvula* | HT | 5 | 0.5 | | 1 | | 0.2 | 5 |
| *Eragrostis leptostachya* | GG | 0.5 | | | 2 | | 0.5 | 1 |
| *Eucalyptus moluccana* | TG | 2 | | | | | 5 | 2 |
| *Eucalyptus tereticornis* | TG | 15 | 2 | 0.1 | 35 | | 15 | 10 |
| *Fimbristylis dichotoma* | GG | 1 | 0.1 | | | | | |
| *Fimbristylis ferruginea* | GG | | | 0.1 | | | | 0.2 |
| *Gamochaeta americana* | EX | | 0.1 | | | | 0.1 | |
| *Glycine tabacina* | OG | | | | 0.3 | | | |

| Scientific Name | Growth form code* | Cover estimate (%) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 849 - Mod | 849 – Derived Grassland | | 835 – Poor | 1071 - Poor | 849 - Poor | |
| | | Plot 1 | Plot 2 | Plot 7 | Plot 3 | Plot 4 | Plot 5 | Plot 6 |
| *Hypochaeris radicata* | EX | | 0.5 | 0.3 | 0.2 | | | 0.2 |
| *Hypoxis hygrometrica* | FG | | 0.1 | 0.1 | | | 0.1 | 0.1 |
| *Lomandra longifolia* | GG | | | | | | | 0.1 |
| *Ludwigia peploides* | FG | | | | | 0.5 | | |
| *Ludwigia peruviana* | HT | | | | | 1 | | |
| *Lycium ferocissimum* | HT | | | | 0.5 | | | |
| *Microlaena stipoides* | GG | 5 | 2 | | 5 | | 5 | 15 |
| *Oxalis perennans* | FG | | | 0.1 | 0.1 | | 0.1 | 0.1 |
| *Oxalis spp.* | FG | | 0.1 | | | | | |
| *Paspalidium distans* | GG | 0.3 | | | 0.1 | | 0.5 | |
| *Paspalum dilatatum* | HT | 10 | 5 | 20 | 40 | | 50 | 4 |
| *Persicaria lapathifolia* | FG | | | | | 2 | | |
| *Phyllanthus virgatus* | FG | | | | 0.1 | | | |
| *Plantago lanceolata* | EX | | | | 0.1 | | 0.1 | |
| *Rumex spp.* | FG | | | | | | 0.1 | |
| *Salvinia molesta* | HT | | | | | 1 | | |
| *Senecio madagascariensis* | HT | 0.1 | 0.1 | 0.1 | 0.5 | | 0.2 | 0.2 |
| *Setaria parviflora* | EX | 4 | 5 | 0.5 | 10 | | 15 | 5 |
| *Sida rhombifolia* | EX | 0.3 | | | 2 | | | |
| *Solanum nigrum* | EX | 0.2 | | | | | | |
| *Solanum pseudocapsicum* | EX | 0.5 | | | 0.2 | | 0.2 | |
| *Solanum linnaeanum* | EX | 0.1 | | | | | 0.1 | |
| *Sonchus oleraceus* | EX | 0.2 | | | | | 0.1 | |
| *Sporobolus creber* | GG | 0.2 | 0.5 | | 0.5 | | 0.1 | 0.5 |
| *Sporobolus fertilis* | HT | | | | 0.5 | | | |
| *Taraxacum officinale* | EX | | | | | | | 0.1 |
| *Themeda triandra* | GG | 0.5 | 35 | 30 | | | 0.5 | 5 |
| *Trifolium arvense* | EX | 0.1 | | | | | | |
| *Triglochin spp.* | FG | | | | | 0.2 | | |
| *Typha orientalis* | GG | | | | | 5 | | |
| *Wahlenbergia gracilis* | FG | 0.1 | | | 0.1 | | 0.1 | 0.1 |

**GF code: TG = Tree, SG = Shrub, GG = Grass and grass-like, FG = Forb, EG = Fern, OG = Other, HT = High Threat weed, EX = Exotic*

# Appendix B. Habitat assessment table

**Likelihood of occurrence criteria**

| Likelihood | Criteria |
|---|---|
| Recorded | The species was observed in the ecological study area during the current survey |
| High | It is highly likely that a species inhabits the ecological study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10km) and is known or likely to maintain resident populations in the ecological study area. Also includes species known or likely to visit the ecological study area during regular seasonal movements or migration. |
| Moderate | Potential habitat is present in the ecological study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the ecological study area opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the ecological study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded. |
| Low | It is unlikely that the species inhabits the ecological study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the ecological study area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the ecological study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded. |
| None | Suitable habitat is absent from the ecological study area. |

**Table B-1 Habitat assessment table – Threatened Flora**

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| Bynoe's Wattle | *Acacia bynoeana* | E | V | Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils (Harden, 2002). Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla, Banksia serrata and Angophora bakeri (NSW National Parks and Wildlife Service, 1999a). | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| Downy Wattle | *Acacia pubescens* | V | V | Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. | PMST, 136 – BioNet | Low – widely recorded in the area. Some areas of suitable habitat around the ecological study area (Cumberland Shale Plains Woodland), however much of the habitat is too disturbed for this species. Surveys did not identify this species. |
| *Allocasuarina glareicola* | *Allocasuarina glareicola* | E | E | Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. | PMST, 1 – BioNet | Low – single record in St Mary's. No suitable habitat and no records found nearby. |
| Netted Bottlebrush | *Callistemon linearifolius* | V | - | Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Was more widespread across its distribution in the past. Some populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park and Werakata National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges. | 1 – BioNet | Low – single record in McMahon. Suitable habitat may be presented by Cumberland River Flat Forest adjacent to the ecological study area. Surveys did not identify this species. |
| White-flowered Wax Plant | *Cynanchum elegans* | E | E | Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub and scree slopes (Harden, 1992). This species typically occurs at the ecotone between dry subtropical forest/woodland communities. | PMST, 1 – BioNet | Low – single record near Abbotsbury. No suitable habitat in ecological study area and no records found nearby. |

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Dillwynia tenuifolia*, Kemps Creek | *Dillwynia tenuifolia* - endangered population | E2 | - | In western Sydney, Dillwynia tenuifolia is generally found on alluvial soils or on residual soil landscapes near the alluvial boundary. In this region this species is strongly associated with the alluvial Hawkesbury – Nepean Terrace Gravels (ferruginised clay and consolidated sand of the Londonderry Clay, the conglomerate of the Rickabys Creek Gravels, laterised sand and clay of the St Mary's Formation). Dillwynia tenuifolia also occurs to a lesser extent on the residual Cumberland Plain landscape on the Bringelly Shale and Ashfield Shale where there is influence from the quaternary alluvium of the Hawkesbury – Nepean Channels and Floodplains (eg South Creek, Kemps Creek, Ropes Creek, and Eastern Creek) and where the gravelly Berkshire Park soil landscape is present (i.e. Kemps Creek, Scheyville). This species is strongly associated with vegetation types including Castlereagh Scribbly Gum Woodland, Cooks River Castlereagh Ironbark Forest, and Shale/Gravel Transition Forest. Some outlier occurrences of Dillwynia tenuifolia occur in patches of Shale Plains Woodland or Alluvial Woodland where these communities intergrade with the aforementioned vegetation types. | 873 – BioNet | Low – many records found north of Erskine Park. Found in Cumberland River Flat Forest, which is found adjacent to the ecological study area. Surveys were undertaken for this species and it was not identified in the ecological study area or immediate surrounds. |
| Yellow Gnat-orchid | *Genoplesium baueri* | E | E | The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Grows in dry sclerophyll forest and moss gardens over sandstone. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| Juniper-leaved Grevillea | *Grevillea juniperina* subsp. *juniperina* | V | - | In the locality, Grevillea juniperina subsp. juniperina is highly associated with the Quaternary alluvium of South Creek and the Londonderry Clay and areas of adjacent Bringelly Shale. | 1095 – BioNet | Recorded – this species was recorded in several locations in the ecological study area. |

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| Small-flower Grevillea | *Grevillea parviflora* subsp. *parviflora* | V | V | Grevillea parviflora subsp. parviflora occurs sporadically throughout the Sydney Basin. It occurs on ridge crests, upper slopes or flat plains in both low-lying areas between 30–65 m above sea level and on higher topography between 200–300 m above sea level south of Sydney. It occurs in sandy or light clay soils, usually over thin shales often with lateritic ironstone gravels which are often infertile and poorly drained. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine-grained sandstones. This species is known from Kemps Creek on the sandy lateritic soils and a recent record from Ropes Creek at Mt Druitt on the alluvial South Creek formation soils. | PMST, 18 – BioNet | Low – nearest records at Ropes Creek at Mt Druitt near Cumberland River Flat Forest. Suitable habitat may be present adjacent the ecological study area. |
| Wingless Raspwort | *Haloragis exalata* subsp. *exalata* | V | V | Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It has a disjunct distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Square Raspwort appears to require protected and shaded damp situations in riparian habitats. Flowering specimens in NSW are recorded from November to January. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Hibbertia puberula* | *Hibbertia puberula* | E | - | Recent work on this species and its relatives has shown it to be widespread, but never common. It extends from Wollemi National Park south to Morton National Park and the south coast near Nowra. It favours low heath on sandy soils or rarely in clay, with or without rocks underneath. | 3 – BioNet | Low – nearest records found near Willmot. No suitable habitat in the ecological study area and no records found nearby. |

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Marsdenia viridiflora* subsp. *viridiflora* in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas | *Marsdenia viridiflora* subsp. *viridiflora* - endangered population | E2 | - | Endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Grows in vine thickets and open shale woodland. | 80 – BioNet | Low – numerous records scattered around Erskine Park. Found in in Cumberland Shale Plains Woodland, which is present on site. Surveys were undertaken for this species and it was not identified in the ecological study area or immediate surrounds. |
| *Micromyrtus minutiflora* | *Micromyrtus minutiflora* | E | V | The occurrences of Micromyrtus minutiflora to the north west of the ecological study area (Londonderry, Llandilo, Agnes Banks, Berkshire Park) are strongly associated with the Hawkesbury – Nepean Terrace Gravels and the presence of the Londonderry Clay geological formation (clay with sand – top layer hard, semi-indurated zone of cemented ironstone pisolites) with the Berkshire Park and Agnes Banks soil landscapes (laterite and sand). | PMST, 6 – BioNet | Low – nearest records found in Ropes Crossing. No suitable habitat in the ecological study area. |
| Tall Knotweed | *Persicaria elatior* | V | V | Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| Hairy Geebung | *Persoonia hirsuta* | E | E | Persoonia hirsuta is patchily distributed on the Central Coast and Tablelands of NSW, in an area bounded by Putty, Glen Davis and Gosford in the north, and Royal National Park (NP) and Hill Top in the south. It occurs in the Sydney coastal area (Gosford, Berowra, Manly and Royal NP), the Blue Mountains area (Springwood, Lithgow and Putty) and the Southern Highlands (Balmoral, Buxton, Yanderra and Hill Top). It is frequently found on ridge tops and the mid slopes of hills and rises in dry sclerophyll forest and woodland with a shrubby understorey, heath, shrubby thickets and sandstone scrubs from near sea level to 600 m altitude. Associated canopy species include Eucalyptus sclerophylla, Corymbia gummifera, Leptospermum trinervium, Eucalyptus sieberi, Eucalyptus punctata, Eucalyptus sparsifolia, Corymbia eximia and Banksia ericifolia. It grows on sandy to stony soils derived from sandstone or very rarely on shale and is often found in disturbed areas, like along track edges. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| Nodding Geebung | *Persoonia nutans* | E | E | Persoonia nutans is restricted to the Cumberland Plain. It is known from an area between Richmond and Macquarie Fields, particularly near the Nepean and Georges Rivers. The range of the species is fragmented, with about 99 per cent of the known populations occurring in the north of the distribution at Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs. This species is also known from Kemps Creek on the sandy lateritic soils. Persoonia nutans is strongly associated with the Hawkesbury – Nepean Terrace Gravels and the presence of the Londonderry Clay geological formation (clay with sand – top layer hard, semi-indurated zone of cemented ironstone pisolites) with the Berkshire Park and Agnes Banks soil landscapes (laterite and sand). | PMST, 32 – BioNet | Low – nearest records found north of Erskine Park near Colyton. Suitable habitat may be present adjacent the ecological study area in riparian vegetation. |

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| Austral Pillwort | *Pilularia novae-hollandiae* | E | - | In NSW, Austral Pilwort has been recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana (including Henty, Walbundrie, Balldale and Howlong) and at Lake Cowal near West Wyalong. The population at Lake Cowal is the only known extant population in NSW. The species has also been recorded in the Australian Capital Territory, Victoria, Tasmania, South Australia and Western Australia. Austral Pillwort grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. Most of the records in the Albury-Urana area were from table drains on the sides of roads. | 1 – BioNet | Low – single record from 1966 from Doonside. No suitable habitat and no records found nearby. |
| *Pimelea curviflora* var. *curviflora* | *Pimelea curviflora* var. *curviflora* | V | V | Pimelea curviflora var. curviflora occurs on ridge tops and upper slopes in open forest and woodland on sandy soil derived from sandstone, on shaley/lateritic soils and shale/sandstone transition soils. The population at Albion Park on the Illawara coastal plain occurs in Lowland Grassy Woodland habitat. It often grows among dense grasses and sedges making it difficult to detect. | PMST, 3 – BioNet | Low – nearest records at Arndell Park from 2018 in disturbed vegetation similar to ecological study area. However preferred soil type and habitat for this species not present in ecological study area. Ecological study area does not contain ridge tops or upper slopes. |
| Spiked Rice-flower | *Pimelea spicata* | E | E | The Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama). The western Sydney/Cumberland Plain populations occur on undulating to hilly country in remnant bushland on Wiannamatta shales. Habitats include open woodlands and grasslands of Grey Box (Eucalyptus moluccana), Narrow-leaved Ironbark (E. crebra), Forest Redgum (E. tereticornis), Blackthorn (Bursaria spinosa) and Kangaroo Grass (Themeda triandra). | PMST, 198 – BioNet | Low – nearest records east of the ecological study area closer to Eastern Creek. Suitable habitat around Ropes Creek in west of the ecological study area. Surveys were undertaken for this species. The highest quality area of habitat would be avoided. |

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| Brown Pomaderris | *Pomaderris brunnea* | E | V | Within the Hawkesbury–Nepean region, Pomaderris brunnea is known from a small area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It is largely restricted to the Picton – Razorback Hills and Nattai Plateau. It is also found near Camden on the Cumberland Plain, Hawkesbury – Nepean Channels and Floodplains, and Hawkesbury – Nepean Terrace Gravels. This species shows a strong preference for alluvial soils and the shale/sandstone transitional zone of the residual Lucas Heights soil landscape around Bargo. Suitable habitat is the Sydney Hinterland Transitional Woodland around Bargo and the Alluvial Woodland and Riparian Forest along the Nepean River at Camden. | PMST | Low – no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. However, preferred soils and vegetation found bordering ecological study area. Surveys were undertaken for this species and it was not identified in the ecological study area or immediate surrounds. |
| Illawarra Greenhood | *Pterostylis gibbosa* | E | E | Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum Eucalyptus tereticornis, Woollybutt E. longifolia and White Feather Honey-myrtle Melaleuca decora. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| Sydney Plains Greenhood | *Pterostylis saxicola* | E | E | Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated. Only one population occurs within a conservation reserve (Georges River National Park). Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where Pterostylis saxicola occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. | PMST, 1 – BioNet | Low – record found near Arndell Park. No sandstone rock shelves above cliff lines present in the ecological study area. |

| Common Name | Scientific Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| Sydney Bush Pea | *Pultenaea parviflora* | E | V | Pultenaea parviflora is confined to the Cumberland Plain and is mainly found between Penrith and Windsor. Pultenaea parviflora is generally found in scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on Wianamatta shale, tertiary alluvium or laterised clays, and in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. | PMST, 394 – BioNet | Low - records scattered throughout the locality. Nearest records in Erskine park 1.6km NE of the ecological study area. Vegetation in the ecological study area does not meet the description for preferred habitat of this species. Surveys were undertaken for this species and it was not identified in the ecological study area or immediate surrounds. |
| Magenta Lilly Pilly | *Syzygium paniculatum* | E | V | Occurs between Bulahdelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea (Harden, 2002). On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| Austral Toadflax | *Thesium australe* | V | V | Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. | PMST | Low – this species has not been recorded in the locality, Cumberland Shale Plains Woodland occurs in the ecological study area which meets the grassy woodland habitat requirement for this species. |

*PMST – Protected Matters Search Tool, BioNet – BioNet Atlas of NSW

**Table B-2 Habitat assessment table – Threatened Fauna**

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| **Frogs** | | | | | | |
| *Heleioporus australiacus* | Giant Burrowing Frog | V | V | In the northern population there is a marked preference for sandstone ridgetop habitat and broader upland valleys. In these locations, the frog is associated with small headwater creek lines and along slow flowing to intermittent creek lines. The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water. They have also been observed occupying artificial ponded structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised over time and are still surrounded by other undisturbed habitat. Do not appear to inhabit areas that have been cleared for agriculture or for urban development. Breed in summer and autumn in burrows in the banks of small creeks (Cogger, 2000, NSW National Parks and Wildlife Service, 2001a). | PMST | Low – the habitats in the ecological study area are not considered suitable for this species. |
| *Litoria aurea* | Green and Golden Bell Frog | E | V | Various types of habitat have been documented. For breeding utilises a wide range of waterbodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral locations that are more often dry than wet. Is found in various small pockets of habitat in otherwise developed areas and has the tendency of often turning up in highly disturbed sites. Lotic situations such as fast flowing streams appear to be one of the few water bodies not utilised, at least for breeding purposes (Department of Environment and Conservation, 2004a, Department of Environment and Conservation, 2005). | PMST ,19 – BioNet | Moderate – the dams offer suitable habitat for this species. Considering the location of a record on Ropes Creek from 2012, this species may disperse to and occur in the habitats in the ecological study area. No targeted surveys were undertaken as part of this assessment, however recent surveys for the Archbold Road upgrade (WSP \| Parsons Brinckerhoff 2017) did not detect this species. |
| *Litoria raniformis* | Growling Grass Frog | E | V | The species is currently widespread throughout the Murray River valley and has been recorded from six Catchment Management Areas in NSW: Lower Murray Darling, Murrumbidgee, Murray, Lachlan, Central West and South East. Found mostly amongst emergent vegetation, including Typha sp. (bullrush), Phragmites sp. (reeds) and Eleocharis sp.(sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| **Birds** | | | | | | |
| *Actitis hypoleucos* | Common Sandpiper | - | M | Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Anthochaera phrygia* | Regent Honeyeater | CE | CE | Occurs mostly in box-ironbark forests and woodland and prefers the wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with Casuarina cunninghamiana and Amyema cambagei are important for feeding and breeding. Important food trees include Eucalyptus sideroxylon (Mugga Ironbark), E. albens (White Box), E. melliodora (Yellow Box) and E. leucoxylon (Yellow Gum) (Garnett and Crowley, 2000) with Eucalyptus robusta (Swamp Mahogany) and Corymbia maculata (Spotted Gum) used in coastal habitats. | PMST, 9 – BioNet | Low – the Regent Honeyeater is a rare visitor to the locality and has not been recorded since 1995 when it was found in a residential garden in the Blacktown LGA. This species is a sporadic visitor to the area and would focus habitat use on larger areas of flowering eucalypts in winter. |
| *Apus pacificus* | Fork-tailed Swift | - | M | Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. | PMST, 5 – BioNet | Moderate – likely to fly over the ecological study area. |
| *Ardea alba* | Great Egret | - | M | Widespread in Australia. Reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Artamus cyanopterus* | Dusky Woodswallow | V | - | The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests (Higgins and Peter, 2002). | 27 – BioNet | Moderate - likely to fly over the ecological study area. May use vegetation in the ecological study area on occasion though this species was not recorded during surveys. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Botaurus poiciloptilus* | Australasian Bittern | V | E | Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spike rushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in territory that is more open. (Garnett and Crowley, 2000, NSW National Parks and Wildlife Service, 2002b). | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Burhinus grallarius* | Bush Stone-curlew | E | - | Open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. | 2 – BioNet | Low – conspicuous species that is no longer known from the region. Last records of this species in the locality are from 1996 from near Penrith. |
| *Calidris acuminata* | Sharp-tailed Sandpiper | - | M | The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation; this includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. Sometimes they occur on rocky shores and rarely on exposed reefs. | 1 – BioNet | Low – record from 2018 near Badgerys Creek, however record cannot be verified. No suitable habitat in the ecological study area. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Calidris ferruginea* | Curlew Sandpiper | E | CE | In Australia, Curlew Sandpipers occur around the coasts of all states and are also quite widespread inland, though in smaller numbers. They occur in Australia mainly during the non-breeding period but also during the breeding season when many non-breeding one-year old birds remain. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh and in mangroves. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Calidris melanotos* | Pectoral Sandpiper | - | M | In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | - | Occurs in wetter forests and woodland from sea level to an altitude over 2000 metres, timbered foothills and valleys, coastal scrubs, farmlands and suburban gardens (Pizzey and Knight, 1997). | 1 – BioNet | Low – record in suburban area near Abbotsbury. There is a low possibility that this species may visit the ecological study area as a vagrant. |
| *Calyptorhynchus lathami* | Glossy-black Cockatoo | V | - | The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are | 1 – BioNet | Low – record in suburban area near Kingswood. No suitable feed trees in or around the ecological study area. There is a low possibility that this species may visit the ecological study area as a vagrant. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| | | | | important foods. Inland populations feed on a wide range of Sheoaks, including Drooping Sheoak, Allocasuarina diminuta, and A. gymnanthera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata). | | |
| *Chthonicola sagittata* | Speckled Warbler | V | - | The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt re-growth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. | 12 – BioNet | Low – all records from a reserve near Penrith and generally old. Native vegetation present in the ecological study area may provide habitat for this species however considered to be an uncommon visitor. |
| *Cuculus optatus* | Oriental Cuckoo | - | M | Migrates from Eurasia as far south as Indonesia, New Guinea and North Australia. Some remain through Australia in the winter. Inhabits rainforest margins, monsoon forest, vine scrub and mangroves. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Daphoenositta chrysoptera* | Varied Sittella | V | - | The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. | 32 – BioNet | Moderate – records scattered throughout locality. One record located 500m north of the ecological study area from 1996. Native vegetation present in the ecological study area may provide habitat for this species. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Dasyornis brachypterus* | Eastern Bristlebird | E | E | The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Ephippiorhynchus asiaticus* | Black-necked Stork | E | - | In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Bulahdelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat). | 1 – BioNet | Low – some marginal habitat is present on the site however this species is very uncommon in the region. |
| *Gallinago hardwickii* | Latham's Snipe | - | M | Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett and Crowley, 2000). | 10 – BioNet | Low – no suitable habitat in the ecological study area. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Glossopsitta pusilla* | Little Lorikeet | V | - | The distribution of the Little Lorikeet extends from just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Royal Australian Ornithologists Union, 2003). Little Lorikeets are generally considered to be nomadic (Higgins, 1999) and forage mainly on flowers, nectar and fruit. The breeding biology of Little Lorikeets is little known however studies indicate that nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts, and hollow openings are approximately 3 cm in diameter (Courtney and Debus, 2006). | 7 – BioNet | High – recorded in 2019 300m from ecological study area in Shale Plains Woodland, which also occurs in the ecological study area. Commonly recorded species in the region. |
| *Grantiella picta* | Painted Honeyeater | V | V | Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett and Crowley, 2000). | PMST | Low – there is a low possibility that this species may visit the ecological study area as a vagrant and it is unlikely to breed in the locality. Has not been previously recorded in the locality. |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | V | M | Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea). | 9 – BioNet | Low – there is a low possibility that this species may visit the ecological study area as a vagrant, but no high-quality habitat is present. No large stick nests were observed during surveys. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Hieraaetus morphnoides* | Little Eagle | V | - | The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant and Higgins, 1993). | 20 – BioNet | Moderate – this species may visit the ecological study area on occasion to hunt, but no high-quality habitat is present. No large stick nests were observed during surveys. |
| *Hirundapus caudacutus* | White-throated Needletail | - | M | Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey and Knight, 1997). | PMST, 1 – BioNet | Low – a migrant that does not breed in the locality. Only likely to forage in the aerial spaces above the site. |
| *Ixobrychus flavicollis* | Black Bittern | V | - | The Black Bittern is found along the coastal plains within NSW, although individuals have rarely been recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water. | 1 – BioNet | Low – there is a low possibility that this species may occur along Ropes Creek as a vagrant, but no high-quality habitat is present in the ecological study area. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Lathamus discolor* | Swift Parrot | E | CE | Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands (Garnett and Crowley, 2000),(Swift Parrot Recovery Team, 2001). | PMST, 35 – BioNet | Moderate – records scattered throughout the locality. Nearest record is from St Clair in 2014. This species is a migrant that does not breed in the locality. The Swift Parrot is considered moderately likely to occur within the ecological study area on an infrequent basis during winter migration. |
| *Lophoictinia isura* | Square-tailed Kite | V | - | This species hunts primarily over open forest, woodland and mallee communities as well as over adjacent heaths and other low scrubby habitats in wooded towns. It feeds on small birds, their eggs and nestlings as well as insects. Seems to prefer structurally diverse landscapes (Garnett and Crowley, 2000). | 2 – BioNet | Low – this species may visit the ecological study area on occasion to hunt, but no high-quality habitat is present. No large stick nests were observed during surveys. |
| *Melithreptus gularis gularis* | Black-chinned Honeyeater | V | - | Extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. | 1 – BioNet | Low – there is a low possibility that this species may visit the ecological study area as a vagrant, but no high-quality habitat is present in the ecological study area. |
| *Merops ornatus* | Rainbow Bee-eater | - | M | Distributed across much of mainland Australia, and occurs on several near-shore islands. Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation | 2 - BioNet | Low – records from suburban area near Abbotsbury. There is a low possibility that this species may visit the ecological study area as a vagrant. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Monarcha melanopsis* | Black-faced Monarch | - | M | Widespread in eastern Australia. Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Motacilla flava* | Yellow Wagtail | - | M | Rare but regular visitor around Australian coast, especially in the NW coast Broome to Darwin. Found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground; occasionally on drier inland plains. | PMST | Low – this species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. There is a low possibility that this species may visit the ecological study area as a vagrant. |
| *Myiagra cyanoleuca* | Satin Flycatcher | - | M | Widespread in eastern Australia and vagrant to New Zealand. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. | PMST | Low – this species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. There is a low possibility that this species may visit the ecological study area as a migrant. |
| *Neophema pulchella* | Turquoise Parrot | V | - | Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. | 1 – BioNet | Low – record from Prospect Reservoir. There is a low possibility that this species may visit the ecological study area as a vagrant but no high–quality habitat is present in the ecological study area. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Ninox strenua* | Powerful Owl | V | - | A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally, feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett and Crowley, 2000). | 14 – BioNet | Moderate – nearest record between Erskine Park and Eastern Creek from 2015. Found in Shale Plains Woodland, which is also present in the ecological study area. Marginal foraging habitat present on site. No large tree hollows suitable for breeding were observed. This species may hunt in the ecological study area on occasion. |
| *Numenius madagascariensis* | Eastern Curlew | - | CE, M | Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Pandion haliaetus* | Eastern Osprey | V | M | Generally, a coastal species, occurring in estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Sometimes ascends larger rivers to far inland. Builds nests high in tree, on pylon or on ground on islands. Feeds on fish (Pizzey and Knight, 1997). | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Petroica boodang* | Scarlet Robin | V | - | In NSW, the Scarlet Robin occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. It prefers an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter, it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris (Higgins and Peter, 2002). | 3 – BioNet | Low – marginal habitat in the ecological study area however this species is very uncommon in the locality and all recorded sighting are old. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Petroica phoenicea* | Flame Robin | V | - | In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats (Higgins and Peter, 2002). The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank. | 2 – BioNet | Low – marginal habitat in the ecological study area however this species is very uncommon in the locality and all recorded sighting are old. |
| *Rhipidura rufifrons* | Rufous Fantail | - | M | Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies usually with a dense shrubby understorey often including ferns. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Rostratula australis* | Australian Painted snipe | E | E | The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. | 1 – BioNet | Low – no suitable habitat in the ecological study area. |
| *Stagonopleura guttata* | Diamond Firetail | V | - | Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (Eucalyptus pauciflora) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. | 2 – BioNet | Low – native vegetation present in the ecological study area may provide habitat however this species is very uncommon in the locality and all recorded sighting are old. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Stictonetta naevosa* | Freckled Duck | V | - | Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. | 1 – BioNet | Low – no suitable habitat in the ecological study area for this species. The dams in the ecological study area are highly disturbed. |
| *Tringa nebularia* | Common Greenshank | - | M | The Common Greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. | 1 – BioNet | Low – no suitable habitat in the ecological study area for this species. |
| *Tyto novaehollandiae* | Masked Owl | V | - | Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett and Crowley, 2000). | 6 – BioNet | Moderate – most suitable habitat is along Ropes Creek. This species may forage in the ecological study area on occasion though no breeding habitat is present. |
| **Mammals** | | | | | | |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | V | V | Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Dasyurus maculatus* | Spotted-tailed Quoll | V | E | Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service, 1999d). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (NSW National Parks and Wildlife Service, 1999c, NSW National Parks and Wildlife Service, 1999d). | PMST, 7 – BioNet | Low – the patches of habitat in the ecological study area are small and isolated from larger areas of potential habitat. Only possible on site as an extremely rare vagrant. |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | V | - | Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are more than 20 metres high (Churchill, 2008) | 17 – BioNet | Moderate – native vegetation present in the ecological study area may provide habitat for this species. |
| *Micronomus norfolkensis* | Eastern Coastal Free-tailed Bat | V | - | Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in human-made structures. | 54 – BioNet | Moderate – native vegetation present in the ecological study area may provide habitat for this species. |
| *Miniopterus australis* | Little Bent-winged Bat | V | - | Feeds on small insects beneath the canopy of well-timbered habitats including rainforest, Melaleuca swamps and dry sclerophyll forests. Roosts in caves and tunnels and has specific requirements for nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Strahan, 1995). | 8 – BioNet | Moderate – native vegetation present in the ecological study area may provide habitat for this species. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat | V | - | Usually found in well-timbered valleys where it forages on small insects above the canopy. Roosts in caves, old mines, stormwater channels and sometimes buildings and often return to a particular nursery cave each year (Churchill, 2008) | 76 – BioNet | Moderate – native vegetation present in the ecological study area may provide habitat for this species. |
| *Myotis macropus* | Southern Myotis | V | - | Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December. | 43 – BioNet | Moderate – there are many records from the locality and the habitat is suitable for foraging. |
| *Petauroides volans* | Greater Glider | - | V | The Greater Glider inhabits eucalyptus forests and woodlands as this species feeds exclusively on Eucalyptus buds and leaves. They occupy tree hollows in the day and tree canopies at night (Department of Environment and Climate Change 2007). | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Petaurus australis* | Yellow-bellied Glider | V | - | Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. | 1 – BioNet | Low – no suitable habitat in the ecological study area for this species. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | E | V | The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. However, the distribution of the species across its original range has declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |
| *Phascolarctos cinereus* | Koala | V | V | Found in sclerophyll forest. Throughout New South Wales, Koalas have been observed to feed on the leaves of approximately 70 species of eucalypt and 30 non-eucalypt species. However, in any one area, Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include Forest Red Gum Eucalyptus tereticornis, Grey Gum E. punctata, Monkey Gum E. cypellocarpa and Ribbon Gum E. viminalis. In coastal areas, Tallowwood E. microcorys and Swamp Mahogany E. robusta are important food species (NSW National Parks and Wildlife Service, 1999b, NSW National Parks and Wildlife Service, 2003). | PMST, 4 – BioNet | Low – associated habitat types present on site however patches of habitat are small and isolated from larger areas of potential habitat. |
| *Pseudomys novaehollandiae* | New Holland Mouse | - | V | The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, NSW and Queensland. The species is now largely restricted to the coast of central and northern NSW, with one inland occurrence near Parkes. In NSW, the New Holland Mouse is known from: Royal National Park (NP) and the Kangaroo Valley; Kuringgai Chase NP; and Port Stephens to Evans Head near the Queensland border. Across the species' range, the New Holland Mouse is known to inhabit open heathland, open woodland with heathy understorey, and vegetated sand dunes. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Pteropus poliocephalus* | Grey-headed Flying-fox | V | V | Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. Feeds on the flowers and nectar of eucalypts and native fruits including lilly pillies. It roosts in the branches of large trees in forests or mangroves (NSW National Parks and Wildlife Service, 2001b, Churchill, 2008) | 422 – BioNet | Moderate – this species is likely to forage in the ecological study area on occasion. |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail Bat | V | - | Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally, a solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows. Thought to be a migratory species (Churchill, 2008). | 4 – BioNet | Moderate – this species is likely to forage in the ecological study area on occasion. |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | V | - | The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks, but it may also forage in rainforest. Typically, it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill, 2008) | 22 – BioNet | Moderate – this species is likely to forage in the ecological study area on occasion. |
| **Fish** | | | | | | |
| *Macquaria australasica* | Macquarie Perch | - | E | The Macquarie Perch is a riverine species that prefers clear water and deep, rocky holes with abundant cover such as aquatic vegetation, large boulders, debris and overhanging banks. In Victorian parts of the Murray-Darling, only small natural populations remain in the upper reaches of the Mitta Mitta, Ovens, Broken, Campaspe and Goulburn Rivers; translocated populations occur in the Yarra River and Lake Eildon. In NSW, natural inland populations are isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers. Populations of the eastern form are confined to the Hawkesbury-Nepean and Shoalhaven river systems. Translocated populations in NSW are found in the Mongarlowe River, Queanbeyan River upstream of the Googong Reservoir and in Cataract Dam. In the ACT, it is restricted to the Murrumbidgee, Paddys and Cotter River. | PMST | None – ecological study area not suitable as habitat. |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|
| *Prototroctes maraena* | Australian Grayling | E | V | The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones. The species has also recorded in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). The species has been found over 100 km upstream from the sea. It has been recorded from many rivers across its range, particularly in Tasmania and Victoria. In NSW it is found from the Shoalhaven River south, with important river systems for the species including the Shoalhaven River, Bega River and Clyde River systems. | PMST | None – ecological study area not suitable as habitat. |
| **Invertebrates** | | | | | | |
| *Meridolum corneovirens* | Cumberland Plain Land Snail | E | - | Primarily inhabits Cumberland Plain Woodland (an endangered ecological community). This community is grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish. | 449 – BioNet | Moderate – this species is likely to use habitats within the ecological study area. |
| *Synemon plana* | Golden Sun Moth | E | CE | The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. The species' historical distribution extended from Bathurst (central NSW) through the NSW Southern Tablelands, through to central and western Victoria, to Bordertown in eastern South Australia. Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by wallaby grasses Austrodanthonia spp. Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses Austrostipa spp. or Kangaroo Grass Themeda australis. | PMST | Low – no suitable habitat and no records found nearby. This species has not been recorded in the locality in the past and predicted presence in the PMST is based on modelled habitat |

| Scientific Name | Common Name | BC Act | EPBC Act | Habitat requirements | Number of records (source)* | Likelihood of occurrence |
|---|---|---|---|---|---|---|

Distribution and habitat requirement information adapted from:

- Australian Government Department of the Environment http://www.environment.gov.au/biodiversity/threatened/index.html
- NSW Department of Planning, Industry and Environment http://www.environment.nsw.gov.au/threatenedspecies/
- Department of Primary Industries – Threatened Fish and Marine Vegetation http://pas.dpi.nsw.gov.au/Species/All_Species.aspx
- Data source includes
- Number of records from the NSW Department of Planning, Industry and Environment Wildlife Atlas record data (Accessed March 2020); and
- Identified from the Protected Matters Search Tool (PMST) Australian Government Department of Sustainability, Environment, Water, Populations and Community http://www.environment.gov.au/epbc/pmst/index.html

**Key:**

E = endangered species

E2 = endangered population

V = vulnerable species

M = migratory species

*PMST – Protected Matters Search Tool, BioNet – BioNet Atlas of NSW

# Appendix C. Tests of significance

Tests of significance have been conducted for threatened species, populations and communities that were recorded in the ecological study area during field surveys or were identified as having a moderate or high potential to occur in the ecological study area based on the presence of suitable habitat (see Appendix B).

The proposal would be assessed under Part 5 of the EP&A Act. Section 7.3 of the BC Act outlines the 'test of significance' that is to be undertaken to assess the likelihood of significant impact upon threatened species or ecological communities listed under the BC Act. These tests of significance have been undertaken in accordance with the *Threatened Species Test of Significance Guidelines* (Office of Environment and Heritage 2018), which outlines a set of guidelines to help applicants/proponents of a development or activity with interpreting and applying the factors of the assessment process. The guidance provided by the former Office of Environment and Heritage has been used here in preparing these tests of significance and in determining whether there is likely to be a significant impact to a threatened species, population or ecological community listed under the BC Act.

For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The ecological communities and species subject to this assessment are outlined in **Table C.1** along with the predicted impact from the proposal.

**Table C.1 Threatened biodiversity subject to this assessment**

| Species / community | BC Act | EPBC Act | Predicted impact (habitat in ha) |
|---|---|---|---|
| Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act) | - | CE | <0.001 ha |
| Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act) | CE | - | 1.74 ha |
| River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act) | E | - | 0.07 ha |
| *Grevillea juniperina* subsp. *juniperina* | V | - | 0.06 ha of potential habitat. No direct impact to individual plants |
| Cumberland Plain Land Snail (*Meridolum corneovirens*) | E | - | <0.001 ha (<10 $m^2$) |
| Green and Golden Bell Frog (*Litoria aurea*) | E | E | 0.11 ha (potential non-breeding habitat) |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | V | V | 1.2 ha (foraging habitat) |

| Species / community | BC Act | EPBC Act | Predicted impact (habitat in ha) |
|---|---|---|---|
| **Insectivorous bats (cave-roosting)** | | | |
| Little Bent-winged Bat (*Miniopterus australis*) | V | - | 1.92 ha (foraging habitat) |
| Large Bent-winged Bat (*Miniopterus orianae oceanensis*) | V | - | |
| Southern Myotis (*Myotis macropus*) | V | - | |
| **Insectivorous bats (hollow-roosting)** | | | |
| Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) | V | - | 1.92 ha (foraging habitat) and 4 hollow-bearing trees |
| Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) | V | - | |
| Greater Broad-nosed Bat (*Scoteanax rueppellii*) | V | - | |
| Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) | V | - | |
| **Woodland birds** | | | |
| Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) | V | - | 1.2 ha (foraging habitat) |
| Varied Sittella (*Daphoenositta chrysoptera*) | V | - | |
| **Nectarivorous birds** | | | |
| Little Lorikeet (*Glossopsitta pusilla*) | V | - | 1.2 ha (foraging habitat) and 4 hollow-bearing trees |
| Swift Parrot (*Lathamus discolor*) | E | CE | |
| **Large predatory birds** | | | |
| Little Eagle (*Hieraaetus morphnoides*) | V | - | 1.2 ha (foraging habitat) |
| Square-tailed Kite (*Lophoictinia isura*) | V | - | |
| Powerful Owl (*Ninox strenua*) | V | - | |
| Masked Owl (*Tyto novaehollandiae*) | V | - | |

# Biodiversity Conservation Act 2016 assessment

**Threatened ecological communities**

The threatened ecological communities that are present in the proposal site and are subject to this assessment include:

- Cumberland Plain Woodland in the Sydney basin Bioregion
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**

**i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

**ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

In addressing this question, the local occurrence of these threatened ecological communities is taken to be the community that occurs within the ecological study area and all contiguous vegetation. Risk of extinction is used here as the likelihood that the local occurrence of the ecological community would become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the threatened ecological community from the proposal. Composition refers to the assemblage of species and the physical structure of the community.

Cumberland Plain Woodland in the Sydney basin Bioregion is listed as a critically endangered ecological community and is considered to be facing an extremely high risk of extinction in New South Wales in the immediate future. The River-Flat Eucalypt Forest TEC is considered likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

The threatened ecological communities subject to this assessment are already at risk of extinction and the proposal would exacerbate this risk. However, the proposal is considered unlikely to result in the extinction of the local occurrence of any TECs. The proposal is predicted to remove around 1.74 hectares of the Cumberland Plain Woodland TEC and a smaller extent of the River-Flat Eucalypt Forest TEC (0.07 hectares). The greatest impact to Cumberland Plain Woodland TEC is to poor quality regenerating woodland and derived grasslands. Higher quality remnants would be retained. When the impacts are considered in the local context (i.e. the ecological study area, a 50-metre buffer around the proposal site), this includes 58 percent of the Cumberland Plain Woodland TEC and 48 percent of the River-Flat Eucalypt Forest TEC present in the ecological study area. This proportion is only accounting for a narrow band around the proposal site. A more valuable calculation would be the proportional impact of the occurrence of these TECs in the locality (the area within a 10-kilometre radius surrounding the proposal site). When this is considered, the proportional impact to Cumberland Plain Woodland TEC (0.09 percent) and River-Flat Eucalypt Forest TEC (0.02 percent) are very low.

| Plant community type (PCT) | % cleared in CMA | Condition class | BC Act | Direct impact[1] (ha) | Area in ecological study area[2] (ha) | Area in locality (ha)[3] |
|---|---|---|---|---|---|---|
| Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) | 93 | Moderate | CE | <0.001 | 0.89 | 2088 |
| | | Poor | CE | 1.13 | 1.7 | |
| | | Derived grassland | CE | 0.61 | 0.81 | |
| | **Sub-total** | | | **1.74** | **3.46** | |

| Plant community type (PCT) | % cleared in CMA | Condition class | BC Act | Direct impact[1] (ha) | Area in ecological study area[2] (ha) | Area in locality (ha)[3] |
|---|---|---|---|---|---|---|
| Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (835) | 93 | Poor | E | 0.07 | 0.55 | 1560 |

[1] Area to be cleared based on ground-truthed vegetation mapping within the proposal site boundary.
[2] Based on a 50-metre buffer around the proposal site.
[3] Based on regional mapping within a 10km radius of the ecological study area.

The proposal is considered unlikely to substantially and adversely modify the composition of the two TECs so that their local occurrences are placed at risk of extinction. The local occurrences of these TECs have already been substantially and adversely modified by past land use practices. All TECs subject to this assessment are currently suffering from altered composition caused by a very large reduction in ecological function, as indicated by:

- altered community structure (i.e. missing structural layers)
- altered species composition (i.e. lack of native species)
- disruption of ecological processes (i.e. altered drainage)
- invasion and establishment of exotic species resulting in weed dominance
- degradation of habitat
- fragmentation.

The highest quality vegetation within the ecological study area would mostly be avoided through design, including through the establishment of an environmental protection area in the south west of the proposal site. Impacts would be primarily to poor quality regenerating woodland and derived grasslands. The proposal is not considered likely to further modify the composition of any of the TECs within the ecological study area such that the local occurrence of either TEC is placed at risk of extinction. The composition of the threatened ecological communities within the ecological study area is predicted to remain intact after the implementation of the proposal. However, the remaining patches would be smaller.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal is predicted to remove around 1.74 hectares of the Cumberland Plain Woodland TEC and a smaller extent of the River-Flat Eucalypt Forest TEC (0.07 hectares). More than 99 percent of this impact would be to poor quality woodland and derived grasslands.

Fragmentation is unlikely to occur from the proposal as the work would largely involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the proposal would not result in the breaking apart of large blocks of high-quality examples of threatened ecological communities. No further habitat fragmentation on a landscape scale would occur because of the proposal. Isolation of habitats is likely to increase by a small extent as the distance between patches on either side of the proposal site would be increased.

Due to the conservation significance of these TECs (particularly the critically endangered Cumberland Plain Woodland in the Sydney basin Bioregion), the remaining patches of these TECs within NSW are likely to be important for their survival. However, the patches within the proposal site are small and are largely degraded and higher-quality remnants adjacent to the ecological study area would be retained. Furthermore, there would be no impact to priority conservation land core habitats or regional corridors (mapped to the west of the proposal site and avoided through design). As such, the TEC patches within the ecological study area can be considered less important than larger high-quality examples of these TECs in the locality that retain high levels of ecological integrity and function.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38 listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to the TECs subject to this assessment (see **Table C.2**). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

**Table C.2 Key threatening processes that may result from the proposal that may affect threatened ecological communities**

| Clear threatening process | Relevance to the proposal |
|---|---|
| Clearing of native vegetation | Yes. The proposal would result in clearing of native vegetation. |
| Infection of frogs by amphibian chytrid causing the disease chytridiomycosis | Yes. The proposal may result in the introduction or spread of amphibian chytrid. However, hygiene measures would be followed to prevent spread of this fungus. |
| Infection of native plants by *Phytophthora cinnamomi* | Yes. The proposal may result in the introduction or spread of *Phytophthora cinnamomi*. However, hygiene measures would be followed to prevent spread of *Phytophthora cinnamomi*. |
| Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae | Yes. The proposal may result in the introduction or spread of Exotic Rust Fungi. However, hygiene measures would be followed to prevent spread of Exotic Rust Fungi. |
| Invasion and establishment of exotic vines and scramblers | Yes. The proposal may result in the invasion and establishment of exotic vines and scramblers. However, weed control measures would be followed to prevent invasion and establishment of exotic vines and scramblers. |
| Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata* | Yes. The proposal may result in the invasion and establishment of African Olive *Olea europaea* L. subsp. *cuspidata*. However, weed control measures would be followed to prevent invasion and establishment of African Olive *Olea europaea* L. subsp. *Cuspidata.* |
| Invasion, establishment and spread of *Lantana camara* | Yes. The proposal may result in the invasion and establishment of *Lantana camara*. However, weed control measures would be followed to prevent invasion and establishment of *Lantana camara.* |
| Invasion of native plant communities by exotic perennial grasses | Yes. This key threatening process is already affecting the site. The proposal may result in further invasion and establishment of exotic perennial grasses in native vegetation that would be retained. However, weed control measures would be followed to prevent this potential impact. |
| Removal of dead wood and dead trees | Yes. Some dead wood and dead trees would be removed as part of the proposal. |

**Conclusion**

In summary, the proposal is considered unlikely to have an adverse effect on the extent of the two TECs such that the local occurrence of each is likely to be placed at further risk of extinction. The impacts to these PCTs is primarily (>99 percent) to poor-quality woodland and derived grasslands. The impact is small when considered in the context the extent of the TECs within the broader locality. The highest quality vegetation in the ecological study area would largely be avoided through design. The proposal is considered unlikely to substantially and adversely modify the composition of any of the TECs as the current composition of the TECs is highly modified.

There is unlikely to be any further increase in fragmentation from the proposal. The TECs within the ecological study area are not recognised as important to the long-term survival of the TECs in the locality as the patches are small and in poor to moderate condition. Furthermore, only a slither (and possibly realistically avoidable) of moderate quality woodland identified as important under the Cumberland Plain Recovery Plan (i.e. priority conservation land) would be impacted. The proposal would contribute to some KTPs that cannot be mitigated against including clearing of native vegetation and removal of dead wood and dead trees.

Considering the context of the TECs and intensity of the potential impacts to these TECs from the proposal, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to these TECs.

***Grevillea juniperina* subsp. *juniperina* (Juniper-leaf Grevillea)**

*Grevillea juniperina* subsp. *juniperina* plants were identified along the southern bank of the large man-made dam in the north of the ecological study area during surveys. These plants may have grown from the transportation of seeds in alluvium soil around Ropes Creek when the dam was built, based on the regrowth of riparian vegetation along the bank. Potential habitat for this species is typically woodland areas on Wianamatta Shale and Tertiary alluvium. Around 30 plants were also identified just outside of the ecological study area in the south west near Ropes Creek. This species appears to be somewhat common along the Ropes Creek corridor based on the prevalence of recorded sightings.

The proposal would result in the removal of around 0.06 hectares of potential habitat. No individual plants would be directly impacted by the proposal.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a. **in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

According to the Environmental Impact Assessment Guidelines for *Grevillea juniperina* subsp. *juniperina* (NSW National Park and Wildlife Service 2002), all populations should be assumed to be viable. Therefore, the four plants along the southern bank of the large man-made dam in the north of in the ecological study area are part of a local viable population around Ropes Creek.

Based on publicly available data, there are 1,092 recorded sightings of *Grevillea juniperina* subsp. *juniperina* in the locality. Considering single records investigated near the ecological study area contained numerous plants, the number of individuals in the locality is likely to be much higher. Over 30 plants were also identified to the west of the ecological study area on the edge of Ropes Creek. Considering this, the population size in the locality is likely quite high.

No individual plants would be impacted by the proposal. The proposal would remove a small area of potential habitat, however the majority of potential alluvial habitat would remain around Ropes Creek. The proposal is unlikely to place *Grevillea juniperina* subsp. *juniperina* at risk of extinction.

b. **in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
    i. **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

ii. **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

c. **in relation to the habitat of a threatened species or ecological community:**
   i. **the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   ii. **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   iii. **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would directly impact (remove) 0.06 hectares of potential habitat. There may also be a small some indirect impacts on the moderate quality woodland to be retained through edge effects, however considering this species is able to grow in open and disturbed sites these edge effects are unlikely to make the habitat unsuitable.

Fragmentation is unlikely to occur from the proposal as the work would largely involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the proposal would not result in the breaking apart of large blocks of high-quality habitats. No further habitat fragmentation on a landscape scale would occur because of the proposal.

Importantly, the proposal would mostly avoid the highest quality alluvium habitat for *Grevillea juniperina* subsp. *juniperina* through design. The work would be undertaken at the edge of the habitat and avoids impacts to the core habitats of the viable population on the edge of Ropes Creek.

d. **whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

e. **whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to *Grevillea juniperina* subsp. *juniperina*, the proposal would directly contribute to one key threatening process (KTPs) listed under the BC Act; Clearing of native vegetation. The proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds, particularly exotic grasses that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for the *Grevillea juniperina* subsp. *juniperina* adjacent to the ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The proposal would directly impact (remove) 0.06 hectares of potential habitat. None of the plants identified in and around the ecological study area would be directly impacted by the proposal. These plants are considered part of the Ropes Creek population, which would not be directly impacted by the proposal. The 0.06 hectares of potential habitat removal is a very small proportion of the area of available alluvial habitat around Ropes Creek Therefore an overall conclusion has been made that the proposal is unlikely to result in a significant impact to *Grevillea juniperina* subsp. *juniperina*.

**Cumberland Plain Land Snail (*Meridolum corneovirens*)**

Live Cumberland Plain Land Snails were found in leaf litter and dumped rubbish in moderate quality woodland vegetation (PCT 849) in the ecological study area during the surveys undertaken for the proposal. This vegetation is the highest quality habitat for the Cumberland Plain Land Snail in the ecological study area due to the presence of a thick leaf litter layer, some large wood debris and piles of dumped rubbish that likely provide sheltering opportunities. Poor quality vegetation across the rest of the ecological study area is likely too disturbed and isolated for the Cumberland Plain Land Snail, however piles of dumped rubbish should be considered during the clearing process.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Cumberland Plain Land Snail primarily inhabits Cumberland Plain Woodland. It lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps and occasionally shelters under rubbish where it is available. It feeds on fungus.

The moderate quality woodland (PCT 849) in the west of the ecological study area that is contiguous with the Ropes Creek riparian corridor presents suitable habitat for the Cumberland Plain Land Snail. The snails were identified in the environmental protection area right on the edge of the proposal site, so this species may spread into the surrounding open and regenerating vegetation, however much of the poor-quality woodland in the study area is unsuitable for this species.

The proposal has been designed to avoid this moderate quality woodland, however considering the proximity of the proposal site boundary some impacts to the ground layer are anticipated. The proposal would remove <0.001 hectares (<10 $m^2$) of suitable habitat for the Cumberland Plain Land Snail, including a small area of surrounding poor-quality regenerating woodland. Although the proposal would result in a direct impact to habitat of the Cumberland Plain Land Snail, the highest quality habitat is to the west of the development proposal site around the Ropes Creek riparian corridor. Pre-clearing surveys and translocation efforts would reduce the potential for direct mortality of individuals during clearing.

This small amount of habitat removal is not considered likely to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
- **ii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **iii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
- **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would remove around <0.001 hectares (<10 $m^2$) of potential habitat for the Cumberland Plain Land Snail.

Fragmentation is unlikely to occur from the proposal as the work would largely involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the proposal would not result in the breaking apart of large blocks of high-quality habitats. No further habitat fragmentation on a landscape scale would occur because of the proposal. The proposal would increase the isolation between the high-quality habitat in the west of the ecological study area and poor-quality habitats in the east. Although these poor-quality areas would become suitable habitat in the future, they currently are likely too disturbed and not inhabited by this species.

Importantly, the proposal would mostly avoid the highest quality patch of habitat for the Cumberland Plain Land Snail through design. The work would be undertaken at the edge of the habitat and avoids impacts to the core habitats on the edge of Ropes Creek.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Cumberland Plain Land Snail, the proposal would directly contribute to two key threatening processes (KTPs) listed under the BC Act:

- Clearing of native vegetation
- Removal of dead wood and dead trees

The proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for the Cumberland Plain Land Snail adjacent to the ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The Cumberland Plain Land Snails identified in the ecological study area were inhabiting vegetation that would largely remain unimpacted by the proposal. The largest area of high-quality habitat would remain to the west of the ecological study area. Pre-clearing surveys of vegetation and rubbish piles, and translocation of individuals prior to clearing would reduce the potential for direct mortality of animals. The impact to habitat would be the edge of a large high-quality habitat and the proposal would not result in fragmentation or isolation of high-quality habitat. Overall, the proposal is unlikely to reduce the population size of the Cumberland Plain Land Snail or decrease the reproductive success of this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to the Cumberland Plain Land Snail.

**Green and Golden Bell Frog (*Litoria aurea*)**

The Green and Golden Bell Frog was not identified in the ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment. Targeted surveys for the Green and Golden Bell Frog were undertaken in proximity to the ecological study area as part of the Archbold Road Upgrade and Extension REF (WSP | Parsons Brinckerhoff 2017), which was unsuccessful at locating this species.

Although records of this species in the locality are rare, the Green and Golden Bell Frog has a moderate likelihood of occurring in habitats in the ecological study area based on the presence of suitable habitat. The proposal would

directly impact (remove) up to 0.11 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats*:*

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Green and Golden Bell Frog is found in a wide variety of water bodies, commonly in disturbed habitats, but not in fast flowing streams. Breeding habitat in NSW includes water bodies that are still, shallow, ephemeral, unpolluted (but the frog can be found in polluted habitats), unshaded, with aquatic plants and free of Mosquito Fish (*Gambusia holbrooki*) and other predatory fish, with terrestrial habitats that consisted of grassy areas and vegetation no higher than woodlands, and a range of diurnal shelter sites (Pyke & White 1996).

The proposal would remove up to 0.11 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat. The Green and Golden Bell Frog has not been identified in the ecological study area though may occur based on the presence of suitable habitat and connectivity that the Ropes Creek riparian corridor provides between the ecological study area and the most recent record (2012) in the locality. The proposal would not directly impact on a known breeding site or key population. The loss of habitat would be to foraging and sheltering habitat only. This impact is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would remove up to 0.11 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat.

Fragmentation is unlikely to occur from the proposal as the work would largely involve removing farm dams along two first order drainage lines that do not provide any east-west connectivity. The habitat removed would likely represent sheltering and foraging habitats for any individuals moving along the Ropes Creek corridor. The Ropes Creek corridor and north-south connectivity would remain after the completion of the proposal.

The habitat that would be removed meets the description of suitable habitat for the Green and Golden Bell Frog (Pyke & White 1996), however this species has not been recorded in the ecological study area. The habitat is likely to represent sheltering and foraging habitat for individuals dispersing across the landscape and is a small proportion of a very large number of similar quality farm dams in the locality. The main connectivity corridor near the ecological study area would be represented by Ropes Creek, which would not be impacted by the proposal. Therefore, the habitats that would be removed are unlikely to be highly important to the long-term survival of the Green and Golden Bell Frog in the locality.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Green and Golden Bell Frog, the proposal is consistent with three key threatening processes listed under the BC Act:

- Clearing of native vegetation
- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands
- Chytridiomycosis due to amphibian Chytrid Fungus.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for the Green and Golden Bell Frog in the surrounding landscape.

The proposal would only impact flow regimes on the two first order streams that cross the ecological study area, however these are very ephemeral and only drain run-off from the immediate surroundings into Ropes Creek, which is normally trapped by the two dams anyway. Therefore, the proposal is unlikely to significantly contribute to this Key Threatening Process.

The disease Chytridiomycosis already exists in the Cumberland Plain and as such it is unlikely that the proposal would further exacerbate this Key Threatening Process. Construction activities would follow frog hygiene practices to limit the spread of this disease.

**Conclusion**

This species has not been identified in the ecological study area and no individuals are expected to be directly impacted. The proposal would remove up to 0.11 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat. The proposal would not directly impact on a known breeding site. The habitats are likely to represent foraging and shelter for individuals dispersing across the landscape and are a small proportion of the availability of similar quality habitat in the locality. Surveys for this species would be undertaken as part of the pre-clearing process prior to the commencement of clearing and de-watering of ponds. Overall, the proposal is considered unlikely to result in a significant impact to the Green and Golden Bell Frog.

**Grey-headed Flying-fox (*Pteropus poliocephalus*)**

The Grey-headed Flying-fox is considered moderately likely to forage in the trees within the ecological study area, particularly *Eucalyptus moluccana* and *Eucalyptus tereticornis*. No roost camps are present in the ecological study area, however the bats from the Parramatta Park camp and/or the intermittent Ropes camp are likely to forage in the ecological study area.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.

There are no roost camps located in the ecological study area and at the time of this assessment the proposal would not directly impact on any known breeding / maternity site. As such, the impacts of the proposal to the

Grey-headed Flying-fox would be limited to loss of feeding habitat caused by direct clearing or damage to native vegetation during the construction phase.

The proposal would remove around 1.2 hectares of potential foraging habitat (although it is not likely that the entirety of this habitat is used), however, removal of vegetation would be avoided where possible. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within the locality. Given the relatively widespread nature of similar poor-quality vegetation in the locality and abundance of higher-quality foraging habitat within the feeding range of the camps located near the ecological study area, the proposal is not expected to significantly affect the life cycle of the species.

The proposal is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The potential habitat of the Grey-headed Flying-fox within the ecological study area is limited to foraging habitat and includes all vegetation where fruiting and flowering trees and shrubs are present. The extent of potential foraging habitat for the Grey-headed Flying-fox would be reduced by around 1.2 hectares. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered.

Importantly, the proposal would not result in fragmentation of habitat for the Grey-headed Flying-fox. This species is highly mobile and would freely fly long distances (up to 50 km) over open areas including urbanised city centres to move between roost camps and foraging sites. The proposal would not affect the movement of the Grey-headed Flying-fox between habitat patches.

Importantly, the proposal would not affect the most important habitats for Grey-headed Flying-fox within the locality. The most important habitats for the local Grey-headed Flying-fox sub-populations are the roosting camps at Parramatta Park (Nationally Important) and Ropes Creek (intermittent). These camps would not be affected by the proposal. Foraging habitat within the ecological study area is likely to form part of an overall foraging range of these sub-populations and would only form a small proportion of available habitat for this species. As such, the foraging habitat within the ecological study area is unlikely to be of critical importance for the survival of the Grey-headed Flying-fox within the locality.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to Grey-headed Flying-fox, the proposal would directly contribute to one key threatening process (KTPs) listed under the BC Act; Clearing of native vegetation. The proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for the Grey-headed Flying-fox adjacent to the ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The Grey-headed Flying-fox would be impacted by a small reduction in extent of suitable foraging habitat from the proposal of around 1.2 hectares. No roosting camps or other important habitat would be impacted. As such, the proposal is considered unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to the Grey-headed Flying-fox.

**Insectivorous bats (cave-roosting)**

The species subject to this assessment include:

- Little Bent-winged Bat (*Miniopterus australis*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Southern Myotis (*Myotis macropus*)

The Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis were not identified in the ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis are moderately likely to occur within the ecological study area based on the presence of native vegetation providing habitat for these species. These species have been recorded widely in the locality and are likely to use the ecological study area as foraging habitat. No roosting habitat would be impacted by the proposal.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Little Bent-winged Bat is generally found in well-timbered areas where they roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and occasionally buildings. They often share roosting sites with the Large Bent-winged Bat. In NSW the largest maternity colony is in close association with a large maternity colony of Large Bent-winged Bat. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites / maternity colonies are known in Australia.

The Large Bent-winged Bat primarily roosts in caves, but will also use derelict mines, storm-water tunnels, buildings and other man-made structures. The Large Bent-winged Bat forms populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 kilometres range of maternity caves. The Large Bent-winged Bat hunts in forested areas.

The Southern Myotis generally roosts in groups of 10 – 15 close to water in caves, mine shafts, hollow-bearing trees, storm-water channels, buildings, under bridges and in dense foliage. The Southern Myotis forages over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW, females have one young each year usually in November or December.

All vegetation within the ecological study area is likely to provide foraging habitat for these three species. The Southern Myotis will preferentially forage in the riparian zones and open water surface of Ropes Creek and potentially the dams within the ecological study area. Riparian zones are also likely to be a focal point for foraging of the Little Bent-winged Bat and Large Bent winged Bat. Only a minor area of riparian habitat would be impacted by the proposal, and the design of the proposal has minimised impacts to riparian vegetation.

The proposal would impact up to 1.92 hectares of suitable foraging habitat for these species, primarily poor condition woodland. Much of this area is not considered high-quality habitat. The current potential for these species to occur, based on the presence of potential foraging habitat around the proposal site, is unlikely to be affected by the proposal.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would remove around 1.92 hectares of potential foraging habitat for the Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis. However, much of the vegetation that would be impacted is considered poor quality habitat. The amount of habitat removal is small when the amount of available higher-quality habitat in the locality is considered.

Much of the native vegetation within the ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence. Importantly, the proposal would not result in fragmentation of habitat for these species. These species are highly mobile and will freely fly long distances over open areas to move between habitats. The proposal would not affect the movement of the Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis between habitat patches.

The vegetation in the ecological study area would form a small component of a larger foraging range for these species. Riparian vegetation is likely to be a focal point of foraging activity, as are the edges of vegetation patches. The loss of native vegetation from the ecological study area would reduce the amount of foraging habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants in the locality, the vegetation within the ecological study area is not considered as important for the long-term survival of these species.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis, the proposal is consistent with two Key Threatening Process (KTP) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis would potentially be impacted by a small reduction in extent of foraging habitat from the proposal. It is unlikely that roosting habitat would be affected. The proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to these threatened insectivorous bats.

**Insectivorous bats (hollow-roosting)**

The species subject to this assessment include:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

The Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat were not identified in the ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat are moderately likely to occur within the ecological study area based on the presence of suitable habitat (particularly vegetated riparian zones) and nearby records. These species have been recorded widely in the locality and are likely to use the ecological study area as foraging habitat on occasion. These species are widespread on the Cumberland Plain and are powerful flyers capable of fast long-distance travel for foraging.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a. **in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Eastern False Pipistrelle prefers to inhabit moist habitats with mature trees taller than 20 metres. This species generally roosts in eucalypt hollows, though has also been found under loose bark on trees or in buildings. The Eastern False Pipistrelle hibernates in winter and females are pregnant in late spring to early summer.

The Eastern Coastal Free-tailed Bat occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in human-made structures.

The Greater Broad-nosed Bat utilises a variety of habitats from woodland through to moist and dry open eucalypt forest and rainforest. This species usually roosts in tree hollows but has also been found in buildings. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of young.

The Yellow-bellied Sheathtail-bat roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. The Yellow-bellied Sheathtail-bat forages in most habitats including forested areas and open paddocks. Breeding has been recorded from December to mid-March, when a single young is born. The seasonal movements of this species are unknown but there is speculation about a migration to southern Australia in late summer and autumn.

The ecological study area is likely to provide suitable habitat for these four species. In particular, the riparian zones are likely to be a focal point for foraging due to the higher productivity of these areas (i.e. more insect prey available around creek lines). Tree hollows were also present in some remnant mature trees around the dam in the north of the proposal site, providing potential roosting opportunities. Tree hollows were recorded as moderately abundant in the large remnant trees in the ecological study area.

These species, particularly the Yellow-bellied Sheathtail-bat are large and fast flyers and will exploit the edges of vegetation and open treeless areas for foraging. As such, foraging habitat for these species is widespread in the locality. It is unknown whether the ecological study area contains a roost site for any of these species. However, the eight hollow bearing trees that were recorded in the ecological study area may provide some suitable roosting habitat for these species. Breeding may potentially occur in these trees or these trees may form part of the range of breeding bats and may be used intermittently as shelters. Other trees and vegetation in the ecological study area may also be suitable for roosting under loose bark or in foliage.

The proposal would impact up to 1.92 hectares of suitable foraging habitat and four hollow-bearing trees would be removed. However, much of this area is not considered high quality habitat. The current potential for these species to occur based on the presence of potential foraging habitat in the ecological study area and wider locality is expected to remain after completion of the project.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would remove around 1.92 hectares of suitable foraging habitat and four hollow-bearing trees would be removed. However, much of this area is considered poor quality habitat. The amount of habitat removal is small when the amount of available habitat in the locality is considered. Tree hollows were present in some remnant mature trees around the dam providing potential roosting opportunities. Tree hollows were recorded as moderately abundant in the large remnant trees in the ecological study area.

Much of the native vegetation within the ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence.

Importantly, the proposal would not result in fragmentation of habitat for these species. These species are highly mobile and will freely fly long distances over open areas to move between habitats. The proposal would not affect the movement of the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat between habitat patches.

The vegetation in the ecological study area would form a small component of a larger foraging range for these species. Riparian vegetation is likely to be a focal point of foraging activity, as are the edges of vegetation patches. The loss of native vegetation and hollow-bearing trees from the ecological study area would reduce the amount of habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants and abundance of tree hollows in the locality, the vegetation within the ecological study area is not considered as important for the long-term survival of these species.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat, the proposal is consistent with two Key Threatening Process (KTP) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The four insectivorous bat species subject to this assessment would potentially be impacted by a small reduction in extent of foraging habitat from the proposal. Up to four hollow-bearing trees that may be utilised as roosts would be impacted. The proposal is unlikely to reduce the population size or decrease the reproductive success of this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to these threatened insectivorous bats.

**Woodland birds**

The two woodland bird species concerning this assessment are known to utilise highly modified and partially-cleared habitats and are likely to pass through the ecological study area periodically. The ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to foraging. The species subject to this assessment include:

- Dusky Woodswallow (*Artamus cyanopterus*)
- Varied Sittella (*Daphoenositta chrysoptera*)

The Dusky Woodswallow and Varied Sittella were not identified in the ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Dusky Woodswallow primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. It feeds on invertebrates, mainly insects, which are captured whilst hovering or sallying above the canopy or over water. It also frequently hovers, sallies and pounces under the canopy, primarily over leaf litter and dead timber. Nests are an open, cup-shape, made of twigs, grass, fibrous rootlets and occasionally casuarina needles, and generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post.

The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.

Suitable foraging habitat for the Dusky Woodswallow and Varied Sittella is present within the ecological study area where there are rough-barked tree species and mature smooth-barked gums with dead branches. Breeding habitat is considered unlikely to be present, due to the poor quality of vegetation in the proposal site. However, potential breeding habitat is more likely to occur in the larger less disturbed vegetation remnants in the locality.

The loss of vegetation within the ecological study area would directly affect the opportunity for these woodland birds to feed in the area. The proposal would impact up to 1.2 hectares of potential suitable habitat for the Dusky Woodswallow and Varied Sittella. However, much of this potential suitable habitat is not considered critical habitat. The current potential for these species to occur, based on the presence of potential foraging habitat, is unlikely to be affected by the proposal.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The extent of habitat for the Dusky Woodswallow and Varied Sittella would be impacted by 1.2 hectares. However, much of this area is considered poor quality habitat. The amount of habitat removal is relatively small when the amount of available habitat in the locality is considered.

Much of the native vegetation within the ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence.

Movement of individuals and exchange of genetic material from the vegetation in the ecological study area to and from vegetation along the Ropes Creek corridor can be expected. Importantly, the proposal would not result in fragmentation of habitat for these species. These species are known to utilise highly modified and partially-cleared habitats and are likely to pass through the ecological study area on occasion. The ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to foraging. The proposal would not affect the movement of the Dusky Woodswallow and Varied Sittella between habitat patches.

The vegetation in the ecological study area would form a small component of a larger foraging range for these species. Riparian vegetation is likely to be a focal point of foraging activity, as are the edges of vegetation patches. The loss of native vegetation from the ecological study area would reduce the amount of foraging habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants in the locality, the vegetation within the ecological study area is not considered as important for the long-term survival of these species.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Dusky Woodswallow and Varied Sittella, the proposal is consistent with three Key Threatening Processes (KTP's) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees

The proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

These two woodland bird species would potentially be impacted by a small reduction in extent of foraging habitat from the proposal. The proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to these species.

**Nectarivorous birds**

The species subject to this assessment include:

- Little Lorikeet (*Glossopsitta pusilla*)
- Swift Parrot (*Lathamus discolor*)

The Little Lorikeet and Swift Parrot were not identified in the ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The Little Lorikeet is highly likely to occur within the ecological study area and was recorded in 2019 occurring 300 metres from the ecological study area in Shale Plains Woodland.

Additionally, the Swift Parrot is moderately likely to occur within the ecological study area and records indicate a scattered distribution throughout the locality. The nearest record is from St Clair in 2014, 3.5 kilometres north west of the ecological study area. However, the Swift Parrot is a migrant species that does not breed in the locality and is considered to occur within the ecological study area on an infrequent basis during winter migration.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Little Lorikeet occurs just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets are generally considered to be nomadic and forage mainly on flowers, nectar and fruit. The breeding biology of Little Lorikeets is partially known however studies indicate that nest hollows are located at heights of between 2 metres and 15 metres, mostly in living, smooth-barked eucalypts, and hollow openings are approximately 3 centimetres in diameter.

The Swift Parrot breeds only in Tasmania and breeding success is strongly correlated with the intensity and extent of flowering of Tasmanian Blue Gums. The majority of the species migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands.

No significant areas of potential foraging habitat for these species was identified during the field survey. *Eucalyptus tereticornis* is a winter flowering species and may provide a foraging resource for migrating Swift Parrots. A range of hollow sizes are present in large remnant trees in the ecological study area, which may provide roosting opportunities for both species and potentially nesting habitat for the Little Lorikeet. The proposal would impact up to 1.2 hectares of vegetation that would provide potential foraging habitat and four hollow-bearing trees would be removed. However, much of this area is not considered critical habitat for these species. Shelter and food resources in the ecological study area are likely to be important for the life cycle of these species, however there is a low potential that the proposal would adversely affect the life-cycle of the species to be impacted given the widespread occurrence of suitable foraging habitat and nearby records.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   - **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   - **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**

i. **the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
ii. **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
iii. **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would remove around 1.2 hectares of potential foraging habitat and four hollow-bearing trees would be removed. However, much of this area is considered poor quality habitat. The amount of habitat removal is relatively small when the amount of available habitat in the locality is considered. A range of hollow sizes are present in large remnant trees in the ecological study area, which may provide roosting opportunities for both species and potentially nesting habitat for the Little Lorikeet.

Much of the native vegetation within the ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence. Movement of individuals and exchange of genetic material from the vegetation in the ecological study area to and from vegetation along the Ropes Creek corridor can be expected. Importantly, the proposal would not result in fragmentation of habitat for these species. These species are highly mobile and will freely fly long distances over open areas to move between habitats. The proposal would not affect the movement of the Little Lorikeet and Swift Parrot between habitat patches.

The vegetation in the ecological study area would form a small component of a larger foraging range for these species. The Swift Parrot has been recorded in the locality (notably three records on Eastern Creek in 2019) and sporadically occurs in the urbanised areas of western Sydney during winter. *Eucalyptus tereticornis* is a winter flowering species and the trees in the ecological study area may provide a foraging resource for migrating Swift Parrots. Additionally, the Little Lorikeet has been recorded in 2019 occurring 300 metres from the ecological study area in Shale Plains Woodland, which also occurs in the ecological study area. A range of hollow sizes are present in large remnant trees in the ecological study area, which may provide roosting opportunities for both species and potentially nesting habitat for the Little Lorikeet. The Swift Parrot and Little Lorikeet may pass through the ecological study area during movements between larger foraging habitats (e.g. from Prospect Nature Reserve to Whalan Reserve and Wianamatta Regional Park and Nature Reserve), though the habitat that would be impacted is not considered to be important to the long-term survival of the species.

d. **whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The proposal would not impact on any declared area of outstanding biodiversity value.

e. **whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Little Lorikeet and Swift Parrot, the proposal is consistent with two Key Threatening Processes (KTP's) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

These two nectarivorous birds would potentially be impacted by a small reduction in extent of foraging habitat from the proposal. The loss of four large hollow-bearing tress may also reduce roosting and nesting (Little Lorikeet) opportunities in the locality. However, considering the small proportion of habitat to be lost, the proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to these species.

**Large predatory birds**

The four large predatory bird species concerning this assessment are known to utilise highly modified and partially-cleared habitats and are likely to pass through the ecological study area periodically. The ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to foraging.

The species subject to this assessment include:

- Little Eagle (*Hieraaetus morphnoides*)
- Square-tailed Kite (*Lophoictinia isura*)
- Powerful Owl (*Ninox strenua*)
- Masked Owl (*Tyto novaehollandiae*)

The Little Eagle, Square-tailed Kite, Powerful Owl and Masked Owl were not identified in the ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a. **in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet.

The Square-tailed Kite hunts primarily over open forest, woodland and mallee communities as well as over adjacent heaths and other low scrubby habitats in wooded towns. It feeds on small birds, their eggs and nestlings as well as insects. Seems to prefer structurally diverse landscapes.

The Powerful Owl is a sedentary species with a home range of approximately 1,000 hectares it occurs within open eucalypt, *Casuarina* or *Callitris* pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally, feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands.

The Masked Owl occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. They are also known to occasionally roost and nest in caves.

These large predatory bird species may visit the ecological study area on occasion to hunt, however no high-quality habitat is present within the ecological study area for these species. No large stick nests for the Little

Eagle and Square-tailed Kite were observed during the field surveys. The nearest record in 2015 of the Powerful Owl is located between Erskine Park and Eastern Creek (2km east of the ecological study area). This record is located in Shale Plains Woodland, vegetation which is also present in the ecological study area. Suitable marginal foraging habitat is present on the proposal site for the Powerful Owl. However, no large tree hollows suitable for breeding were observed during the field survey. Alternatively, the most suitable habitat for the Masked Owl exists along Ropes Creek. The Masked Owl exhibits no breeding habitat within the ecological study area.

The proposal would impact up to 1.2 hectares of potential foraging habitat for these species. However, much of this area is not considered critical habitat for these species. No nesting habitat for these species would be impacted by the proposal. Shelter and food resources in the ecological study area are likely to be important for the life cycle of these species, however there is a low potential that the proposal would adversely affect the life-cycle of the species to be impacted given the widespread occurrence of suitable foraging habitat and nearby records in the locality.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
- **ii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **iii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
- **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The extent of potential foraging habitat for the Little Eagle, Square-tailed Kite, Powerful Owl and Masked Owl would be reduced by 1.2 hectares. However, no high-quality habitat is present within the ecological study area for these species and these species may only visit the ecological study area on occasion to hunt. The amount of habitat removal is small when the amount of available habitat in the locality is considered. No stick nests or large hollows were observed during the field surveys.

Much of the native vegetation within the ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence. Importantly, the proposal would not result in fragmentation of habitat for these species. These species are known to utilise highly modified and partially-cleared habitats and are likely to pass through the ecological study area on occasion to hunt. The ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to foraging. The proposal would not affect the movement of these four large predatory bird species between habitat patches.

The vegetation in the ecological study area would form a small component of a larger foraging range for these species. The loss of native vegetation from the ecological study area would reduce the amount of foraging habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants in the locality, the vegetation within the ecological study area is not considered as important for the long-term survival of these species.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)**

The proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Little Eagle, Square-tailed Kite, Powerful Owl and Masked Owl, the proposal is consistent with three Key Threatening Processes (KTP's) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees

The proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

These four large predatory birds would potentially be impacted by a small reduction in extent of potential foraging habitat from the proposal. No breeding habitat is likely to be impacted. The proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to these species.

## Environment Protection and Biodiversity Conservation Act 1999 assessment

**Cumberland Plain Woodland in the Sydney Basin Bioregion**

An action is likely to have a significant impact on a Critically Endangered or Endangered ecological community if there is a real chance or possibility that it will:

**1. reduce the extent of an ecological community**

Based on the estimated construction proposal site, the project may result in the direct clearing of about <0.001 hectares of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. Therefore, the actual impact is likely to be limited to potential indirect edge effects on retained vegetation.

**2. fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines**

The proposal would not break apart continuous areas of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community into separate smaller 'fragments'. Impacts would be limited to the edge of a large contiguous patch. Habitat connectivity is expected to remain in a similar state after completion of the proposal and there is unlikely to be an alteration to community composition, altered species interactions, or altered ecosystem functioning in the locality due to the action. Habitat fragmentation is not considered an important impact of the action with regard to its context and intensity.

3. **adversely affect habitat critical to the survival of an ecological community**

Due to the conservation significance of this TEC, all remaining patches and associated habitat within NSW are likely to be important for its survival. An impact of <0.001 hectares has been calculated, however it is likely that this would be avoided, and the actual impact would be limited to potential indirect edge effects on retained vegetation. Therefore, it is unlikely that the proposal would adversely affect habitat critical to the survival of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

4. **modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**

Where the TEC would be removed by the action, all abiotic factors (i.e. water, nutrients and soil) would be permanently modified and/or destroyed through vegetation removal and construction of infrastructure. The proposal may also modify abiotic factors of retained vegetation based on the proximity of its operations, though these modifications are likely to be very minor.

5. **cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**

The composition of the TEC is likely to be modified as a result of the action through potential weed invasion and removal of vegetation. The patch of the TEC to be impacted is in moderate condition, though is already on the edge of a very disturbed area and suffering from edge effects. Some reduction in ecological function can be expected from indirect edge effects. Species composition in the patch is considered unlikely to occur as it is already highly altered by weed invasion from past disturbance. Functionally important species have already been lost from the patch and the proposal is not considered likely to cause any further substantial change in species composition.

6. **cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**
    a. **assisting invasive species, that are harmful to the listed ecological community, to become established**
    b. **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**

Weed introduction and spread and the infection of native plants by *Phytophthora cinnamomi* have been identified as being spread by construction machinery. The proposal site currently contains a high abundance of exotic perennial grasses throughout areas historically cleared for agriculture. Moderate condition woodland surrounding the Ropes Creek riparian corridor contains a lower abundance of exotic grasses, mostly due to shaded cover, though a moderate abundance of exotic shrubs is present (e.g. African Boxthorn). The proposal has the potential to result in the spread of existing exotic species and potential introduction of new species into these areas by ground disturbance and movement of plant propagules.

*Phytophthora* infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction for the project has the potential to introduce and transmit weed propagules and *Phytophthora*. This is a potential indirect impact through the spread and transmission of weeds and pathogens into retained habitat.

These impacts can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene but an impact, particularly from weeds, is likely. The project mitigation strategy and environmental management procedures should include guidance for preventing the introduction and/or spread of weeds and disease-causing agents such as bacteria and fungi. Considering the current disturbance of vegetation adjacent to the ecological study area, the proposal is unlikely to cause a substantial reduction in the quality or integrity of the occurrence of this TEC.

7. **interfere with the recovery of an ecological community.**

A national recovery plan for the TEC has not been prepared. However, the Cumberland Plain Recovery Plan (Department of Environment, Climate Change and Water 2010) has been prepared with the overall objective

provide for the long-term survival of the threatened biodiversity of the Cumberland Plain. As this TEC is restricted to NSW, this recovery plan should be considered.

The Cumberland subregion Biodiversity Investment Opportunities Map (BIO Map) (Office of Environment and Heritage, 2015) aims to achieve better biodiversity outcomes in Western Sydney by directing biodiversity investment funding to the strategic locations of greatest benefit. The areas identified for investment, termed priority investment areas, include core areas and biodiversity corridors of state and regional significance. The action would impact a very small edge of a vegetation patch that is connected to an area of mapped Priority Conservation Land or regional corridor. However, the proposal has been designed to avoid this vegetation so the actual impact is likely to be limited to potential indirect edge effects.

**Conclusion**

After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. The predicted impacts are minor.

**Green and Golden Bell Frog (*Litoria aurea*)**

The ecological study area contains suitable habitat for the Green and Golden Bell Frog. Although there are very few recent records of this species in the locality and no known populations, there is potential for the Green and Golden Bell Frog to disperse along the Ropes Creek riparian corridor. Therefore, the Green and Golden Bell Frog is moderately likely to occur in the habitats in the ecological study area.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

1. **lead to a long-term decrease in the size of a population**

The ecological study area contains some areas of habitat (PCT 1071) that meet characteristics that have been described for the Green and Golden Bell Frog. This species has not been confirmed in the ecological study area. A single record on Ropes Creek eight kilometres north of the ecological study area from 2012 may be evidence that a low-density population is active in the locality. This species may possibly disperse as far as 10 kilometres (White & Pyke 2008) and therefore has the potential to occur based on the presence of this suitable habitat and the connectivity corridor provided by Ropes Creek.

The proposal would impact up to 0.11 hectares of suitable aquatic habitat in the form of PCT 1071, as well as surrounding exotic grasslands that may be suitable foraging and dispersing habitat. The proposal would not directly impact on a known breeding site or key population. The loss of habitat would be to potential foraging and sheltering habitat only. The habitat lost is a very small proportion of the availability of similar-quality farm dam habitats in the locality. Therefore, the proposal is unlikely to lead to a long-term decrease in the size of a population.

2. **reduce the area of occupancy of the species**

The Green and Golden Bell is found in a wide range of water bodies across the Cumberland Plain, except fast flowing streams. This species is highly mobile and may disperse up to 10km. The Green and Golden Bell Frog has not been identified on the proposal site, therefore the proposal is unlikely to directly impact a population. The proposal would reduce the area of available foraging and sheltering habitat in the locality by 0.11 hectares. However, considering the availability of similar-quality farm dam habitats in the locality, the proposal is unlikely to reduce the area of occupancy of the Green and Golden Bell Frog in the Cumberland Plain.

3. **fragment an existing population into two or more populations**

Fragmentation is unlikely to occur from the proposal, as the farm dams along two first order drainage lines which would be removed do not provide any east-west connectivity. The habitat removed would likely represent potential sheltering and foraging habitats for any individuals moving along the Ropes Creek corridor. The Ropes Creek corridor and north-south connectivity would not be impacted by the proposal.

**4. adversely affect habitat critical to the survival of a species**

No critical habitat has been listed for the Green and Golden Bell Frog on the EPBC Act Register of Critical Habitat.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long-term evolutionary development
- For the reintroduction of populations or recovery of the species or ecological community.

The most important habitat for the Green and Golden Bell Frog located in the ecological study area is occurrence of PCT 1071. A moderate to high abundance of the predatory Eastern Gambusia was identified in these areas and so are somewhat reduced in their capacity to be used as successful breeding habitat. The habitats on site may be used as foraging and sheltering habitat by dispersing individuals and are unlikely to be critical to the species' survival.

**5. disrupt the breeding cycle of a population**

This species has not been recorded at the proposal site. No breeding is reasonably expected to occur. The impact would be limited to a reduction in potential sheltering and foraging habitat for dispersing individuals. The breeding cycle of a population is unlikely to be disrupted by the proposal.

**6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The proposal would reduce the area of available foraging and sheltering habitat in the locality by 0.11 hectares. However, considering the availability of similar-quality farm dam habitats in the locality, the action is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

**7. result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species' habitat**

Introduced Eastern Gambusia, which are known to prey on the tadpoles of the Green and Golden Bell Frog, are already established in the habitats in the ecological study area. Therefore, the proposal is unlikely to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

**8. introduce disease that may cause the species to decline, or**

The presence and spread of the Chytrid Fungus is recognised as a Key Threatening Process in Australia and is widely regarded as playing an important role in the decline of the Green and Golden Bell Frog. Chytrid Fungus is already widespread in NSW; however, some populations of this species are free from or resistant to it. It has been suggested that such populations are in areas inhospitable to the growth of the disease, such as fluctuating levels of salinity.

The disease has been recorded in the Parramatta key population. Any work in and around the suitable habitat during clearing would follow the Hygiene Protocol for the Control of Disease in Frogs (Department of Environment and Climate Change 2008b) to reduce the spread of Chytrid fungus. Therefore, the proposal is unlikely to introduce disease that may cause the species to decline.

**9. interfere with the recovery of the species.**

There is no recovery plan for the Green and Golden Bell Frog. The Management Plan for the Green and Golden Bell Frog Parramatta Key Population (Department of Environment and Climate Change, 2007b) provides a list of six strategies.

The proposal would reduce the area of available foraging and sheltering habitat in the locality by 0.11 hectares, which does not align with recovery of this species. However, given this is a very minor loss of habitat in proportion to the amount of similar-quality habitat available in the locality, the proposal is unlikely to interfere with the recovery of the Green and Golden Bell Frog.

**Conclusion**

This species has not been identified in the ecological study area and no individuals are expected to be directly impacted. The proposal would remove up to 0.11 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat. The proposal would not directly impact on a known breeding site or any habitat critical to the survival of this species. The habitats are likely to represent foraging and shelter for individuals dispersing across the landscape and are a small proportion of the availability of similar quality habitat in the locality. Surveys for this species would be undertaken as part of the pre-clearing process prior to the commencement of clearing and de-watering of ponds. Overall, the proposal is considered unlikely to result in a significant impact to the Green and Golden Bell Frog.

**Grey-headed Flying-fox (*Pteropus poliocephalus*)**

The Grey-headed Flying-fox is considered moderately likely to utilise the PCTs within the ecological study area as foraging habitat.

The Grey-headed Flying-fox exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. As a result, for this assessment, the impact has been considered in terms of 'important habitat' as opposed the presence of an 'important population'.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

**1. lead to a long-term decrease in the size of an important population of a species**

There are no roost camps in the ecological study area and the action would not affect any known permanent roosting, breeding / maternity site. Therefore, it is likely that the impacts of construction and operation of the action would be confined to minor loss of foraging habitat caused by direct clearing or damage to native vegetation during the construction phase. There is also a low risk of vehicle strike during operation.

The proposal would remove around 1.2 hectares of potential foraging habitat. Given the relatively widespread nature of similar poor condition vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of local individuals, the proposal is not expected to significantly affect important habitat or lead to a long-term decrease in the size of an important population.

**2. reduce the area of occupancy of an important population**

The area of occupancy of the Grey-headed Flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The area occupied by this species would remain the same after the action. No decrease in the area of occupancy for this species expected as a result of the proposal.

**3. fragment an existing important population into two or more populations**

Highly mobile species such as bats are expected to be less impacted by fragmentation. The Grey-headed Flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom in differing parts of the landscape. The proposal would not fragment an important population of the Grey-headed Flying-fox. Individuals would still be able to disperse between roosts along the east Australian coast. Genetic exchange within the population and dispersal would not be disrupted by the proposal.

**4. adversely affect habitat critical to the survival of a species**

This species typically exhibits very large home range and Grey-headed Flying-fox is known to travel distances of at least 50 kilometres from roost sites to access seasonal foraging resources. There are no known roost camps within the ecological study area and the proposal site does not provide critical roosting habitat. However, there are a number of known roost camps with a 50-kilometre radius of the proposal, the closest being the Nationally Important Parramatta Park camp and/or the intermittent Ropes Creek camp. The draft recovery plan for the Grey-headed Flying-fox identifies critical foraging habitat for this species as:

- Productive during winter and spring, when food bottlenecks have been identified
- Known to support populations of >30,000 individuals, within an area of 50-kilometre radius of a camp site
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (Sept-May)
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

Native vegetation within the ecological study area may constitute critical foraging habitat however the affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50-kilometre radius of the Parramatta Park camp and/or the intermittent Ropes Creek camp. Given the extensive nature of high-quality foraging habitats along the escarpment, the proposal is not expected to adversely affect foraging habitat critical to the survival of this species in this region.

**5. disrupt the breeding cycle of an important population**

As stated above there would be a minor impact on foraging habitat during the breeding cycle of the species. The proposal would not directly impact on a known roost camp / breeding or maternity site. Extensive foraging resources are available in the locality that would provide suitable resources during the maternity season. The habitats in the ecological study area are not limiting for this species.

**6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The impacts to foraging habitat are minimal and no evidence of a roost camp has been identified from the ecological study area. This impact is not expected to lead to a decline in the species in this region considering the magnitude of this impact and the expanse of high-quality foraging habitat available to local animals along the escarpment.

**7. result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat**

The action is unlikely to result in an invasive species harmful to the Grey-headed Flying-fox becoming established in the habitat. The potential for weed invasion is considered possible with a proposal of this nature and appropriate management and mitigation measures would be implemented during construction and operation of the proposal to reduce this threat. The management of invasive species would be managed under the construction environmental management plan and during operation of the facility using best practice methods.

**8. introduce disease that may cause the species to decline, or**

There are no known disease issues affecting this species in relation to the action. The action would be unlikely to increase the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the facility. This can be mitigated through the development

and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols to prevent the introduction or spread of pathogens.

The project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

**9. interfere substantially with the recovery of the species.**

The *Draft National Recovery Plan for the Grey-headed Flying-fox* (*Pteropus poliocephalus*) (Department of Environment Climate Change and Water, 2009) outlines the following actions:

- Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
- Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- Monitor population trends for the Grey-headed Flying-fox
- Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan

The recovery actions listed above are largely not applicable to the action and the action is not expected to interfere substantially with the recovery of the species.

**Conclusion**

The Grey-headed Flying-fox would suffer a small reduction in extent of suitable foraging habitat from the action. No breeding camps or other important habitat would be impacted. The action is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The action would not interfere with the recovery of the Grey-headed Flying-fox and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Grey-headed Flying-fox.

**Swift Parrot (*Lathamus discolor*)**

The Swift Parrot (*Lathamus discolor*) is considered moderately likely to occur based on the presence of suitable winter foraging habitat and potential roosting habitat in four large hollow-bearing *Eucalyptus tereticornis* trees.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

**1. lead to a long-term decrease in the size of a population**

The ecological study area contains some potential foraging and roosting (hollow-bearing trees) habitat for the Swift Parrot. While the habitat in the ecological study area is not optimal, the loss of potential feed trees would directly affect the species opportunity to feed in the area. However, the ecological study area is not considered a critical area for the Swift Parrot. The Swift Parrot may utilise trees in the ecological study area for foraging intermittently when no other suitable inland (i.e. box ironbark woodlands) or coastal resources (i.e. Spotted Gum or Swamp Mahogany forests) are available. The potential foraging habitat for this species would be reduced by

about 1.2 hectares, as well as a loss of up to four large hollow-bearing trees. Within the Cumberland subregion, this potential habitat removal represents less than 0.01 percent of the currently available habitat for this species.

The Swift Parrot does not breed in the ecological study area and the extent of habitat remaining in the locality area would provide sufficient resources to sustain future visitation, such that the action itself is unlikely to lead to a long-term decrease in the size of the Australian population.

**2. reduce the area of occupancy of the species**

Swift Parrots are vulnerable to the loss of quantity and quality of key forage tree species. As a large-scale migrant, it has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the region and may utilise trees in the ecological study area for foraging intermittently when no other suitable resources are available.

The project would contribute to the loss of potential foraging habitat which would reduce the area of habitat available. However, the action would not reduce the area of occupancy of this species which is estimated at 4,000 square kilometres.

**3. fragment an existing population into two or more populations**

Importantly, the action would not result in fragmentation of habitat for the Swift Parrot. This species is highly mobile and as a regular behaviour flies long distances over open areas to move between suitable foraging habitats. The action would not affect the movement of the Swift Parrot between habitat patches or fragment the population.

**4. adversely affect habitat critical to the survival of a species**

Key habitats for this species on the coast and coastal plains of New South Wales include large stands of Spotted Gum (*Corymbia maculata*), Swamp Mahogany (*Eucalyptus robusta*), Red Bloodwood (*Corymbia gummifera*) and Forest Red Gum (*Eucalyptus tereticornis*) forests. The ecological study area supports some Forest Red Gum and therefore suitable habitat for this species is considered to be present. The hollow-bearing trees in the ecological study area may also be used by migrating birds to rest.

The habitat within the ecological study area is considered to be secondary habitat for the Swift Parrot as this species is not regularly recorded from the area and it is not known as critical habitat.

**5. disrupt the breeding cycle of a population**

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania, and migrates to mainland Australia in autumn. As such, the action would not impact on breeding habitat for this species. Important winter foraging grounds would not be impacted.

**6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

Potential foraging habitat for this species would be reduced by about 1.2 hectares. Four hollow-bearing trees that may provide roosting habitat for migrating birds would also be removed. As a large-scale migrant, it has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the region and may utilise trees in the ecological study area for foraging intermittently when no other suitable resources are available. The action is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

**7. result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species' habitat**

The main invasive species harmful to the habitat for the Swift Parrot is weeds. Noisy Miners are abundant in and around the habitats in the ecological study area which may make the habitat less suitable for the Swift Parrot due to competitive exclusion. The action may result in weed invasion and the removal of habitat may concentrate

local miner populations increasing competition. The management of invasive species would be managed under in accordance with mitigation measures listed in **Table 8-1**.

**8. introduce disease that may cause the species to decline, or**

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the facility. This would be adequately mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols to prevent the introduction or spread of pathogens.

The project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

**9. interfere with the recovery of the species.**

The *National Recovery Plan for the Swift Parrot* (Commonwealth of Australia 2019) aims to achieve and sustain a positive population trend for the Swift Parrot over the life of the Recovery Plan. This will be achieved by implementing the actions set out in this Recovery Plan that minimise threats while protecting and enhancing the species' habitat throughout its range. These objectives would be achieved by implementing recovery actions for each of the following specific recovery objectives:

- Strategy 1: Develop and apply techniques to measure changes in population trajectory in order to measure the success of recovery actions.
- Strategy 2: Manage and protect known Swift Parrot breeding and foraging habitat at the landscape scale.
- Strategy 3: Reduce impacts from Sugar Gliders at breeding sites.
- Strategy 4: Improve understanding of foraging and breeding habitat use at a landscape scale in order to better target protection and restoration measures.

These objectives, and the associated recovery actions outlined in the *National Recovery Plan for the Swift Parrot* (Commonwealth of Australia 2019) are not applicable to the ecological study area or proposal. The identified recovery actions mostly relate to identifying the extent and quality of habitat, monitoring, raising community awareness, and coordinating and reviewing the recovery process. There is an action relating to manage and protect Swift Parrot habitat at the landscape scale. However, this action applies to fencing off habitat on private land to encourage regeneration of habitat, revising forestry practices, developing a strategic management plan for Swift Parrot breeding habitat in Tasmania, and providing Swift Parrot conservation information for consideration during the New South Wales Local Government Local Environmental Planning review process. The recovery actions identified in the *National Recovery Plan for the Swift Parrot* (Commonwealth of Australia 2019) would not be interfered with by the proposal.

**Conclusion**

The Swift Parrot would suffer a small reduction in extent of foraging habitat and loss of potential roosting habitat (four hollow-bearing trees) from the action. The action is unlikely to reduce the population size of the Swift Parrot or decrease the reproductive success of this species. The action would not interfere with the recovery of the Swift Parrot. For the Swift Parrot, impacts are most likely to be significant where a proposal or activity may result in loss of habitat in, or adjacent to priority foraging, nesting and roosting sites (Saunders and Tzaros, 2011). The proposal would not impact on any priority foraging habitat. As such, after consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Swift Parrot.

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# Appendix I

## Hydrology and Flooding

# Sydney Metro Precast Facilityies

## Technical Paper - Hydrology and Flooding

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**Sydney Metro Authority**

# Sydney Metro Precast Facilityies

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| Project Manager: | Katrina Smallwood |
| Author: | Lih Chong |
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Jacobs Australia Pty Limited

Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.jacobs.com



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## Contents

# Executive Summary

A Review of Environmental Factors (REF) has been prepared for the proposed Sydney Metro West precast facilities (the proposal) seeking approval under Part 5 of the *Environmental Planning and Assessment 1979* (EP&A Act) for the construction and operation of two precast facilities and associated ancillary infrastructure. The proposal site is located on the eastern side of Ropes Creek, in the suburb of Eastern Creek in the Blacktown local government area. Two (2) separate precast facilities, the northern precast facility and the southern precast facility comprise the overall proposal.

A hydrology and flooding assessment has been conducted to support the REF for the proposal. The assessment has considered the available flooding studies, policies and guidelines to define existing case flooding conditions and development controls for the proposal site. Additional hydrologic and hydraulic modelling was undertaken where there were data gaps, that is, for overland flooding around and through the proposal site, for the catchment development conditions relevant to the nature and timing of proposed development on and around the proposal site during its construction and operation.

Review of existing flooding conditions in Ropes Creek indicate that the proposal site is entirely above the 1% AEP flood extent. The proposal site is also mostly above the probable maximum flood, with exception of a small encroachment into the flood extent at the south-western corner of the southern precast site, outside the environmental protection area.

There are two main overland flow paths which pass through each of the northern and southern precast sites. These overland flow paths drain currently undeveloped upstream catchments located to the east of the proposal site. Management of these external flows through/around the site would be required.

An assessment of impacts of the proposal on flooding was undertaken based on qualitative assessment and updated hydrologic modelling. Potential impacts include partial impediment of Ropes Creek flows caused by filling in the south-western corner of the site resulting in negligible flood impacts in the probable maximum flood only, increases in peak flows being discharged to Ropes Creek due to development of the proposal site, impacts on creek geomorphology due to altered flow regime and impacts on overland flooding behaviour and drainage. The final-state construction phase and the operational phase of the proposal were considered to have similar potential impacts to flooding and hydrology. The potential change in impacts during a future climate change scenario were also considered. The cumulative impacts of the proposal in combination with other development in the area are addressed in the Review of Environmental Factors.

A range of mitigation and management measures have been identified to manage the potential impacts to flooding, and are summarised in Table 1. Indicative sizing has been provided for structural measures, which include stormwater/flood detention facilities and external flow diversion channels for the northern and southern precast sites.

Table 1: Construction and operational environmental management measures

| No. | Impact | Mitigation measure |
|---|---|---|
| F1 | Increase in mainstream peak flood flows | Detailed design of the proposal site would include provision of appropriate on-site stormwater detention/flood detention facilities to cater for up to and including the 1% AEP event. |

| No. | Impact | Mitigation measure |
|---|---|---|
| F2 | Geomorphic impacts due to changed flow regime in low flows and frequent flood events | Detailed design of the proposal site would include the provision of appropriate on-site stormwater detention/ flood detention facilities. Outlet sizing would be designed to satisfactorily mitigate potential increases in peak flows in frequent events. |
| F3 | Impacts on overland flooding and drainage conditions | Detailed design of the proposal site would include the provision of appropriate flow diversion channels or culverts for management of external flows. |
| F4 | | Detailed design would integrate with proposed Archbold Road cross drainage and road drainage outlets. |
| F5 | | Detailed design would provide appropriate scour protection works at channel/culvert discharge points to Ropes Creek. |
| F6 | Impacts on the proposal resulting from flooding | Detailed design would provide filling to a height of at least 0.5m above Ropes Creek 1% AEP flood level. |

# Key Terms

| Term | Meaning |
|---|---|
| AEIs | Areas of environmental interest |
| afflux | Increase in flood level as a result of obstruction to flow |
| AHD | Australian Height Datum. A common national surface level datum approximately corresponding to mean sea level. |
| Annual Exceedance Probability (AEP) | The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. In this study AEP has been used consistently to define the probability of occurrence of flooding. The following relationships between AEP and ARI applies to this study (ARR, 2019). |

| Frequency Descriptor | EY | AEP (%) | AEP (1 in x) | ARI |
|---|---|---|---|---|
| Very frequent | **12** | | | |
| | **6** | 99.75 | 1.002 | 0.17 |
| | **4** | 98.17 | 1.02 | 0.25 |
| | **3** | 95.02 | 1.05 | 0.33 |
| | **2** | 86.47 | 1.16 | 0.50 |
| Frequent | **1** | **63.2** | 1.58 | 1.00 |
| | 0.69 | **50.00** | 2 | 1.44 |
| | **0.5** | 39.35 | 2.54 | 2.00 |
| | 0.22 | **20.00** | 5 | 4.48 |
| | **0.2** | 18.13 | 5.52 | 5.00 |
| Infrequent | 0.11 | **10.00** | 10.00 | 9.49 |
| | 0.05 | **5.00** | 20 | 20.0 |
| | 0.02 | **2.00** | 50 | 50.0 |
| | 0.01 | **1.00** | **100** | 100 |
| Rare | 0.005 | 0.50 | **200** | 200 |
| | 0.002 | 0.20 | **500** | 500 |
| | 0.001 | 0.10 | **1000** | 1000 |
| Extremely Rare | 0.0005 | 0.05 | **2000** | 2000 |
| | 0.0002 | 0.02 | 5000 | 5000 |
| | | | ↓ | |
| Extreme | | | PMP | |

| Term | Meaning |
|---|---|
| ARR | Australian Rainfall and Runoff. Guidelines prepared by the Institute of Engineers Australia for the estimation of design floods. Reference is made to the 1987 or the 2019 versions of ARR, as specified. |
| Average Annual Damage (AAD) | Depending on its size (or severity), each flood will cause a different amount of flood damage to a flood prone area. AAD is the average damage per year that would occur in a nominated development situation from flooding over a very long period of time. |
| Average Recurrence Interval (ARI) | The long-term average number of years between the occurrences of a flood as big as or larger than the selected event. For example, floods with a discharge as great as or greater than the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event. Also refer to Average Exceedance Probability (AEP), which is the industry standard terminology for definition of design flood events. |
| catchment | The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location. |
| conveyance | The transport of flood water downstream. |
| development | Is defined in Part 4 of the EP&A Act<br>In fill development: refers to the development of vacant blocks of land that are generally surrounded by developed properties and is permissible under the current zoning of the land. Conditions such as minimum floor levels may be imposed on infill development.<br>New development: refers to development of a completely different nature to that associated with the former land use (e.g. The urban subdivision of an area previously used for rural purposes). New developments involve re-zoning and typically require major extensions of exiting urban services, such as roads, water supply, sewerage and electric power.<br>Redevelopment: refers to rebuilding in an area (e.g. As urban areas age, it may become necessary to demolish and reconstruct buildings on a relatively large scale). Redevelopment generally does not require either re-zoning or major extensions to urban services. |
| DIPNR | Former NSW Government Department of Infrastructure, Planning and Natural Resources. Now the Department of Planning Industry and Environment (DPIE). |
| discharge | The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second ($m^3/s$). Discharge is different from speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s). |
| effective warning time | The time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being |

| Term | Meaning |
|---|---|
| | undertaken. The effective warning time is typically used to move farm equipment, move stock, raise furniture, evacuate people and transport their possessions. |
| exceedances per year (EY) | The number of times an event is likely to occur or be exceeded within any given year. |
| flood | Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami. |
| flood fringe areas | The remaining area of flood prone land after floodway and flood storage areas have been defined. |
| flood liable land /flood prone land | Is synonymous with flood prone land (i.e.) land susceptibility to flooding by the probable maximum flood event. Note that the term flooding liable land covers the whole floodplain, not just that part below the FPL (see flood planning area) |
| floodplain | Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is flood prone land. |
| floodplain risk management options | The measures that might be feasible for the management of particular area of the floodplain. Preparation of a floodplain risk management plan requires a detailed evaluation of floodplain risk management options. |
| floodplain risk management plan | A management plan developed in accordance with the principles and guidelines in this manual. Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defines objectives. |
| flood plan (local) | A sub-plan of a disaster plan that deals specifically with flooding. They can exist at state, division and local levels. Local flood plans are prepared under the leadership of the State Emergency Service. |
| flood planning levels (FPLs) | Are the combination of flood levels (derived from significant historical flood events or floods of specific AEPs) and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans. FPLs supersede the "designated flood" or the “flood standard” used in earlier studies. |
| flood proofing | A combination of measures incorporated in the design, construction and alteration of individual buildings and structures subject to flooding, to reduce or eliminate flood damages. |
| flood readiness | Readiness is an ability to react within the effective warning time. |
| flood risk | Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances |

| Term | Meaning |
|---|---|
| | across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described below.<br>Existing flood risk: the risk a community is exposed to as a result of its location on the floodplain.<br>Future flood risk: the risk a community may be exposed to as a result of new development on the floodplain.<br>Continuing flood risk: the risk a community is exposed to after floodplain risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure. |
| flood storage areas | Those parts of the floodplain that are important for the temporary storage of floodwaters during passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas. |
| floodway areas | Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels. |
| freeboard | Provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the FPL is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. Freeboard is included in the flood planning level. |
| hazard | A source of potential harm or situation with a potential to cause loss. In relation to this technical paper the hazard is flooding which has the potential to cause damage to the community. |
| hydraulics | The study of water flow in waterways; in particular, the evaluation of flow parameters such as water level and velocity. |
| hydrograph | A graph which shows how the discharge or stage/flood level at a particular location varies with time during a flood. |
| hydrology | The study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods. |
| IFD | Intensity Frequency Duration. Describes rainfall in terms of intensity (typically mm/hr), frequency (e.g. ARI) and duration of the storm. |
| LEP | Local Environmental Plan |

| Term | Meaning |
|---|---|
| local overland flooding | Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam. |
| LPI | Land and Property Information |
| m AHD | metres Australian Height Datum (AHD) |
| m/s | metres per second. Unit used to describe the velocity of floodwaters. |
| $m^3/s$ | Cubic metres per second or "cumecs". A unit of measurement of creek or river flows or discharges. It is the rate of flow of water measured in terms of volume per unit time. |
| mainstream flooding | Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam. |
| modification measures | Measures that modify either the flood, the property or the response to flooding. |
| Northern precast facility | Proposed precast facility at the north of the proposal site |
| overland flow path | The path that floodwaters can follow as they are conveyed towards the main flow channel or if they leave the confines of the main flow channel. Overland flow paths can occur through private property or along roads. |
| probable maximum flood (PMF) | The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The probable maximum flood defines the extent of flood prone land, that is, the floodplain. |
| probable maximum precipitation (PMP) | The PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to probable maximum flood estimation. |
| proposal (the) | Construction of two separate precast facilities, including boiler, aggregate bins and consumables, hardstand/laydown areas, offices, parking, precast carousel including batch plant, and warehouses. |
| proposal site (the) | Site located at Lenore Drive, Eastern Creek |
| risk | Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of this technical paper it is the likelihood of consequences arising from the interaction of floods, communities and the environment. |

| Term | Meaning |
|---|---|
| runoff | The amount of rainfall which ends up as a streamflow, also known as rainfall excess. |
| scour | Erosion by mechanical action of water, typically of soil. |
| Southern precast facility | Proposed precast facility at the south of the proposal site |
| stage | Equivalent to water level (both measured with reference to a specified datum) |
| study area | Area encompassing the proposal site and surrounds. For the precast facility flooding assessment this was taken to be within 500m of the site. |
| TUFLOW | TUFLOW is a computer program which is used to simulate free-surface flow for flood and tidal wave propagation (hydraulics). It provides coupled 1D and 2D hydraulic solutions using a powerful and robust computation. The engine has seamless interfacing with GIS and is widely used across Australia. |
| XP-RAFTS | XP-RAFTS is a computer program which is used to simulate storm rainfall-runoff processes (hydrology) and estimate flood peak flows and temporal variation of flows. |

# 1. Introduction

## 1.1 Sydney Metro West Eastern Creek Precast Facilities

Sydney Metro propose to establish two precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. A Review of Environmental Factors (REF) has been prepared for the proposal seeking approval under Part 5 of the *Environmental Planning and Assessment 1979* (EP&A Act).

The proposal would comprise the following key features:

- Site establishment at the proposal site at Eastern Creek including vegetation clearing, remediation, and earthworks
- The establishment and operation of two separate adjacent and precast facilities on the proposal site, the northern and southern precast facilities. Each precast facility would include:
  - A precast yard including a shed for construction of precast concrete segments and storage laydown areas
  - Boiler, aggregate bins and consumables
  - Office facilities
  - On-site parking for up to 60 light vehicles
- Internal roads with entrances to each facility from the Western Access Road located between the northern and southern precast facilities (external roads would be subject to separate approvals)
- Ancillary supporting infrastructure, including utilities installation (power, water, sewerage, gas and communications), lighting, signage and landscaping.

The northern and southern precast facilities would operate concurrently, 24 hours a day, seven days a week for the majority of the lifespan of the project.

A small portion of the south-western portion of the proposal site would be conserved as an environmental protection area associated with the presence of Cumberland Plain Woodland. Vegetation within this area would be retained and protected during works.

The footprint and operational layout of the proposal is shown in Figure 1-1.

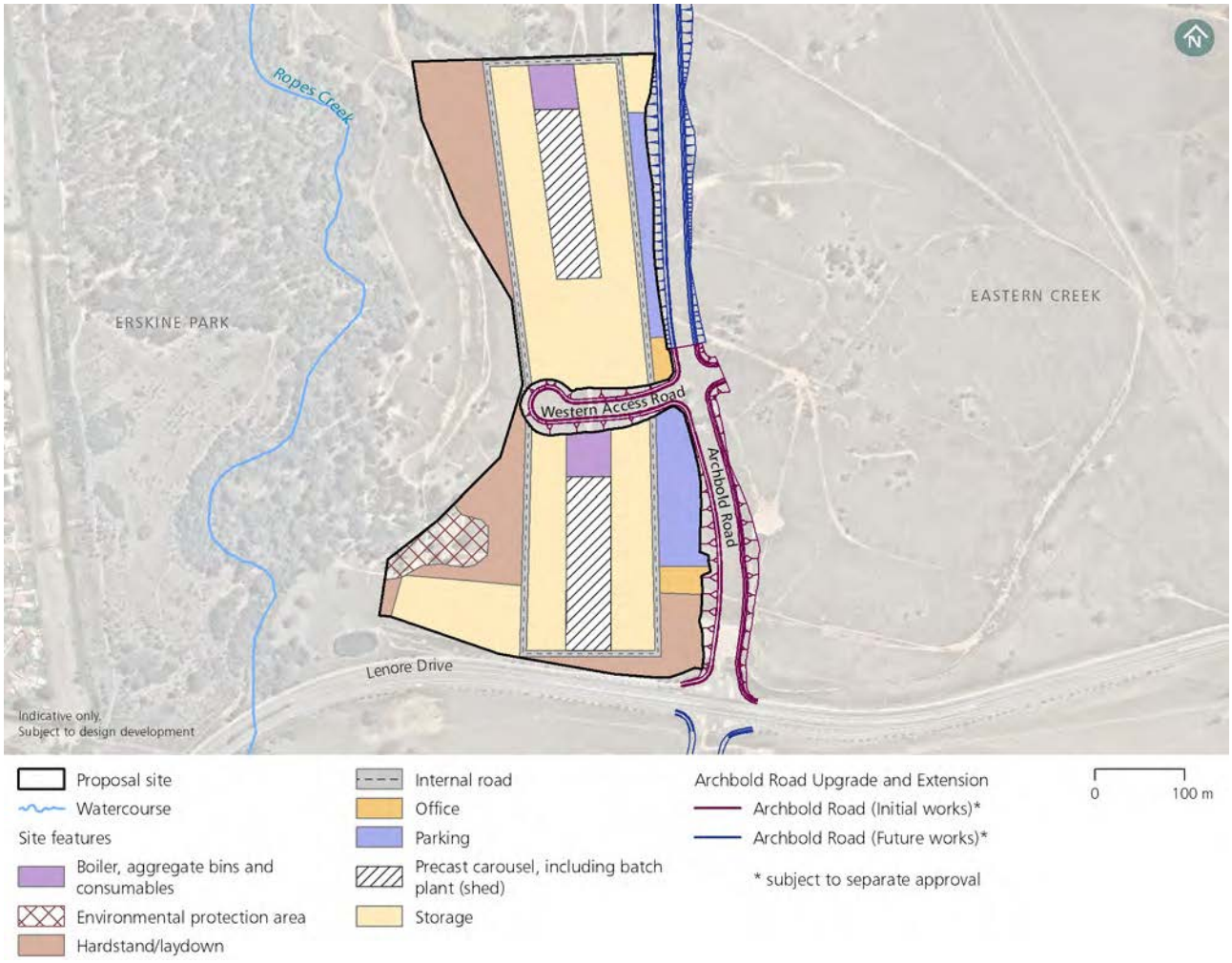



Figure 1-1: Overview of the proposal

## 1.2 Purpose and scope of this report

This technical paper, Technical Paper: Hydrology and Flooding, is one of a number of technical papers that form part of the REF. The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to catchment hydrology, and mainstream and overland flooding.

## 1.3 Structure of this report

The remainder of this report is structured as follows:

- Chapter 2 outlines the relevant legislative and policy framework
- Chapter 3 documents the assessment methodology including a description of the overall approach and the review of existing information
- Chapter 4 details the existing hydrologic environment
- Chapter 5 provides an assessment of the potential impacts of the proposal to flooding during construction, including cumulative impacts
- Chapter 6 provides an assessment of the potential impacts to flooding during the operation of the proposal. Discussion of potential impacts during future climate change scenario and cumulative impacts are also provided
- Chapter 7 identifies mitigation and management measures
- Chapter 8 provides conclusions and recommendations forthcoming from this study.

# 2. Legislative and policy framework

The assessment has been undertaken generally in accordance with the following key guidelines and design references as applicable:

- *Australian Rainfall and Runoff (*ARR) 2019
- *NSW Floodplain Development Manual* (NSW Government, 2005)
- Blacktown City Council policies planning instruments.

## 2.1 Australian Rainfall and Runoff 2019

*Australian Rainfall and Runoff 2019* ("ARR 2019"; reference: Ball et al, 2019) provides industry guidance on technical analysis and specifies design rainfall parameters for flooding and hydrologic studies in Australia. These guidelines have been adopted for new hydrologic assessment undertaken in this study.

The existing flood studies reviewed in this assessment are based on the design rainfall data provided in *Australian Rainfall and Runoff 1987* ("ARR 1987"; reference: Institute of Engineers Australia, 1987). The ARR 2019 design rainfall data provides design rainfall depths which vary from ARR 1987, due to analysis of an additional 30 years of data. For the 1% AEP event the difference is +/- 5% compared to ARR 1987, for storm durations between one hour and six hours, which are relevant to the proposal site.

Consideration of flood affectation and flood impacts during detailed construction planning should adopt ARR 2019 in line with the current industry guidance.

## 2.2 Floodplain Development Manual

The assessment of potential flooding impacts of the proposal on existing flood regimes has been conducted in accordance with the requirements of the *Floodplain Development Manual* (NSW Government, 2005), which incorporates the NSW Government's *Flood Prone Land Policy*. The key objectives of this policy are to identify potential hazards and risks, reduce the impact of flooding and flood liability on owners and occupiers of flood prone property, and to reduce public and private losses resulting from floods. This policy also recognises the benefits of the use, occupation and development of flood prone land.

## 2.3 Blacktown City Council Policies

### 2.3.1 Blacktown Local Environment Plan 2015

The Blacktown Local Environment Plan 2015 (Blacktown LEP 2015) adopts the Department of Planning and Environment's model flood planning clause as clause 7.1. The objectives of clause 7.1 Flood Planning are to:

- Minimise the flood risk to life and property associated with the use of land;
- Allow development on land that is compatible with the land's flood hazard, considering projected changes as a result of climate change; and
- Avoid significant adverse impacts of flood behaviour on the community.

This clause applies to land at or below the flood planning level or the highest historical flood level.

Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development—

(a) is compatible with the flood hazard of the land, and

(b) will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and

(c) incorporates appropriate measures to manage risk to life from flood, and

(d) will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and

(e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

In this clause—

- highest historical flood event means the highest recorded flood in the Blacktown local government area, which occurred in 1867.
- land at or below the flood planning level means the level of a 1:100 ARI (average recurrent interval) flood event plus 0.5 metres freeboard.

It should be noted that, although the provisions of the Blacktown LEP 2015 are taken into consideration, Sydney Metro is the determining authority for the proposal and the provisions of the LEP 2015 do not apply.

### 2.3.2 Blacktown Development Control Plan 2015

Section 9 in *Blacktown Development Control Plan 2015 – Part A Introduction and General Guidelines* (Blacktown DCP 2015) outlines the development controls related to development on flood prone land. In determining any application for development on land designated as being within the floodway or flood fringe, Council will take into consideration those matters listed under Section 79C of the *Environmental Planning and Assessment Act 1979* as appropriate. Council shall also take into consideration the following:

(a) Whether the proposed building materials are suitable

(b) Whether the buildings are to be sited in the optimum position to avoid flood waters and allow evacuation

(c) Whether proposed structures or the filling of land are likely to affect flood flows

(d) Whether consultation with other authorities is considered necessary (e.g. NSW Office of Water)

(e) The NSW Government Floodplain Development Manual 2005.

In general, Council is generally unlikely to support development which includes the filling of land within the floodway. Council would generally support development within the flood fringe subject to a range of development controls.

Relevant to the development of the proposal site (zoned Industrial), the floor level should be at least 300 millimetres above the designated flood level. Where subdivision is approved in industrial and commercial zones, the land must be filled to 300 millimetres above the designated flood level.

Section 10 in *Blacktown Development Control Plan 2015 – Part A Introduction and General Guidelines* includes provisions for development on addressing the risks posed from overland flooding. Review of the document indicates that it is geared towards in-fill development and redevelopment in urban areas, for example ensuring that individual building footprints and fencelines on properties are designed to ensure adequate provision for movement of overland flow and site drainage and to ensure unobstructed overland flows. The guidelines for developing around overland flow areas are not directly relevant to the proposal site, which is a greenfield site in an area which is zoned for industrial use.

Note that Blacktown DCP 2015 provides development controls for Blacktown LGA in general. The *Ropes Creek Precinct Draft Development Control Plan 2016* provides development controls specific to the Ropes Creek Precinct, which includes the proposal site. Refer to Section 2.4.

It should also be noted that, although the provisions of the Blacktown DCP 2015 are taken into consideration, Sydney Metro is the determining authority for the proposal and the provisions of the DCP 2015 do not apply.

### 2.3.3 Blacktown City Council Engineering Guide for Development 2005

The *Blacktown City Council Engineering Guideline for Development 2005* (amended 2018) specifies design requirements for trunk drainage and on-site stormwater detention. Trunk drainage is to be designed to the 1% AEP event and open channels require a 0.5m freeboard from the design flood level to top of bank.

Sizing and permissible discharge rates for on-site stormwater detention systems are generally based on pro-rata values depending on the site area, for most catchment areas where in-fill development is occurring. The proposal site is a greenfield site and is denoted being within "Exempt OSD Catchment Areas – Regional Basins or Trunk Drainage Augmentation", hence the pro-rata sizing approach does not apply. There is no specific guidance on design storm events to be accommodated or sizing requirements contained in the *Engineering Guide,* although local councils generally require that the developed case peak site discharge rates are not to exceed the existing case for storm events between the 1 in 2 exceedances per year (EY) event up to the 1% AEP event. Sizing of on-site stormwater or flood detention system should be undertaken to achieve this.

Note that the *Engineering Guide* specifies the use of ARR 1987 design rainfall data for design and assessment. The *Engineering Guide* has not yet been updated to adopt the current ARR 2019 design rainfall and procedures. For the design and assessment for the greenfield proposal site it is considered appropriate to adopt ARR 2019.

It should be noted that, although the provisions of the *Engineering Guide* are taken into consideration, Sydney Metro is the determining authority for the proposal and the provisions of the *Engineering Guide* do not apply.

## 2.4 Ropes Creek Precinct Draft Development Control Plan 2016

The *Ropes Creek Precinct Draft Development Control Plan 2016* has been prepared in response to rezoning of the land in the Ropes Creek Precinct (Lot 10 DP1157491), including the proposal site, to 'IN2 General Industrial' under the State Environmental Planning Policy Western Sydney Employment Area 2009 (WSEA SEPP) and in accordance with section 74(C) of the *Environmental Planning and Assessment Act 1979*. The DCP is listed as "Under Consideration" as of May 2020.

The *Ropes Creek Precinct Draft Development Control Plan 2016* includes provisions for management of flooding on the site. Excerpts of the DCP are provided below.

**Objectives**

- To ensure that development does not increase the flood hazard or extents.
- To ensure that development within flood affected land is appropriately designed to minimise damage to property or risks to loss of life.

**Controls**

Council may require a flood assessment to be undertaken for allotments that are flood affected, within an overland flow path or in proximity to such land. The assessment would need to demonstrate that the development will not increase flood impacts, hazard or damage to other properties. Specifically, in accordance with the WSEA SEPP 2009, the assessment may need to address the following (subject to advice from Council):

- the impact of flooding on proposed development, including an estimation of the extent of flood prone land, high hazard areas and floodways, the implications of the full range of floods and the safety of people using or within the site;
- the impact of proposed development on flood behaviour on and off the site (including existing and planned development in the wider area);
- the flood hazard in the area (including hydraulic hazard, flood warning time, rate of rise of floodwater and duration of floods) and access and evacuation issues; and
- viable strategies to manage any adverse impact of proposed development on flood behaviour.

In general, Council would not support development, including the filling of land, within the floodway due to its function as the main flowpath for flood waters once the main channel has overflowed and the possibility of a significant threat to life and property occurring in a major flood.

For industrial and commercial buildings, the floor level is to incorporate a minimum 500mm freeboard above the designated flood level.

Buildings within a flood prone area are to be constructed with materials approved by Council's Building Services Team, resistant to damage by immersion by flood waters for prolonged periods, to the satisfaction of Council.

The *Ropes Creek Precinct Draft Development Control Plan 2016* is to be read in conjunction with Blacktown Council Engineering Guidelines. It does not provide specific requirements for sizing of on-site stormwater or flood detention facilities. The guidance as discussed in Section 2.3.3 is referred to.

It should be noted that, although the provisions of the Ropes Creek Precinct Draft DCP 2016 are taken into consideration, Sydney Metro is the determining authority for the proposal and the provisions of the Draft DCP 2016 do not apply.

# 3. Assessment methodology

## 3.1 Overall assessment approach

The objective of this hydrology and flooding assessment is to address flood immunity and flood impacts for the proposed precast facilities. The methodology for this hydrology and flooding assessment is summarised below:

- Desktop review of available flood study reports from Blacktown City Council and other sources to characterise existing flooding conditions at the proposal site and the surrounding area. Parameters considered include:
  - The topography in the vicinity of the sites and presence of flow paths and watercourses, using aerial laser survey data
  - Flood depths and levels
  - Flood hazard
  - Flood hydraulic categories including floodway and flood storage
- Where there is no adequate existing flood information (i.e. for overland flooding), flood modelling has been undertaken to determine flooding conditions
- Review of Blacktown City Council planning and policy documents to identify flood-related development controls including impact mitigation requirements
- Assessment of potential impacts to flooding as a result of the proposal for construction and operational phases
- Identification of the potential impacts to the proposal caused by flooding
- Identification of mitigation and management measures.

## 3.2 Review of Existing Studies

### 3.2.1 South Creek Flood Study (Worley Parsons, 2015)

Worley Parsons conducted a flood study for South Creek and its tributaries, including Ropes Creek in the section adjacent to the proposal site. The study focussed on mainstream flooding within the main creeks and did not include minor overland flow paths. Flood modelling was undertaken using RMA-2 software to define the existing flooding conditions for the 20, 50, 100, 200 and 500 year ARI events (i.e. 5%, 2%, 1%, 0.2% and 0.5% AEP events, respectively) and probable maximum flood event. The study was based on ARR 1987 design rainfall data and procedures. Flood mapping including depths, levels, flood hazard and hydraulic categories is presented.

The flood study is referenced in this flooding assessment to define mainstream flood behaviour in Ropes Creek. The study is adopted by Blacktown City Council.

### 3.2.2 Master Planning reporting for Ropes Creek Precinct

The NSW Office of Strategic Lands (part of the NSW Department of Planning, Industry and Environment Cluster) commissioned assessments to guide future development and formulation of development controls for the Ropes Creek Precinct. The proposal site comprises one sub-portion of the overall Ropes Creek Precinct. A watercycle management strategy was undertaken including assessment of hydrology, flood hydraulics and water quality management. Hydrologic and flood modelling was undertaken in accordance with ARR 1987 design rainfall and procedures.

### 3.2.3 Archbold Road Upgrade and Extension – Review of Environmental Factors (Transport for NSW, 2017)

A concept design and REF was prepared for the upgrade and extension of Archbold Road in Minchinbury south through the Western Sydney Employment Area (WSEA) to Old Wallgrove Road in Horsley Park. The project would form a new road immediately to the east of the proposal site and linking to Lenore Drive and Old Wallgrove Road in the south.

The *Archbold Road Flooding and Drainage* (Lyall & Associates, 2016) was undertaken to support the REF. Hydrologic and flood modelling was undertaken as a part of the study to determine existing flooding conditions, inform the road drainage design and demonstrate the satisfactory mitigation of flooding and hydrologic impacts. A concept design drainage layout including water quality devices was prepared as shown on Figure 3-1. It indicates that the major cross drainage structures in the vicinity of the proposal site are aligned with the major overland flow paths, while pavement drainage outlets are located adjacent to the cross drainage. Flows discharged from the Archbold Road drainage structures (without the proposal site) were anticipated to be conveyed in the natural overland flow paths through the existing proposal site. There does not appear to be provision of formalised channels to convey flows from the drainage structures to Ropes Creek.

No water quality basins are proposed adjoining the proposal site in the Archbold Road Upgrade and Extension REF (2017). The Archbold Road Upgrade and Extension Addendum REF includes the provision of a basin to the west of the site, adjacent to the Western Access Road.

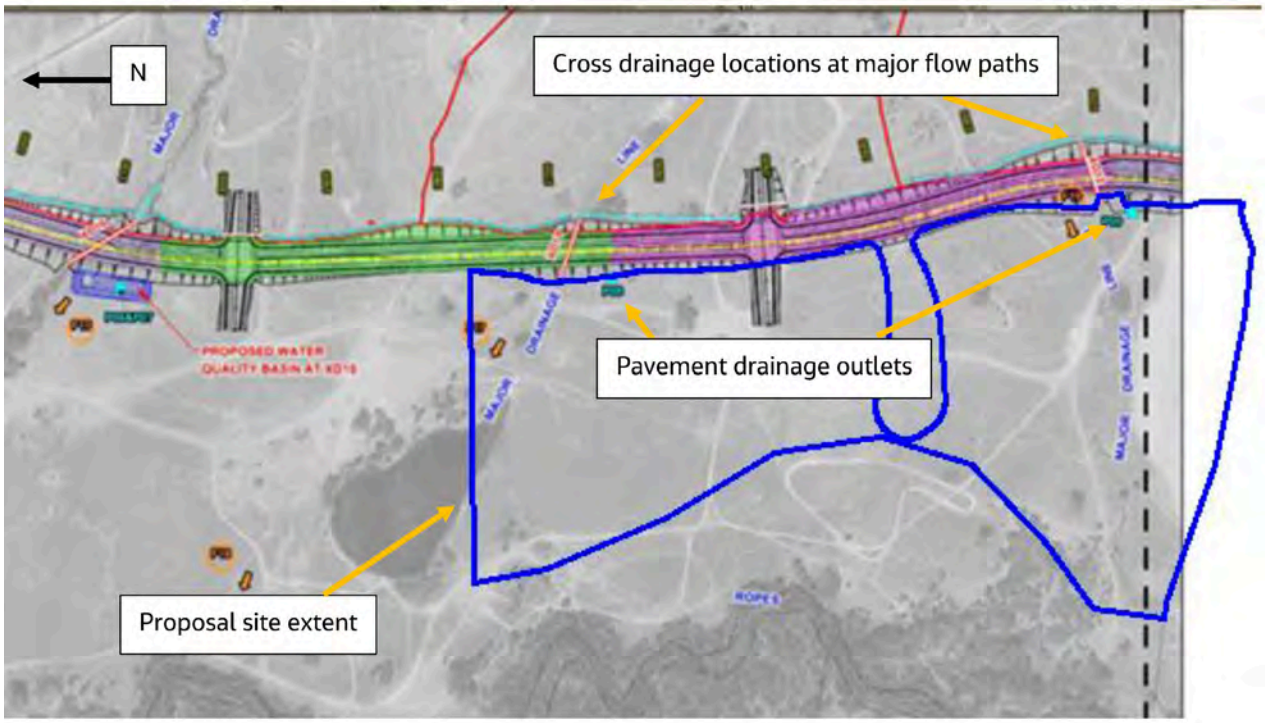



Figure 3-1: Excerpt of concept drainage strategy from *Archbold Road Flooding and Drainage* (Lyall & Associates, 2016)

Drainage structures were sized for a 1% AEP design flow based on ARR 1987, which is expected to result in larger sizes than if based on the current ARR 2019 guidelines. Sizing and design flows for two cross drainage structures are indicated in Table 3-1. For the purpose of the investigation, sizing of the cross drainage was based on peak flow estimates for a level of development consistent with present day conditions. However, consideration has also been given to the potential for uncontrolled development within the catchments which drain to the cross drainage structures.

Pavement drainage outlet locations were indicated but sizing and design flows not provided.

Table 3-1: Archbold Road upgrade concept design sizing for cross drainage structures near proposal site

| **Structure** | **Dimensions** | **1% AEP Flow ($m^3/s$)** |
|---|---|---|
| XD11<br><br>(northern proposal site) | 3 x 1200mm x 600mm box culvert | 4.93* see Note 1 |
| XD12<br><br>(southern proposal site) | 1 x 1350mm diameter pipe | 3.49* see Note 1 |

* Note 1: Cross drainage design flows extracted from Table 7.1 in Lyall & Associates (2016) for "post road upgrade". Assumes no development to currently greenfield catchment area upstream of the road.

As a part of the assessment for the proposal, sizing of drainage structures on the proposal site need to be cognisant of the proposed hydraulic structures for the Archbold Road upgrade.

# 4. Existing hydrologic environment

## 4.1 Proposal site

The proposal is located at Eastern Creek within the Blacktown City Council local government area. The proposal would be located at Lenore Drive, Eastern Creek (the proposal site).

The 'proposal site' refers to the area that would be directly impacted (except for the environmental protection area) by the proposal as shown in Figure 1-1. The environmental protection area would be conserved, with vegetation retained and protected during works.

The proposal site is an undeveloped greenfield site within the broader context of surrounding established and future industrial areas at Eastern Creek.

## 4.2 Study area hydrologic context

The proposal site is located on the eastern side of Ropes Creek, in the suburb of Eastern Creek in the Blacktown local government area. The existing topography on the site consists of gently undulating land which generally grades to the west towards Ropes Creek.

Ropes Creek flows from south to north to the west of the proposal site. Two main overland flow paths (northern and southern flow paths) originate from the area to the east of the proposal site on land which is gently to moderately sloping, refer to Figure 4-1. A minor, shallow flow path is also present in the middle section of the proposal site.

The northern flow path drains in a north-westerly direction, intersecting the north-eastern corner of the proposal site and drains to a large existing farm dam which straddles the northern boundary of the proposal site, which then discharges to Ropes Creek to the north of the proposal site. There is a second, small existing farm dam on the northern flow path, located about 300 metres upstream of the large farm dam and situated outside of the proposal site boundary.

The southern flow path drains in a westerly direction through the southern portion of the proposal site, approximately 100 metres north of Lenore Drive, and discharges to Ropes Creek adjacent to the south-western corner of the proposal site. There is an existing farm dam on the southern flow path, located within the footprint of the proposal site.

The proposal site and surrounding area was historically agricultural and grazing land, and to date has largely retained its rural appearance. The land includes coverage by grassland with scattered stands of trees. The riparian corridor along Ropes Creek, immediately to the west of the proposal site is moderately to densely vegetated with trees. There is little to no riparian vegetation along the two flow paths.

There is currently no existing development within or in the immediate vicinity of the proposal site. There are existing industrial properties located approximately 1 kilometre to the west of the site, on the catchment boundary or outside the catchment areas draining to the two overland flow paths. Existing residential development is present in the suburb of Erskine Park on the western side of Ropes Creek. Lenore Drive is an existing main road running east-west to the south of the proposal site but is outside of the overland flow paths catchment areas.

## 4.3 Assessment of Existing Case Flooding

### 4.3.1 Ropes Creek Mainstream Flooding

The *South Creek Flood Study* (Worley Parsons, 2015), adopted by Blacktown City Council, is referenced for the design flooding conditions in Ropes Creek at the proposal site. The 1% AEP flood mapping from the study has been extracted and mapped with the proposal site layout on Figure 4-2 to Figure 4-5. The flood levels, flood depths, flood hazard and hydraulic categories are presented. The probable maximum flood levels and depths are shown on Figure 4-6 and Figure 4-7, respectively.

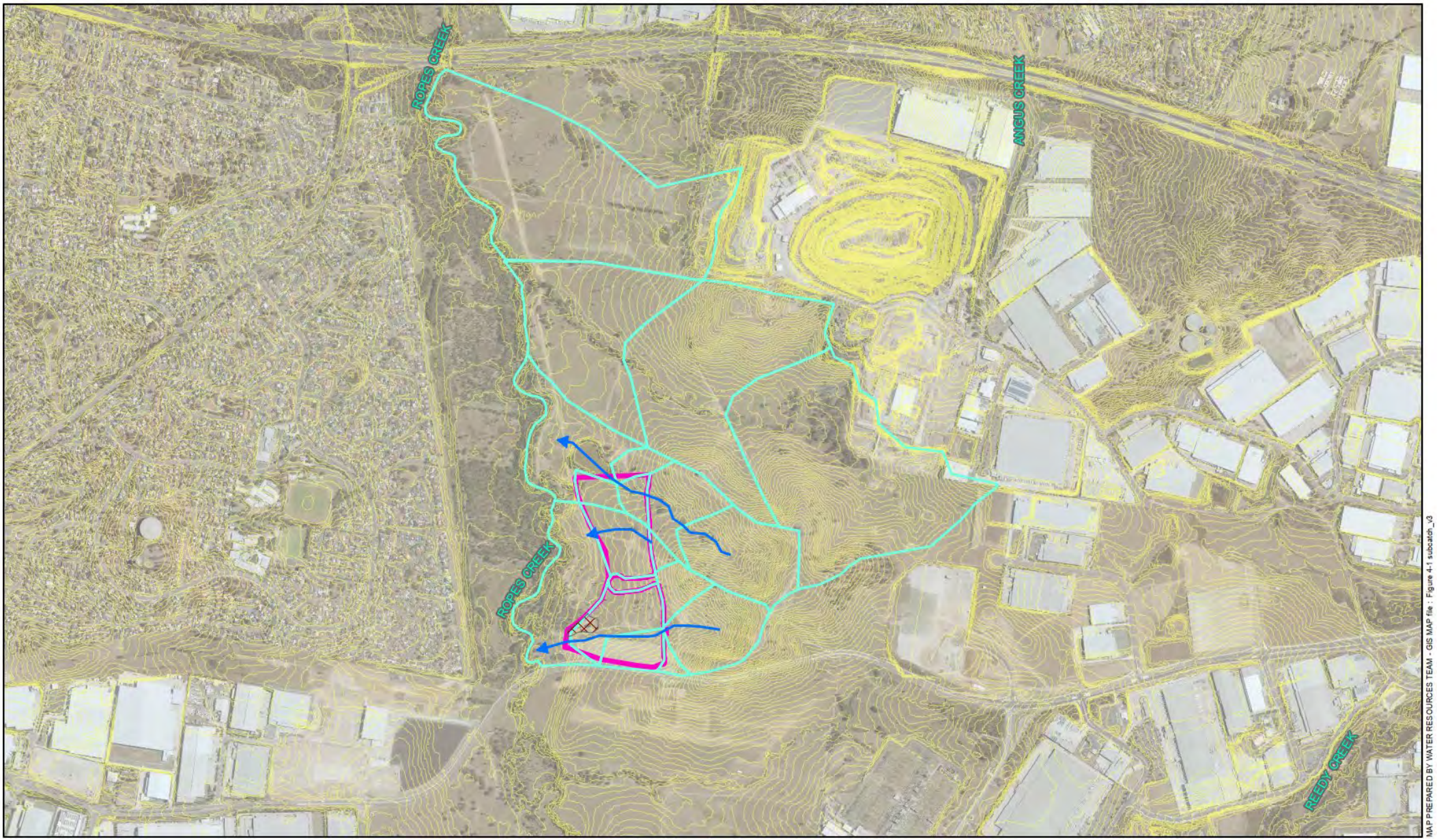



Figure 4-1: Study area terrain and existing hydrologic sub-catchments

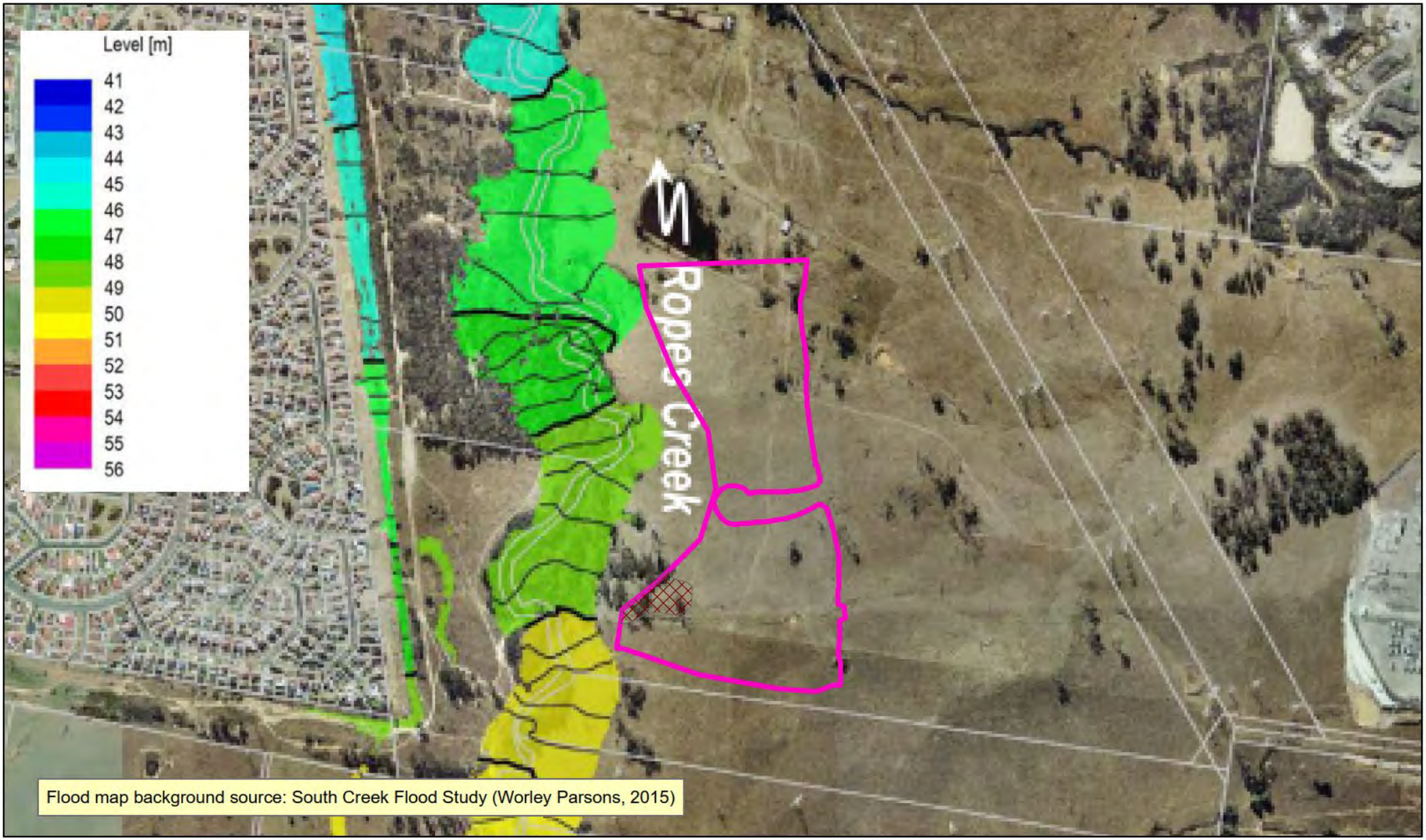
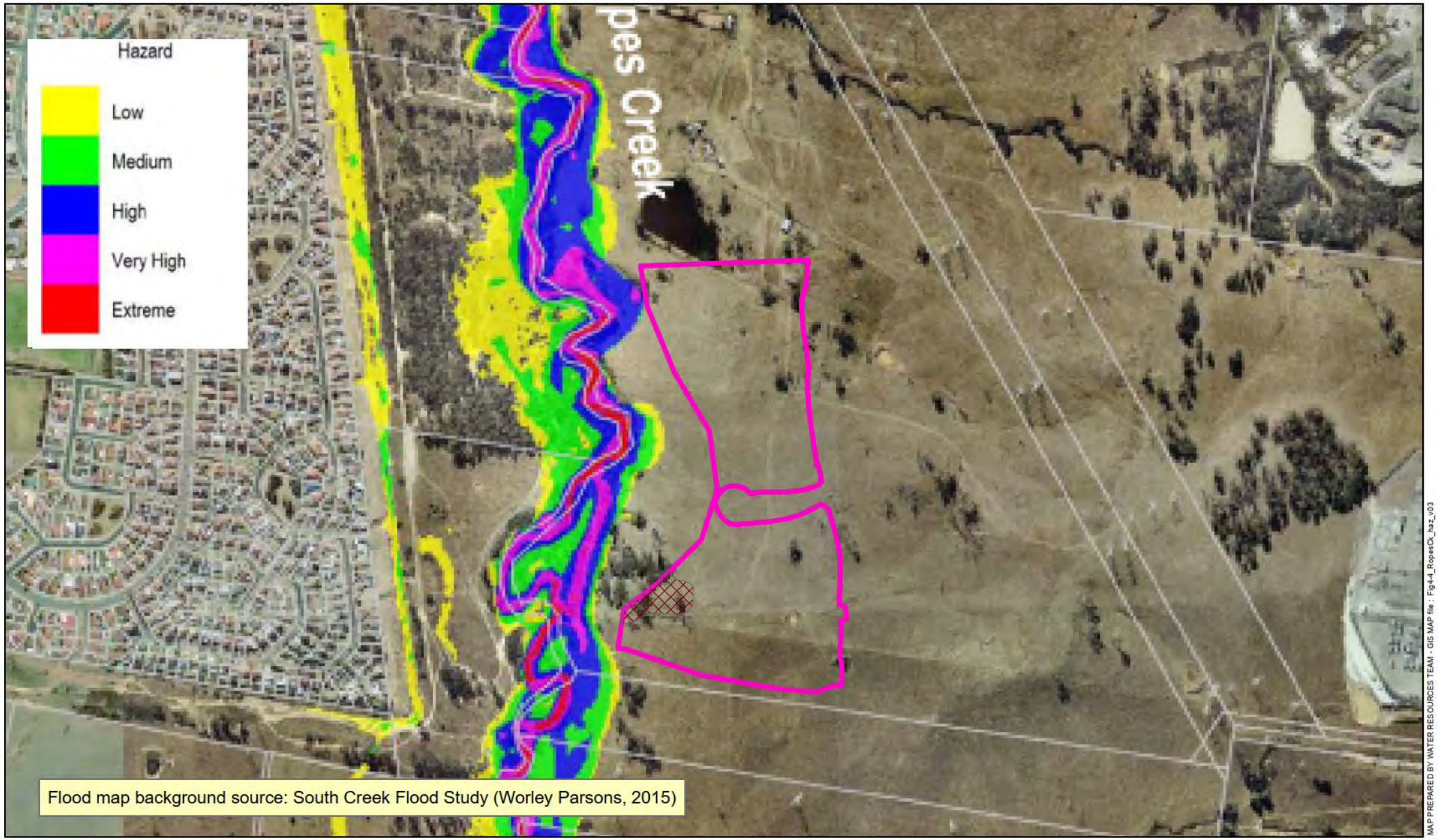



Figure 4-2 Existing 1% AEP flood levels – Ropes Creek


Figure 4-3 Existing 1% AEP flood depths – Ropes Creek




**Legend**

Proposal site

Environmental protection area

GDA 1994 MGA Zone 56

Metres

0 50 100 200 300 400

Jacobs

Disclaimer: Flood mapping is based on data and assumptions identified in this report. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

| | | | | | |
|---|---|---|---|---|---|
| TITLE | | Existing 1% AEP flood hazard – Ropes Creek | | | |
| PROJECT | | Sydney Metro Precast Facility Hydrology and flooding | | | |
| DRAWN | AI | Project # | IA199800 | Figure 4-4 | 1:8,000 |
| CHECK | LC | Date | 7/09/2020 | | |

Figure 4-4 Existing 1% AEP flood hazard – Ropes Creek

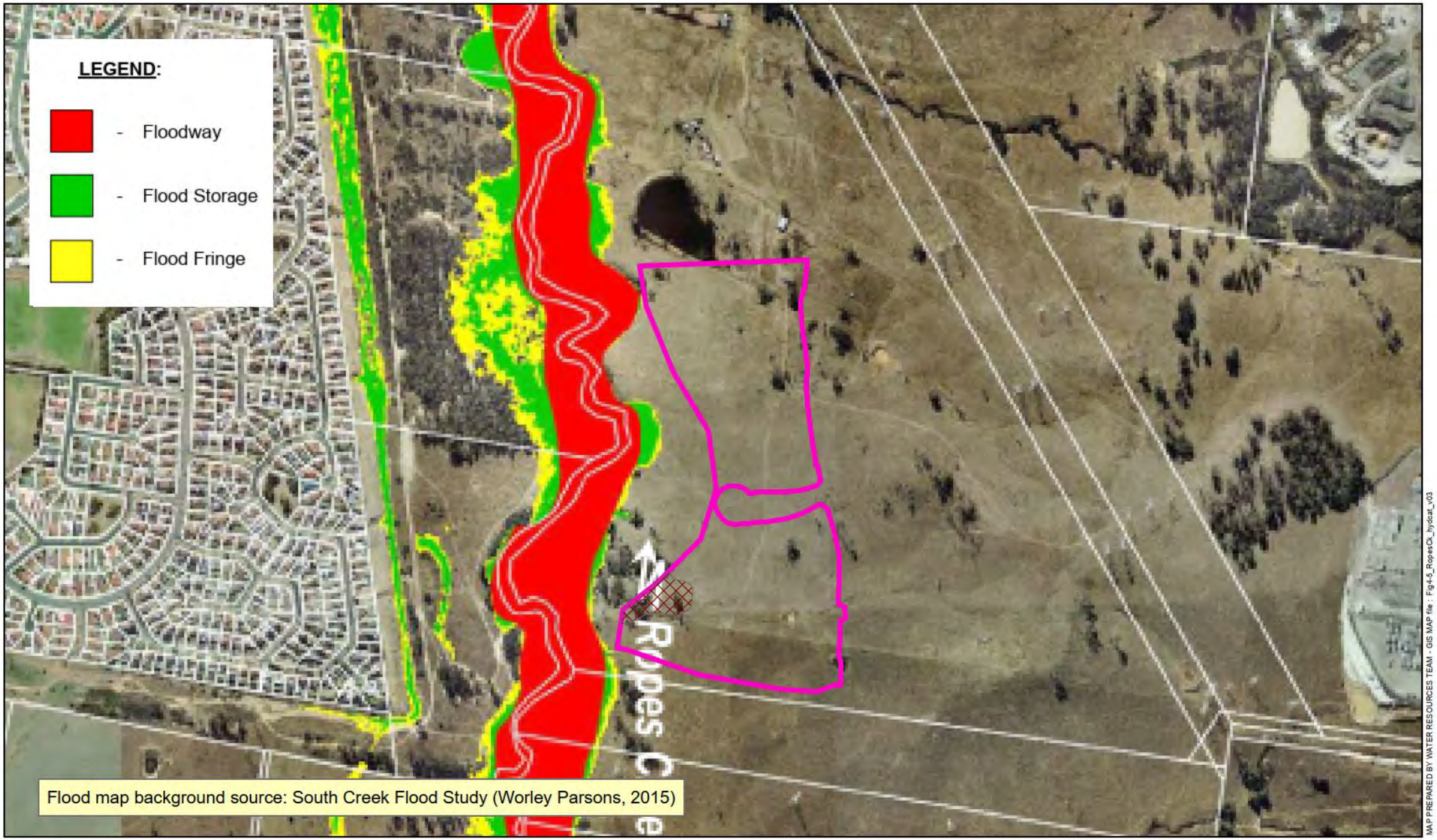



Figure 4-5 Existing 1% AEP hydraulic categories – Ropes Creek

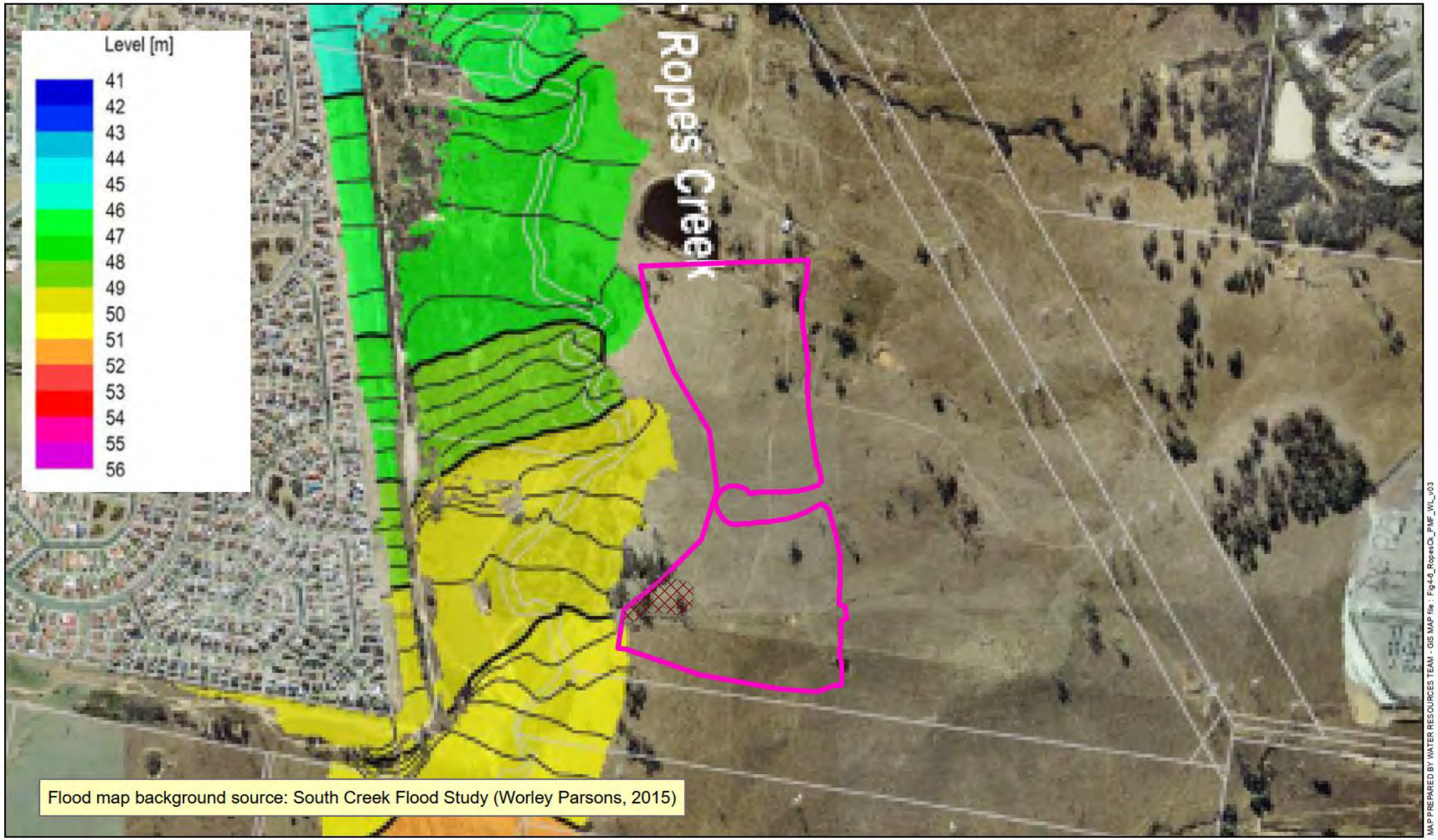



Figure 4-6 Existing probable maximum flood levels – Ropes Creek


Figure 4-7 Existing probable maximum flood depths – Ropes Creek

The majority of the proposal site is not flood affected by Ropes Creek flooding in the probable maximum flood, with the exception of the south-western corner (outside of the environmental protection area, refer to Figure 4-7). The entire proposal site is not affected by events up to and including the 1% AEP. Details of the existing case mainstream flooding conditions at the proposal site are summarised below:

- The 1% AEP flood levels in Ropes Creek range from 49.4 metres AHD at the south-western corner of the proposal site to 46.7 metres AHD at the north-western corner of the proposal site.
- The probable maximum flood levels in Ropes Creek range from 50.5 metres AHD at the south-western corner of the proposal site to 47.8 metres AHD at the north-western corner of the proposal site.
- The proposal site is entirely above the Ropes Creek 1% AEP flood extent. At the north-western section of the proposal site, the site boundary approaches the fringe of the 1% AEP flood extent. The minimum ground elevation is 48.2 metres AHD, which is above the 1% AEP flood level at that location of 46.9 metres AHD.
- The proposal site is also largely above the Ropes Creek probable maximum flood level except for an encroachment of 15 metres in horizontal extent into the south-western corner of the proposal site. The maximum depth is about 0.1 metres at the south-western corner of the proposal site. At the north-western section of the proposal site where the site boundary approaches the fringe of the probable maximum flood extent, the minimum ground elevation is 48.2 metres AHD, which is above the probable maximum flood level at that location of 47.9 metres AHD.
- Since the proposal site is above the 1% AEP flood level, it does not encroach on the Ropes Creek floodway area.

### 4.3.2 Overland flow flooding

Overland flows in the two main flow paths through the proposal site were estimated using hydrologic modelling in XP-RAFTS and hydraulic modelling in TUFLOW software. The overland flow assessment was undertaken based on the hydrologic analysis procedures outlined in ARR 2019 and is described in detail in Appendix A. Existing farm dams including the farm dam on the northern boundary of the proposal site were assumed full in the hydrologic modelling. The peak flows at key locations are summarised in Table 4-1. Refer to Figure A-2 for the locations and existing case model node layout.

Table 4-1: Existing peak flows and critical storm duration at selected locations

| Location | Total Catchment area | 0.5EY | 1% AEP |
|---|---|---|---|
| Upstream of southern precast site<br>(Model nodes CA-3 + CA-7) | 10.8 ha | 0.52 $m^3/s$<br>6 hrs critical duration | 3.7 $m^3/s$<br>15 minutes critical duration |
| Discharge point of southern precast site<br>(Model node CA-6) | 31.9 ha | 1.21 $m^3/s$<br>6 hrs critical duration | 8.25 $m^3/s$<br>45 minutes critical duration |
| Main flow path upstream of northern precast site<br>(Model node CA-10) | 16.9 ha | 0.72 $m^3/s$<br>6 hrs critical duration | 4.44 $m^3/s$<br>45 minutes critical duration |
| Discharge point of northern precast site<br>(Model node ReprtDummy) | 37.5 ha | 1.37 $m^3/s$<br>6 hrs critical duration | 7.95 $m^3/s$<br>45 minutes critical duration |

**Flood events analysed**

The 1% AEP flood event was analysed to define the overland flooding conditions around the proposal site. The coincident flood event in Ropes Creek was assumed to be the 5% AEP event, in line with ARR 2019 guidelines. The modelled flooding in Ropes Creek needs to be considered in conjunction with the mainstream flood conditions for the 1% AEP event as described in Section 4.3.1.

**Description of existing overland flood conditions**

Mapping of the overland flood depths is shown on Figure 4-8. The Ropes Creek 1% AEP flood extent (as defined in the South Creek Flood Study, Worley Parsons, 2015) is also shown. Both the main northern and southern overland flow paths are mapped. A minor overland flow path which flows through the middle of the proposal site is also indicated.

Overland flow depths in the northern flow path are typically around 0.4 – 0.6 metres in the existing case. Depths of water in the existing farm dam is shown to be over 0.6 metres, however, are expected to be deeper than indicated due to the model topography showing the dam water surface and not reflecting the actual bed level of the dam.

Flow depths in the southern flow path are typically 0.4 – 0.7 metres deep in the main flow path. There are some shallow overflows from the main flow path up to 0.1 metres deep.

The minor middle flow path exhibits shallow (less than 0.05 metres depth) dispersed flow with some deeper ponding within an access track which is in cut below the surrounding ground level.

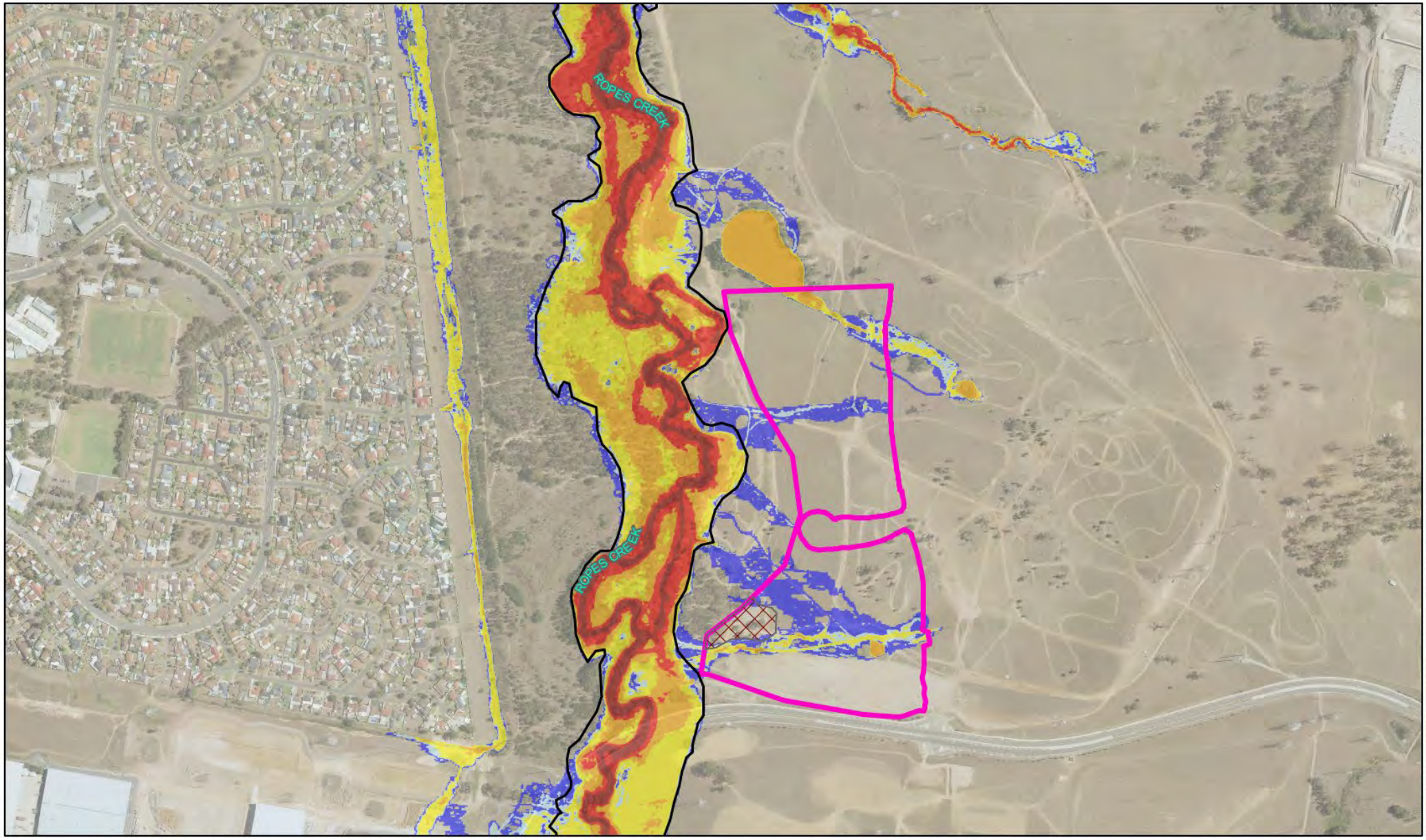



Figure 4-8: Overland flood depths – Existing case

# 5. Construction impact assessment

## 5.1 Overview

The construction phase consists of the following stages for each precast facility:

- Site establishment
- Civil and building work
- Commissioning.

Key activities in the construction phase which have the potential to impact on flooding behaviour include:

- Earthworks and site filling (during the site establishment, civil and building works stages)
- Changed drainage conditions (primarily during the civil and building work stage)
- Paving and construction of buildings (during the civil and building work stage).

The potential impacts to flooding behaviour from these construction activities are discussed in this section.

## 5.2 Key assumptions

The key assumptions in the construction impact assessment are summarised below:

- Based on the description of construction activities the worst-case stage for the construction phase would be upon completion of the civil and building work stage. This would be when earthworks and filling are complete in addition to installation of impervious paved and roof surfaces, and have the maximum potential impact on flood flow obstruction and increased site runoff rates. The worst-case stage for the construction phase would be similar to the operational phase from a hydrologic perspective.
- Filling would be required to raise flood-affected parts of the proposal site above the 1% AEP flood level plus 0.5 metres freeboard.
- The proposal site in its worst-case final state is assumed to be 90% impervious, reflecting the industrial land use zoning. Hardstand areas are assumed to be effectively impervious for the flooding assessment.
- All site internal drainage including mitigation works is assumed to be installed during the construction phase and contributing to the worst-case hydrologic condition.
- A temporary haul road would be established for site access prior to completion of the proposed Archbold Road upgrade and extension works. Drainage structure outlets are assumed to be located as per the concept design in Section 3.2.3. If Archbold Road is constructed concurrent to or following the proposal site, it is assumed the road drainage will be coordinated with the precast site drainage.
- For the purposes of sizing the flood detention for the proposal site, the effects of the completed Archbold Road upgrade and extension on increased flood flows have not been taken into account. Sizing of the proposal site flood detention facilities has been undertaken to mitigate the impacts of development of the proposal site only. Overland flows and road drainage from upstream of the proposal site are assumed to be diverted through or around the site, separating them from the site runoff flows.
- Given the construction stage would occur in the short term, the upstream catchments to the east of the proposal site are assumed to remain undeveloped.

## 5.3 Impacts on mainstream flooding hydraulics and flood levels

The proposal site is entirely above the 1% AEP flood. It is also almost entirely above the probable maximum flood, except for a small section in the south-western corner of the site where probable maximum flood depths are about 0.1 metres. Potential impacts would be negligible in the probable maximum flood event from filling of

the south-western corner of the proposal site obstructing the shallow 0.1 metres flow depths. There would be no flooding impacts in other portions of the proposal site as these are above the probable maximum flood level and any filled embankments would be outside of the flood extent.

Similarly, there would not be any flood impacts in the 1% AEP event as the entire proposal site is above the 1% AEP flood level and any filled embankments would be outside of the flood extent.

## 5.4 Impacts on mainstream peak flows

The proposal may potentially impact on the peak flows in Ropes Creek as a result of increased impervious areas on the proposal site from its currently undeveloped state. The impervious areas are expected to include building roof areas, road paving and hardstand areas. Increased site imperviousness has the potential to increase peak runoff rates and volumes, which may result in increased peak flow rates in Ropes Creek during flood events which could impact on downstream properties due to associated increased flood levels.

The potential increase in peak flows has been quantified in the XP-RAFTS model. The model sub-catchments covering the proposal site were updated to reflect the increased imperviousness of the developed site. The model link network was also modified to reflect diversion of external upstream flows and the drainage on the northern and southern sites being directed to a centralised discharge point on each site. The developed case (construction and operational) XP-RAFTS model layout is presented in in Appendix B. A comparison of the existing case and developed case (construction and operational) peak flows is presented in Table 5-1.

Table 5-1: Comparison of existing and developed (no mitigation) case peak flows and critical storm duration at selected locations*

| Location | Scenario | 0.5EY | 1% AEP |
|---|---|---|---|
| Discharge point of southern precast site (including diverted external flows) | Existing | 1.21 $m^3/s$<br>6 hrs critical duration | 8.25 $m^3/s$<br>45 minutes critical duration |
| | Developed | 1.64 $m^3/s$<br>15 minutes critical duration | 8.75 $m^3/s$<br>45 minutes critical duration |
| Discharge point of northern precast site (including diverted external flows) | Existing | 1.37 $m^3/s$<br>6 hrs critical duration | 7.95 $m^3/s$<br>45 minutes critical duration |
| | Developed | 1.44 $m^3/s$<br>20 minutes critical duration | 7.57 $m^3/s$<br>45 minutes critical duration |

* The flows at the selected locations includes the proposal site runoff combined with diverted external flows. Flow reporting locations upstream of the proposal site have been omitted due to additional catchment areas diverted to the reporting locations by Archbold Road drainage.

It is observed that the peak flows generally increase from the existing to the developed case as a result of the increase in imperviousness of the proposal site, which reduces the infiltration capacity and increases the ground surface smoothness, both producing increased runoff from the proposal site. The exception is at the discharge point of the northern precast site in the 1% AEP event, where a minor reduction in peak flow is experienced. This is due to the northern precast site, which is located at the downstream end of the northern overland flow path,

producing runoff which discharges from the site at a higher peak flow rate but quicker than the upstream external catchment. By the time the peak in flow from the external catchment reaches the discharge point, the northern precast site flows have receded, therefore resulting in the reduction of the combined peak flow. This may suggest that mitigation would not be required for the 1% AEP event, however, mitigation would be required in any case for the 0.5EY event and potentially other flood events.

## 5.5 Impacts on creek geomorphology

Without mitigation, increased site runoff peak rates, volumes and durations of flow may result in changes to flow regimes in Ropes Creek in low flows and frequent flood events. This can lead to geomorphic changes in the creek channel as the creek system adjusts to the new flow regime, which may include increased channel erosion, bank slumping and other effects which may cause further impacts on creek habitat and ecology. Further geomorphologic assessment is recommended relating to the potential change in flow regime.

The proposal site is entirely outside of the 1% AEP flood extent. The filled sections of the proposal site would not interact with the 1% AEP flow in Ropes Creek and hence are not expected to result in changes to creek geomorphology due to obstruction of creek flows.

## 5.6 Impacts on overland flooding and drainage

Development of the proposal site would involve filling and levelling of the proposal site, which would fill in existing overland flow paths and farm dams. The proposal site would abut the Archbold Road upgrade and extension. Design coordination of drainage arrangements for Archbold Road and the detailed design of the proposal site would be undertaken. Without such coordination and implementation of other management measures, the proposal has the potential to impact on the drainage of the overland flows and road drainage discharge points. The potential impacts include obstruction of flows and drainage, causing uncontrolled flooding upstream of the road cross-drainage points and overtopping of the road by floodwaters and poor drainage of the proposed road corridor. There would also be impacts on the construction site resulting from uncontrolled overland flows discharging through the site if no mitigation measures are implemented.

## 5.7 Construction impacts summary

Without mitigation, the construction phase has the potential to result in the following impacts:

- Increases in site runoff peak flow rates and volumes into Ropes Creek. While the increment in flow compared to existing Ropes Creek flows is small, the potential impacts of the proposal combined with other external developments, without mitigation, may increase downstream flooding.
- Geomorphic changes may result due to changes in flow regimes in the creek in low flow conditions and frequent flood events without mitigation.
- Without design coordination with Archbold Road and implementation of other mitigation measures, construction of the proposal site would change drainage patterns and obstruct overland flow paths, resulting in flooding and drainage impacts to the proposed Archbold Road upgrade and extension. In the absence of mitigation measures there would also be impacts on the construction site due to uncontrolled overland flows.

# 6. Operational impact assessment

## 6.1 Key assumptions

In terms of hydrology and flooding, the operational phase of the proposal is expected to be similar to the worst-case condition in the construction phase, which would be the same as the operational layout of the proposal site.

## 6.2 Flood impacts under climate change scenario

The proposal is anticipated to commence construction in early 2021 and be completed by the end of 2022, and would operate for a period of four – five years (up to about 2027), subject to the delivery strategy for Sydney Metro West. Interim climate change factors for the year 2030 for an upper range projection scenario of anthropogenic greenhouse gas emissions are available from ARR Data Hub, which suggests a 4.9% increase in storm rainfall intensities which would result in increase in flood flows and flood levels. The majority of this increment in rainfall intensity may be expected to occur during the operational phase.

It is expected that there would be a minor increase in flood depths and negligible increase in flow velocities in Ropes Creek at the proposal site. This would not materially affect the flood immunity of the proposal site, as finished site levels are expected to be well above the prescribed 0.5 metre freeboard above the 1% AEP flood level.

Runoff rates from the developed proposal site and from external catchments would increase by a minor increment as a result of climate change. It is expected that any small factor of safety which is provided by the proposed mitigation and management measures would be able to accommodate theses minor increases in flows, so that there is no net impact downstream of the proposal site.

## 6.3 Operational impacts summary

The potential hydrologic and flooding impacts of the proposal in the operational phase are expected to be similar to the potential construction phase impacts. Refer to Section 5 for discussion.

# 7. Mitigation and management measures

## 7.1 Construction and operational management

Environmental management measures for the mitigation of impacts to flooding which are to be implemented during the construction and operational phases of the proposal are listed in Table 7-1. Construction and operational impacts are expected to be similar, hence the same set of mitigation and management measures are proposed for each phase.

Table 7-1: Construction and operational environmental management measures – hydrology and flooding

| No. | Impact | Mitigation measure |
|---|---|---|
| F1 | Increase in mainstream peak flood flows | Detailed design of the proposal site would include provision of appropriate on-site stormwater detention/flood detention facilities to cater for events up to and including the 1% AEP event. |
| F2 | Geomorphic impacts due to changed flow regime in low flows and frequent flood events | Detailed design of the proposal site would include the provision of appropriate on-site stormwater detention/ flood detention facilities. Outlet sizing would be designed to satisfactorily mitigate potential increases in peak flows in frequent events. |
| F3 | Impacts on overland flooding and drainage conditions | Detailed design of the proposal site would include the provision of appropriate flow diversion channels or culverts for management of external flows. |
| F4 | | Detailed design would integrate with proposed Archbold Road cross drainage and road drainage outlets. |
| F5 | | Detailed design would provide appropriate scour protection works at channel/culvert discharge points to Ropes Creek. |
| F6 | Impacts on the proposal resulting from flooding | Detailed design would provide filling to a height of at least 0.5m above Ropes Creek 1% AEP flood level. |

# 8. Conclusion

A hydrology and flooding assessment has been conducted to support the REF for the proposed precast facilities (the proposal). The assessment has considered the available flooding studies, policies and guidelines to define existing case flooding conditions and development controls for the proposal site. Additional hydrologic and hydraulic modelling was undertaken where there were data gaps, that is, for overland flooding around and through the proposal site, for the catchment development conditions relevant to the nature and timing of proposed development on and around the proposal site during its construction and operation.

Review of existing flooding conditions in Ropes Creek indicate that the proposal site is entirely above the 1% AEP flood extent. The proposal site is also mostly above the probable maximum flood, with exception of a small encroachment into the flood extent at the south-western corner of the southern precast site.

There are two main overland flow paths which pass through each of the northern and southern precast sites. These overland flow paths drain currently undeveloped upstream catchments located to the east of the proposal site. Management of these external flows through/around the site would be required.

An assessment of impacts of the proposal on flooding was undertaken based on qualitative assessment and updated hydrologic modelling. Potential impacts include partial impediment of Ropes Creek flows caused by filling in the south-western corner of the site resulting in negligible flood impacts in the probable maximum flood only, increases in peak flows being discharged to Ropes Creek due to development of the proposal site, impacts on creek geomorphology due to altered flow regime and impacts on overland flooding behaviour and drainage. The final-state construction phase and the operational phase of the proposal were considered to have similar potential impacts to flooding and hydrology. The potential change in impacts during a future climate change scenario was also considered.

A range of mitigation and management measures have been identified to manage the potential impacts to flooding. Indicative sizing has been provided for structural measures, which include stormwater/flood detention facilities and external flow diversion channels for the northern and southern precast sites.

# 9. References

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# Appendix A. Site flooding, drainage and detention assessment

## A.1 Introduction

The proposal site is situated on the eastern side of Ropes Creek, with the previous *South Creek Flood Study* (Worley Parsons, 2015) providing information on the existing mainstream flooding at the proposal site. The proposal site is largely unaffected by mainstream flooding with the exception of a small section in the south-western corner of the proposal site in the PMF. The mainstream flooding conditions are discussed in Section 4.3.1 in the main body of this report.

Two overland flow paths flow through the proposal site, and a flood modelling assessment is required to define the flooding conditions in these flow paths in accordance with the current ARR 2019 guidelines.

The proposal site would be developed from a currently greenfield site to an industrial facility and hence assessment is also required to define the hydrology of the site and potential impacts to hydrology and peak runoff rates from the site. Mitigation in terms of on-site stormwater detention or flood detention are identified as a part of this assessment.

Overland flow management through the site is also determined. An assessment of drainage requirements has been undertaken in this regard, including consideration of the proposed Archbold Road upgrade and extension and its associated drainage infrastructure.

## A.2 Assessment approach

This flooding, drainage and detention assessment involves numerical modelling of hydrology and hydraulics, and its details are provided in this appendix. In summary, the approach includes the following, with discussion on each aspect provided:

- Definition of existing case overland flooding and drainage conditions, including hydrologic and hydraulic model development and simulation
- Assessment of developed case (no mitigation) conditions, with update of modelling to reflect development of the proposal site
- Identification of mitigation requirements, including representation and confirming details of flood detention facilities
- Confirmation of drainage requirements for management of external flood flows, including update of modelling to reflect the completed Archbold Road project.

## A.3 Assessment of existing case flooding conditions

### A.3.1 Hydrologic modelling

An XP-RAFTS model was developed to estimate flood flows in the overland flow paths through the proposal site. The model also defines the runoff characteristics from the proposal site itself which will assist with subsequent mitigation assessment.

#### Sub-catchments

The overall catchment areas of the flow paths were delineated and subdivided into sub-catchments based on a LiDAR ground elevation terrain model. Refer to Figure A-1. The sub-catchment data is presented in Appendix B. The existing case XP-RAFTS model layout is shown on Figure A-2.

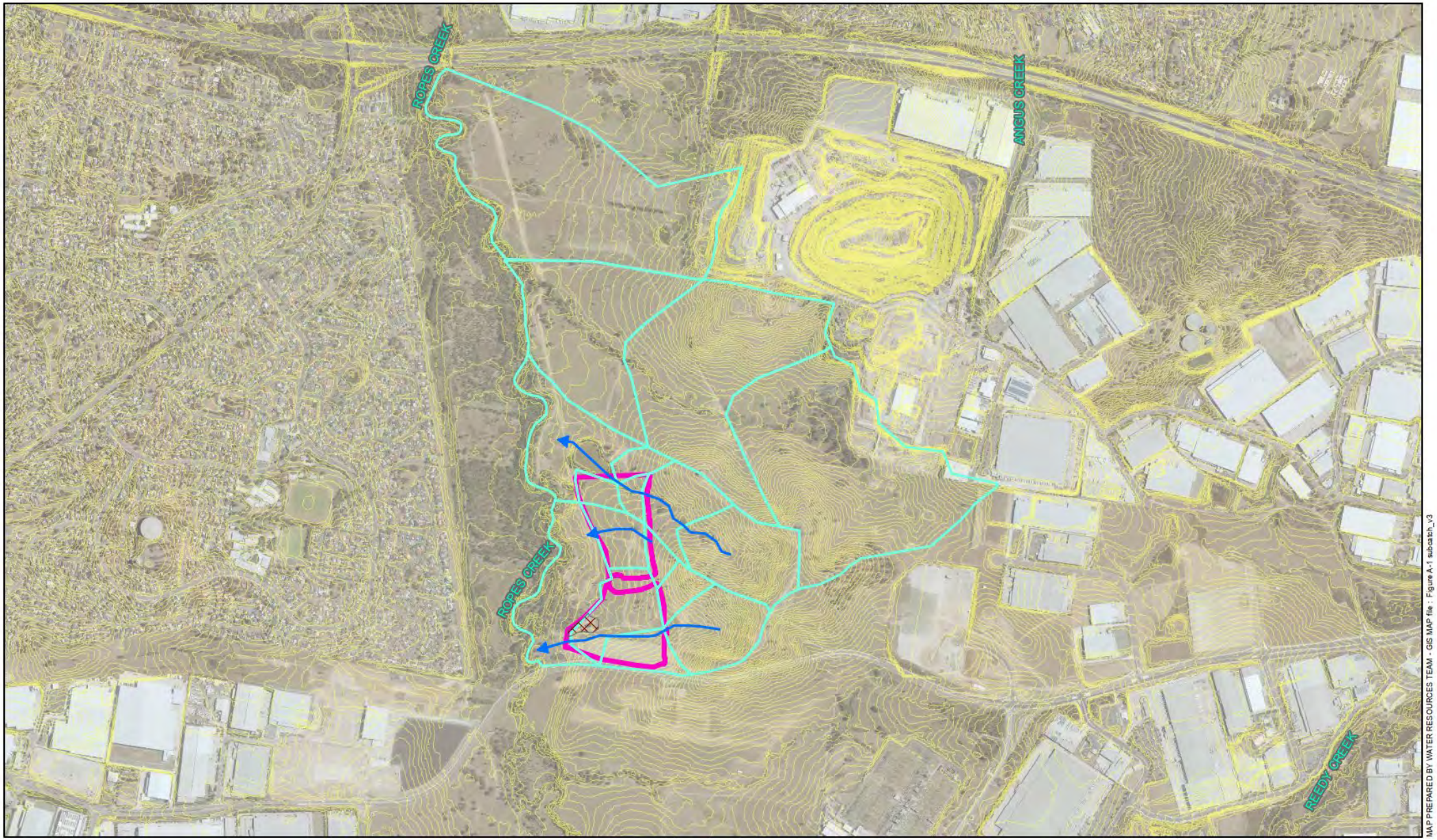



Figure A-1: XP-RAFTS sub-catchments for overland flow paths


Figure A-2: XP-RAFTS layout – Existing case

**Hydrologic parameters**

The ARR 2019 design rainfall and rainfall losses were extracted from ARR Data Hub. The design rainfall adopted for the hydrologic modelling is presented in Appendix B. The rainfall losses are summarised in Table A-1 along with adopted catchment roughness parameter value. For conciseness, the parameter values for developed and mitigated case models are also shown.

Table A-1: Rainfall losses and catchment roughness

| Parameter | Pervious | Impervious* |
|---|---|---|
| Rainfall burst initial losses | Varies depending on AEP and duration.<br>▪ 0.5EY event 26.1 – 31.1 mm.<br>▪ 1% AEP event 6.9 – 11.6 mm. | 1 mm |
| Continuing losses | 0.92 mm/hour<br>(i.e. ARR Data Hub value of 2.3 mm/hour multiplied by correction factor of 0.4 for NSW). | 0 mm/hour |
| Catchment roughness parameter value | 0.05. Rural catchment.<br>0.025 for pervious areas in developed catchments. | 0.015 |

* Impervious area parameters apply to developed and mitigated case only.

**Farm dams**

There are several existing farm dams, located on the overland flow paths, in the vicinity of the proposal. These are assumed to be full, and hence do not contribute to flood storage and detention of overland flows.

**Analysis results**

The ARR 2019 storms include ensembles of ten storms for each event AEP and duration. Each ensemble member represents an alternative storm rainfall temporal pattern which affects the runoff characteristics of the storm event. The ensemble rainfall data and hydrologic parameters were input into the XP-RAFTS model and the ensemble results analysed using the Storm Injector software module. The median value peak flow at each key location is selected from each AEP/duration ensemble as the representative flow for that AEP/duration.

For the purposes of this flooding and hydrology assessment the design event flows for the 0.5EY and 1% AEP events were analysed. A range of storm durations from 10 minutes to 9 hours were analysed to select the critical duration.

The peak flows at key locations are summarised in Table A-2.

Table A-2: Existing peak flows and critical storm duration at selected locations

| Location | Total Catchment area | 0.5EY | 1% AEP |
|---|---|---|---|
| CA-3 + CA-7<br>Upstream of southern precast site | 10.8 ha | 0.52 $m^3/s$<br>6 hrs critical duration | 3.7 $m^3/s$<br>15 minutes critical duration |
| CA-6<br>Discharge point of southern precast site | 31.9 ha | 1.21 $m^3/s$<br>6 hrs critical duration | 8.25 $m^3/s$<br>45 minutes critical duration |

| Location | Total Catchment area | 0.5EY | 1% AEP |
|---|---|---|---|
| CA-10<br>Main flow path upstream of northern precast site | 16.9 ha | 0.72 $m^3/s$<br>6 hrs critical duration | 4.44 $m^3/s$<br>45 minutes critical duration |
| Node "ReprtDummy"<br>Discharge point of northern precast site | 37.5 ha | 1.37 $m^3/s$<br>6 hrs critical duration | 7.95 $m^3/s$<br>45 minutes critical duration |

### A.3.2 Hydraulic modelling

Hydraulic modelling was undertaken based on the hydrologic model results to define overland flood behaviour for the existing case, including flood depths and extents. New modelling was conducted as the previous studies did not assess overland flooding based on the current ARR 2019 guidelines and results were not available for detailed analysis.

**Model configuration**

A TUFLOW two-dimensional hydraulic model was developed to include the overland flow path areas. The Ropes Creek channel and floodplain were also included to represent the tailwater conditions during flood events. Topography in the TUFLOW model was defined with a 2 metre grid and was based on LiDAR data dated February 2011 and sourced from NSW LPI. The overland flow paths and Ropes Creek were represented as two-dimensional features.

The overall model configuration is shown on Figure A-3.

**Inflow boundaries**

Inflows from the local overland flow catchments were input at the locations indicated on Figure A-3.

Flow in Ropes Creek was extracted from the *South Creek Flood Study* (Worley Parsons, 2015) report. Flooding in Ropes Creek was modelled as a steady peak flow for the purposes of this study.

**Downstream boundary**

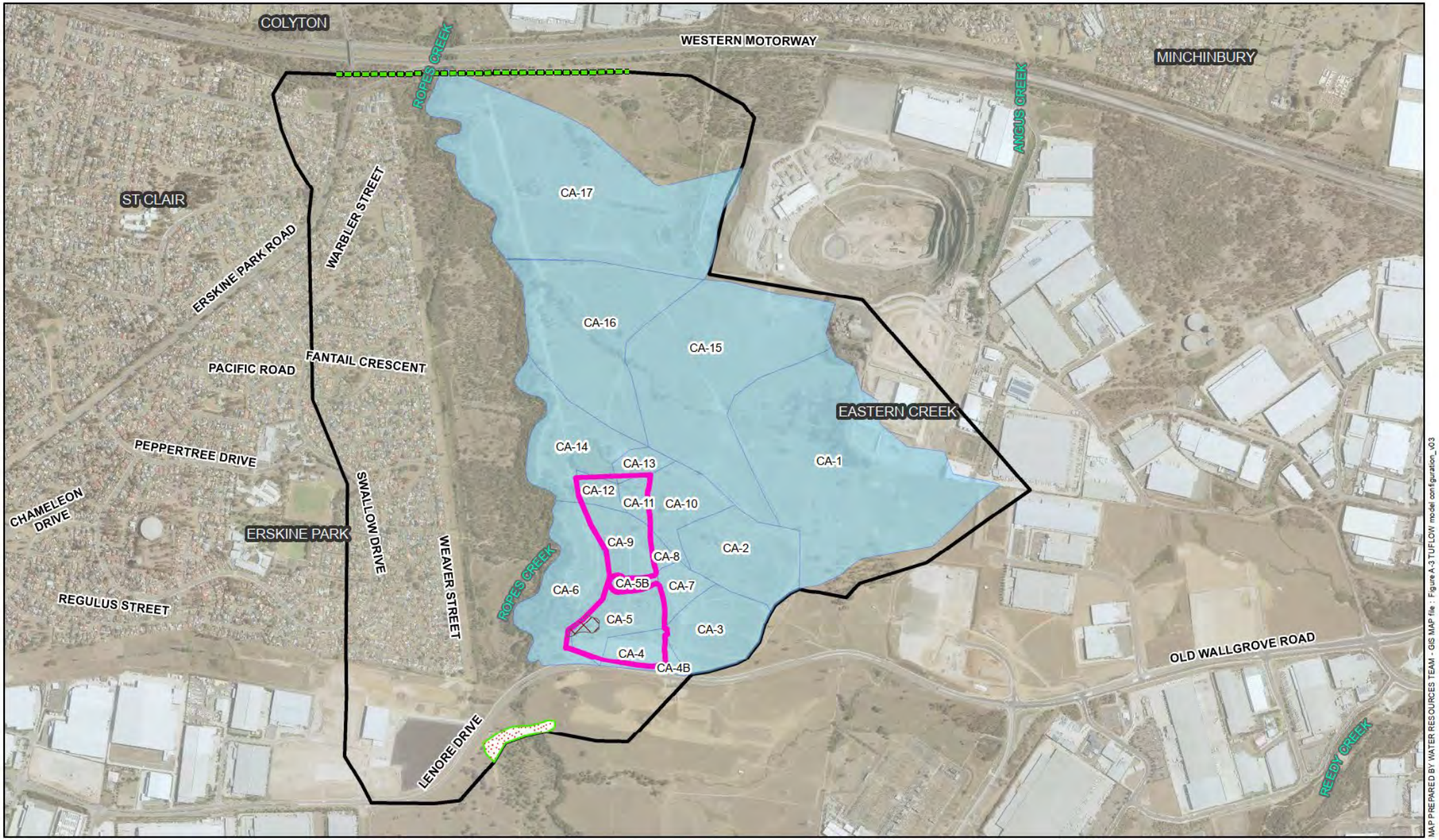
Downstream boundary in Ropes Creek was extracted from the *South Creek Flood Study* (Worley Parsons, 2015) report and was modelled as a steady water level boundary for the purposes of this study.

**Hydraulic Roughness**

Manning's n hydraulic roughness parameter values were defined based on typical values for different land use areas and consistent with the current ARR 2019 guidelines. Refer to Table A-3 for the adopted values. The land use types corresponding with the adopted Manning's n values in the TUFLOW model are mapped on Figure A-4.

Table A-3: Adopted Manning's n values

| Land Use Type | Manning's n value |
|---|---|
| Grassland | 0.05 |
| Paved areas | 0.02 |
| Roads | 0.025 |
| Vegetation | 0.10 |
| Urban residential block (Erskine Park) | 0.35 |




**Legend**

- Proposal site
- Environmental protection area
- TUFLOW 2D model domain
- Tailwater boundary
- Local inflows
- Upstream inflows

GDA 1994 MGA Zone 56

0 125 250 500 Metres

Jacobs

Disclaimer: Flood mapping is based on data and assumptions identified in this report. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

| | | | | | |
|---|---|---|---|---|---|
| TITLE | TUFLOW model configuration | | | | |
| PROJECT | Sydney Metro Precast Facility Hydrology and flooding | | | | |
| DRAWN | AI | Project # | IA199800 | Figure A-3 | 1:18,000 |
| CHECK | LC | Date | 7/09/2020 | | |

Figure A-3: TUFLOW model configuration

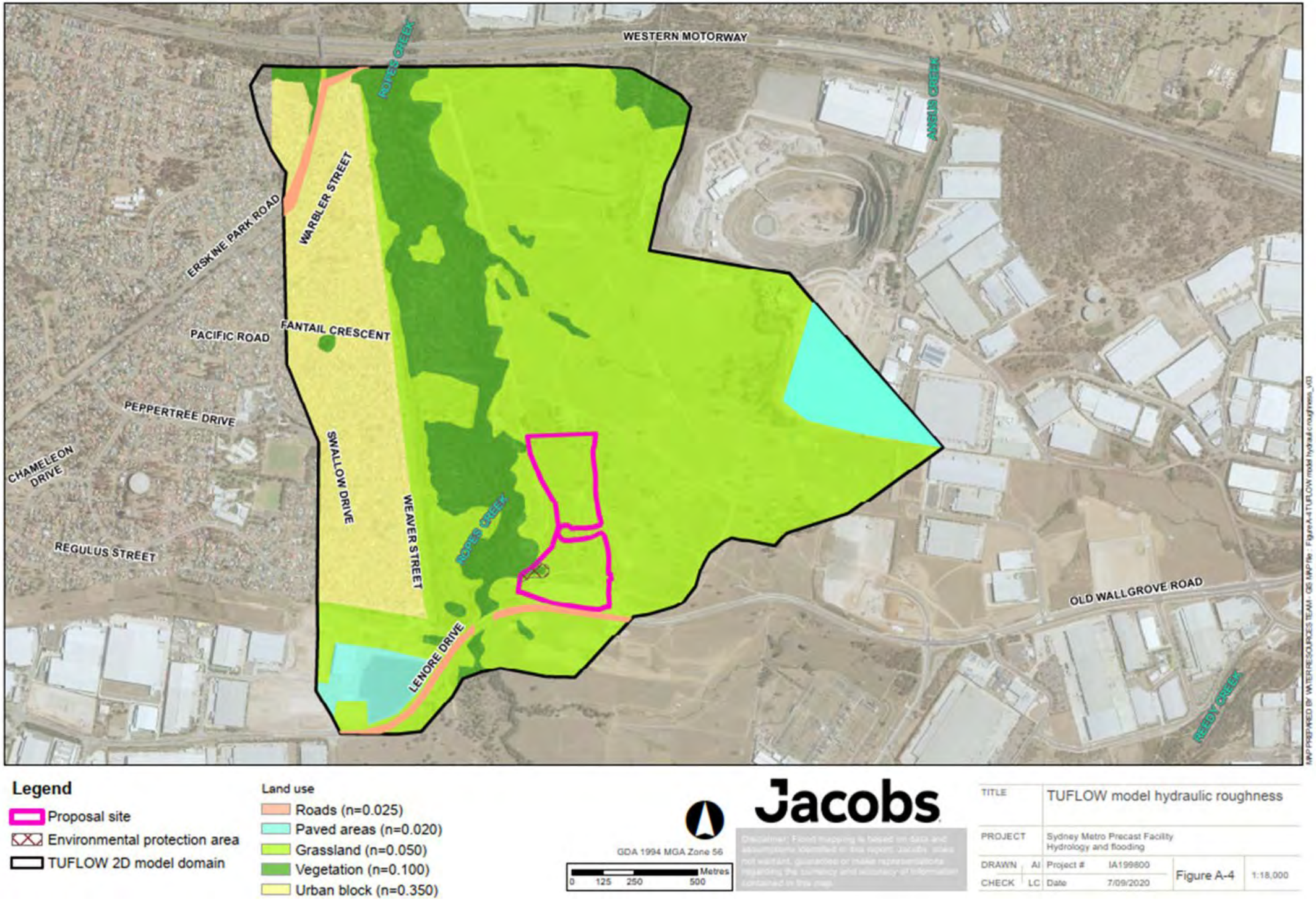



Figure A-4: TUFLOW model hydraulic roughness

**Flood events analysed**

The 1% AEP flood event was analysed to define the overland flooding conditions around the proposal site. The coincident flood event in Ropes Creek was assumed to be the 5% AEP event, in line with ARR 2019 guidelines. The modelled flooding in Ropes Creek needs to be considered in conjunction with the mainstream flood conditions for the 1% AEP event as described in Section 4.3.1 in the main body of this report.

Mapping of the overland flood depths is shown on Figure 4-6 in the main body of this report. The Ropes Creek 1% AEP flood extent is also shown.

Overland flow depths in the northern flow path are typically around 0.4 – 0.6 metres in the existing case. Depths of water in the existing farm dam is shown to be over 0.6 metres, however, are expected to be deeper than indicated due to the model topography showing the dam water surface and not reflecting the actual bed level of the dam.

Flood depths in the southern flow path are typically 0.4 – 0.7 metres deep in the main flow path. There are some shallow overflows from the main flow path up to 0.1 metres deep.

The minor middle flow path exhibits shallow (less than 0.05 metres depth) dispersed flow with some deeper ponding within an access track which is in cut below the surrounding ground level.

## A.4 Assessment of developed case flooding

The XP-RAFTS hydrologic model was updated to reflect the developed case (construction final state and operational phases). Updates to the model included:

- The areas of sub-catchments CA-11, CA-12, CA-13 and CA-14 were adjusted to reflect a part of the proposal site now draining into CA-11 and CA-12 on the proposal site (previously draining out of the proposal site to CA-13 and CA-14).
- Developed parts of the proposal site are assumed to be 90% impervious. The sub-catchment properties were updated accordingly.
- The link network in the existing case was previously configured to reflect the natural directions of drainage. For the developed case the link network was adjusted such that areas within the proposal site drained to two centralised locations (one each for the northern and southern sites, which would be operated independently). External flows from sub-catchments to the east of the site are assumed to be diverted around or through the site separately from the site runoff.
- The external sub-catchments containing the proposed Archbold Road upgrade and extension were retained in their undeveloped states, so that the hydrologic impact of the proposal site only could be analysed. While there is potential for the external catchments to be developed during the operational phase of the proposal, it is expected that stormwater and flood detention would be provided on these developed areas to mitigate against the potential impacts on flooding.

The updated XP-RAFTS model layout is shown on Figure A-5, and the peak flows are summarised in Table A-4. The peak flows from the southern and northern site areas and the flows at their discharge points to Ropes Creek (combined with diverted external flows) are shown.

The results indicate that peak flows from the northern and southern sites increase as a result of development of the site. Peak flows from the southern site combined with the southern external flows increase for both the 0.5EY and the 1% AEP event. However, for the northern site combined with northern external flows, the peak flows increase of the 0.5EY event only but are reduced for the 1% AEP event. This is attributed to the developed case site flows running off faster due to quicker catchment response time, hence there is a reduced coincident timing of the site runoff peak and the external flow peak.

Although the 1% AEP northern combined discharge to Ropes Creek is reduced in the developed case, mitigation is still required to manage the flow impacts in the 0.5EY event, and potentially other flood events which have not been assessed.


Figure A-5: XP-RAFTS layout – Developed case (construction and operational)

Table A-4: Developed case (no mitigation) peak flows and critical storm duration at selected locations

| Location | 0.5EY | | 1% AEP | |
|---|---|---|---|---|
| | Existing | Developed | Existing | Developed |
| CA-6<br><br>Discharge point of southern precast site including diverted external flows | 1.21 $m^3/s$<br><br>6 hrs critical duration | 1.64 $m^3/s$<br><br>15 minutes critical duration | 8.25 $m^3/s$<br><br>45 minutes critical duration | 8.75 $m^3/s$<br><br>45 minutes critical duration |
| Node "ReprtDummy"<br><br>Discharge point of northern precast site including diverted external flows | 1.37 $m^3/s$<br><br>6 hrs critical duration | 1.44 $m^3/s$<br><br>20 minutes critical duration | 7.95 $m^3/s$<br><br>45 minutes critical duration | 7.57 $m^3/s$<br><br>45 minutes critical duration |

## A.5 Assessment of mitigation case and flood detention requirements

The developed case XP-RAFTS model was updated to include flood detention basins at the outlet points for the southern and northern sites, refer to Figure A-6 for the updated model configuration. Basin dimensions and discharge configurations were iteratively adjusted to ensure site runoff and the combined discharge with diverted external flows are not increased from the existing case for the 0.5EY and 1% AEP events. Details of the proposed indicative detention basins are provided in Table A-5. The mitigated case peak flows are indicated on Table A-6, which demonstrate that the proposed basins mitigate developed case peak flows to below existing levels.

While this assessment refers to the detention facility as a basin, it would be satisfactory to incorporate the detention facility as an equivalent underground tank facility if appropriate.


Figure A-6: XP-RAFTS layout – Mitigation case (construction and operational)

Table A-5: Proposed indicative detention basin details

| | **Basin 1**<br>**Southern precast site** | **Basin 2**<br>**Northern precast site** |
|---|---|---|
| Basin volume, $m^3$ | 3,500 | 3,200 |
| Assumed depth, m | 2.0 | 2.3 |
| Surface area, $m^2$ | 1,750 | 1,400 |

Table A-6: Mitigated case peak flows and critical storm duration at selected

| Location | 0.5EY | | 1% AEP | |
|---|---|---|---|---|
| | Existing | Developed +Mitigation | Existing | Developed +Mitigation |
| CA-6<br><br>Discharge point of southern precast site including diverted external flows | 1.21 $m^3/s$<br><br>6 hrs critical duration | 1.14 $m^3/s$<br><br>6 hrs critical duration | 8.25 $m^3/s$<br><br>45 minutes critical duration | 7.63 $m^3/s$<br><br>45 minutes critical duration |
| Node "ReprtDummy"<br><br>Discharge point of northern precast site including diverted external flows | 1.37 $m^3/s$<br><br>6 hrs critical duration | 1.25 $m^3/s$<br><br>6 hrs critical duration | 7.95 $m^3/s$<br><br>45 minutes critical duration | 7.7 $m^3/s$<br><br>45 minutes critical duration |

## A.6 Management of external flows

External catchment overland flows need to be intercepted at the proposed Archbold Road cross drainage and road drainage structure outlets and diverted around the southern and northern precast sites in channel or culvert. The XP-RAFTS mitigated case model was updated to include the new impervious areas associated with the proposed road. The model was run for the 1% AEP event and peak flows defined.

Details on the proposed site grading are not known at this stage, although it is assumed that site finished levels would be relatively flat. Hence for the purposes of this assessment it is assumed that diversion channel and/or culverts would be installed at a 1% grade.

The estimated external catchment peak flows, including Archbold Road runoff, and the required flow diversion structure dimensions are provided in Table A- 7. The estimated flows were compared to the Archbold Road concept design cross drainage flows (refer to Table 3-1) and are observed to be comparable. The proposed routes for the external catchment flow diversion structures are shown on Figure A-7. Appropriate scour protection works are required at discharge points to Ropes Creek.

Table A- 7: External catchment flows and diversion structure dimensions

| Location | 1% AEP Flow ($m^3/s$) | Flow diversion dimensions* | |
|---|---|---|---|
| | | Open channel option | Culvert option |
| northern precast site external flow diversion (discharge from Archbold Road drainage) | 5.0 | Width, bottom: 0.3m<br><br>Width, top: 3.3m<br><br>Side: 1:1 batter slope<br><br>Depth: 1.5m | 1 x 1200mm x 1000mm |

| Location | 1% AEP Flow ($m^3/s$) | Flow diversion dimensions* | |
|---|---|---|---|
| | | Open channel option | Culvert option |
| southern precast site external flow diversion (discharge from Archbold Road drainage) | 3.4 | Width, bottom: 0.3m<br>Width, top: 3.0m<br>Side: 1:1 batter slope<br>Depth: 1.35m | 1 x 1200mm x 750mm |

* Assumed 1% longitudinal grade for channel and culvert.

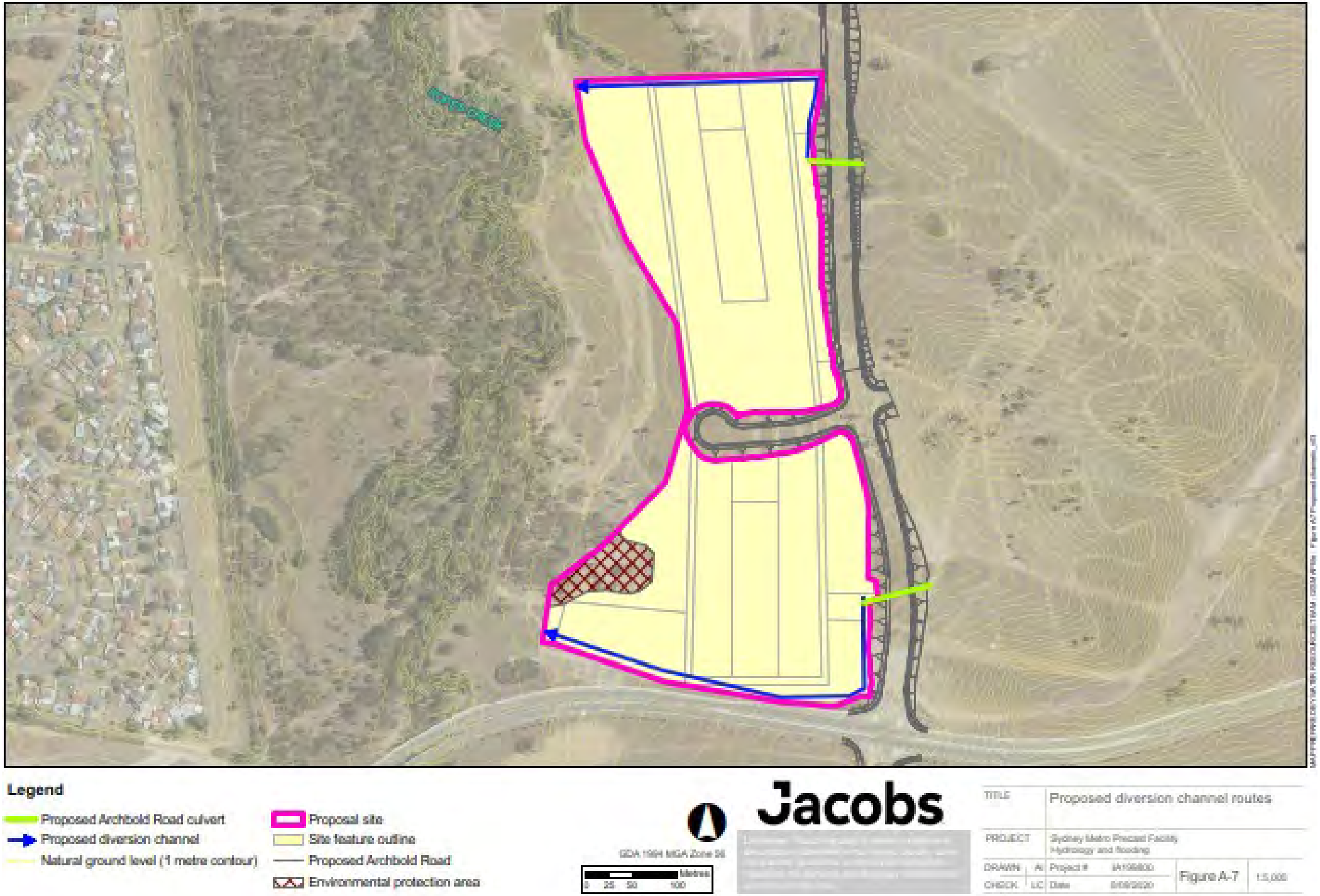



Figure A-7: Proposed route of external flow diversion structures

# Appendix B. Hydrologic modelling input data

Table B-1: ARR 2019 Design rainfall data for Precast Facility



All Design Rainfall Depth (mm)

| | | | | |
|---|---|---|---|---|
| Issued: | 20-Apr-20 | | | |
| Location Label: | Precast Facility | | | |
| Requested coordinate: | Latitude | -33.808406 | Longitude | 150.8175 |
| Nearest grid cell: | Latitude | 33.8125 (S) | Longitude | 150.8125 (E) |

| Duration | Duration in min | 0.5EY | 0.2EY | 10% | 5% | 2% | 1% |
|---|---|---|---|---|---|---|---|
| 1 min | 1 | 2.58 | 3.29 | 3.85 | 4.47 | 5.31 | 5.96 |
| 2 min | 2 | 4.15 | 5.17 | 6.03 | 6.97 | 8.27 | 9.31 |
| 3 min | 3 | 5.79 | 7.25 | 8.46 | 9.78 | 11.6 | 13.1 |
| 4 min | 4 | 7.31 | 9.22 | 10.8 | 12.5 | 14.8 | 16.6 |
| 5 min | 5 | 8.7 | 11 | 12.9 | 14.9 | 17.7 | 19.9 |
| 10 min | 10 | 13.9 | 17.9 | 20.9 | 24.3 | 28.9 | 32.4 |
| 15 min | 15 | 17.4 | 22.3 | 26.2 | 30.4 | 36.1 | 40.5 |
| 20 min | 20 | 19.9 | 25.5 | 29.9 | 34.8 | 41.3 | 46.3 |
| 25 min | 25 | 21.9 | 28 | 32.8 | 38.1 | 45.2 | 50.7 |
| 30 min | 30 | 23.5 | 30 | 35.1 | 40.8 | 48.4 | 54.3 |
| 45 min | 45 | 27.1 | 34.3 | 40.1 | 46.5 | 55.3 | 62.1 |
| 1 hour | 60 | 29.7 | 37.4 | 43.7 | 50.7 | 60.2 | 67.7 |
| 1.5 hour | 90 | 33.7 | 42.1 | 49.1 | 56.9 | 67.7 | 76.3 |
| 2 hour | 120 | 37 | 45.9 | 53.5 | 62 | 73.8 | 83.3 |
| 3 hour | 180 | 42.4 | 52.4 | 60.9 | 70.6 | 84.2 | 95.3 |
| 4.5 hour | 270 | 49.1 | 60.6 | 70.4 | 81.9 | 97.9 | 111 |
| 6 hour | 360 | 54.9 | 67.9 | 79 | 92 | 110 | 125 |
| 9 hour | 540 | 64.9 | 80.8 | 94.4 | 110 | 132 | 150 |
| 12 hour | 720 | 73.3 | 92.2 | 108 | 127 | 152 | 172 |
| 18 hour | 1080 | 87.3 | 111 | 131 | 155 | 186 | 211 |
| 24 hour | 1440 | 98.5 | 127 | 151 | 178 | 214 | 243 |
| 30 hour | 1800 | 108 | 141 | 168 | 199 | 239 | 270 |
| 36 hour | 2160 | 115 | 152 | 182 | 216 | 259 | 293 |
| 48 hour | 2880 | 128 | 170 | 205 | 244 | 292 | 330 |
| 72 hour | 4320 | 144 | 194 | 235 | 281 | 336 | 377 |
| 96 hour | 5760 | 154 | 208 | 252 | 302 | 359 | 403 |
| 120 hour | 7200 | 160 | 215 | 260 | 313 | 371 | 416 |
| 144 hour | 8640 | 164 | 219 | 264 | 317 | 376 | 422 |
| 168 hour | 10080 | 167 | 221 | 264 | 318 | 376 | 422 |

Table B-2 Overland flow sub-catchment data – Existing case

| | Total Area [ha] | Catchment Mannings 'n' | Vectored Slope [%] |
|---|---|---|---|
| CA-1 | 43.4 | 0.05 | 2 |
| CA-2 | 11 | 0.05 | 6.2 |
| CA-3 | 8.3 | 0.05 | 8.8 |
| CA-4 | 2.8 | 0.05 | 5.1 |
| CA-5 | 5.2 | 0.05 | 2.7 |
| CA-6 | 11.6 | 0.05 | 3 |
| CA-7 | 2.5 | 0.05 | 9.2 |
| CA-8 | 0.8 | 0.05 | 6.6 |
| CA-9 | 4.5 | 0.05 | 2.4 |
| CA-10 | 5.9 | 0.05 | 5.7 |
| CA-11 | 1.5 | 0.05 | 3.8 |
| CA-12 | 1.6 | 0.05 | 1.7 |
| CA-13 | 1.7 | 0.05 | 6 |
| CA-14 | 10.5 | 0.05 | 2.6 |
| CA-15 | 33.9 | 0.05 | 4 |
| CA-16 | 23.6 | 0.05 | 3.7 |
| CA-17 | 45 | 0.05 | 3.5 |
| CA-4A | 0.7 | 0.05 | 5.1 |
| CA-5B | 0.8 | 0.05 | 2.7 |

# Appendix J

## Bushfire Risk Assessment

BLACKASH
BUSHFIRE CONSULTING

# Bushfire Risk Assessment

## Sydney Metro West Precast Facility

Prepared for

Arcadis

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

Version 1.7

28 October 2020

| | |
|---|---|
| **Project Name:** | Bushfire Risk Assessment Sydney Metro Precast Facility |
| **Prepared by** | Lew Short |
| **Client Details:** | Mr. Westley Owers<br>NSW Environment Team Leader<br>Arcadis<br>Level 16, 580 George Street<br>Sydney, NSW 2000 Australia<br>westley.owers@arcadis.com |
| **BlackAsh Contact Details** | |
| **Lew Short** | Principal |
| **0419 203 853** | lew.short@blackash.com.au |

| Version | Primary Author(s) | Description | Date Completed |
|---|---|---|---|
| 1.7 | Lew Short | Final | 28 October 2020 |

Lew Short | Principal
BlackAsh Bushfire Consulting
B.A., Grad. Dip. (Design for Bushfires), Grad. Cert. of Management (Macq), Grad. Cert. (Applied Management)
Fire Protection Association of Australia BPAD Level 3 BPD-PA 16373

**Disclaimer**

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The client may, at its discretion, use the report to inform regulators and the public.

# Contents

## Glossary

This section defines those core terms and concepts which are adopted throughout the body of this report.

| Term | Definition |
|---|---|
| **Asset Protection Zone (APZ)** | A fuel-reduced area surrounding a built asset or structure which provides a buffer zone between a bushfire hazard and an asset. The APZ includes a defendable space within which firefighting operations can be carried out. The size of the required APZ varies with slope, vegetation and FFDI. |
| **Bushfire** | A general term used to describe fire in vegetation, includes grass fire. |
| **Bushfire attack mechanisms** | The various ways in which a bushfire can impact upon people and property and cause loss or damage. These mechanisms include flame contact, radiant heat exposure, ember attack, fire wind and smoke. |
| **Bushfire Attack Level (BAL)** | A means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact. The BAL is used as the basis for establishing the requirements for construction to improve protection of building elements and to articulate bushfire risk. |
| **Bushfire Management Committee** | A Bushfire Management Committee (BFMC) provides a forum for cooperative and coordinated bushfire management in a local area. The BFMC is responsible for preparing, coordinating, reviewing and monitoring the Bush Fire Risk Management Plan for the Local Government Area. The BFMC consists of a range of stakeholders such as land managers, fire authorities and community organisations. |
| **Bushfire prone land (BFPL)** | An area of land that can support a bushfire or is likely to be subject to bushfire attack, as designated on a bushfire prone land map. |
| **Bushfire Hazard** | Any vegetation that has the potential to threaten lives, property or the environment. |
| **Bushfire Threat** | Potential bushfire exposure of an asset due to the proximity and type of a hazard and the slope on which the hazard is situated. |
| **Forest Fire Danger Index (FFDI)** | Measures the degree of danger of fire in Australian forests. The index combines a record of dryness, based on rainfall and evaporation, with meteorological variables for wind speed, temperature and humidity. |

| Term | Definition |
|---|---|
| **Risk** | The degree of risk presented by that interaction will depend on the likelihood and consequence of the bushfire occurring. Risk may be defined as the chance of something happening, in a specified period of time that will have an impact on objectives. It is measured in terms of consequences and likelihood. |
| **Risk assessment** | A systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking, having regard to factors of likelihood, consequence, vulnerability and tolerability. |
| **Risk-based land use planning** | The strategic consideration of natural hazard risk and mitigation in informing strategic land use planning activities. |
| **Hazard** | A hazard is any source of potential harm or a situation with a potential to cause loss. A hazard is therefore the source of risk. |
| **Likelihood** | The chance of an event occurring. Likelihood may be represented as a statistical probability (such as an Annual exceedance probability), or whether this is not possible, it can be represented qualitatively using measures such as 'likely', 'possible' and 'rare'. |
| **Managed land** | Land that has vegetation removed or maintained to a level that limits the spread and impact of bushfire. This may include developed land (residential, commercial or industrial), roads, golf course fairways, playgrounds, sports fields, vineyards, orchards, cultivated ornamental gardens and commercial nurseries. Most common will be gardens and lawns within curtilage of buildings. These areas are managed to meet the requirements of an APZ. |
| **Mitigation** | The lessening or minimizing of the adverse impacts of a bushfire event. The adverse impacts of bushfire cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures include engineering techniques, retrofitting and hazard-resistant construction as well as on ground works to manage fuel and separate assets from bushland. |
| **Planning for Bushfire Protection 2019 (PBP 2019)** | NSW Rural Fire Service publication effective from 1 March 2020 which is applicable to all new development on bushfire prone land in NSW. |

| Term | Definition |
|---|---|
| **Tolerable risk** | Organisation's readiness to bear the risk after risk treatment to achieve its objectives. |
| **Vulnerability** | The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.<br>The degree of susceptibility and resilience of the community and environment to hazards. |

# 1. Introduction

Blackash Bushfire Consulting has been engaged by Arcadis to complete a Bushfire Hazard Assessment Report for Sydney Metro to provide specialist bushfire services in support of the proposed precast facilities (the proposal) at Lenore Drive opposite Old Wallgrove Road, Eastern Creek (the proposal site) (Figure 1).

Sydney Metro (as 'the proponent') is seeking approval for the construction and operation of two precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The precast facilities would manufacture precast concrete segments necessary for lining the underground tunnels.

The northern and southern precast facilities would operate concurrently, 24 hours a day, 7 days a week, for the majority of the lifespan of the project.

A small portion of the south-western portion of the proposal site would be conserved as an environmental protection area associated with the presence of Cumberland Plain Woodland. Vegetation within this area would be retained and protected during works.

The proposed layout of the proposal is provided in Figure 2.

On completion of the operation of the proposal, the future use beyond the operation of the proposal would be determined by Sydney Metro and would be subject to separate approvals, as required. If no future use of the site is proposed at that time, the site would be placed into care and maintenance.

The proposal does not include the construction of the surrounding road network (extension of Archbold Road), which would be undertaken by Transport for NSW (TfNSW) under separate approval.

The objective of the report is an analysis of bushfire risk and compliance with the NSW Rural Fire Service (RFS) document *Planning for Bushfire Protection 2019* (PBP 2019). The proposal site is partially located within designated bushfire prone land and bushfire impact is a key consideration to ensure risk is understood and mitigation measures are implemented to reduce the consequences of any bushfire impacts.

This bushfire risk assessment has adopted a risk-based land use management and planning approach to analyse the extent of bushfire risk exposure to the site and associated facilities.

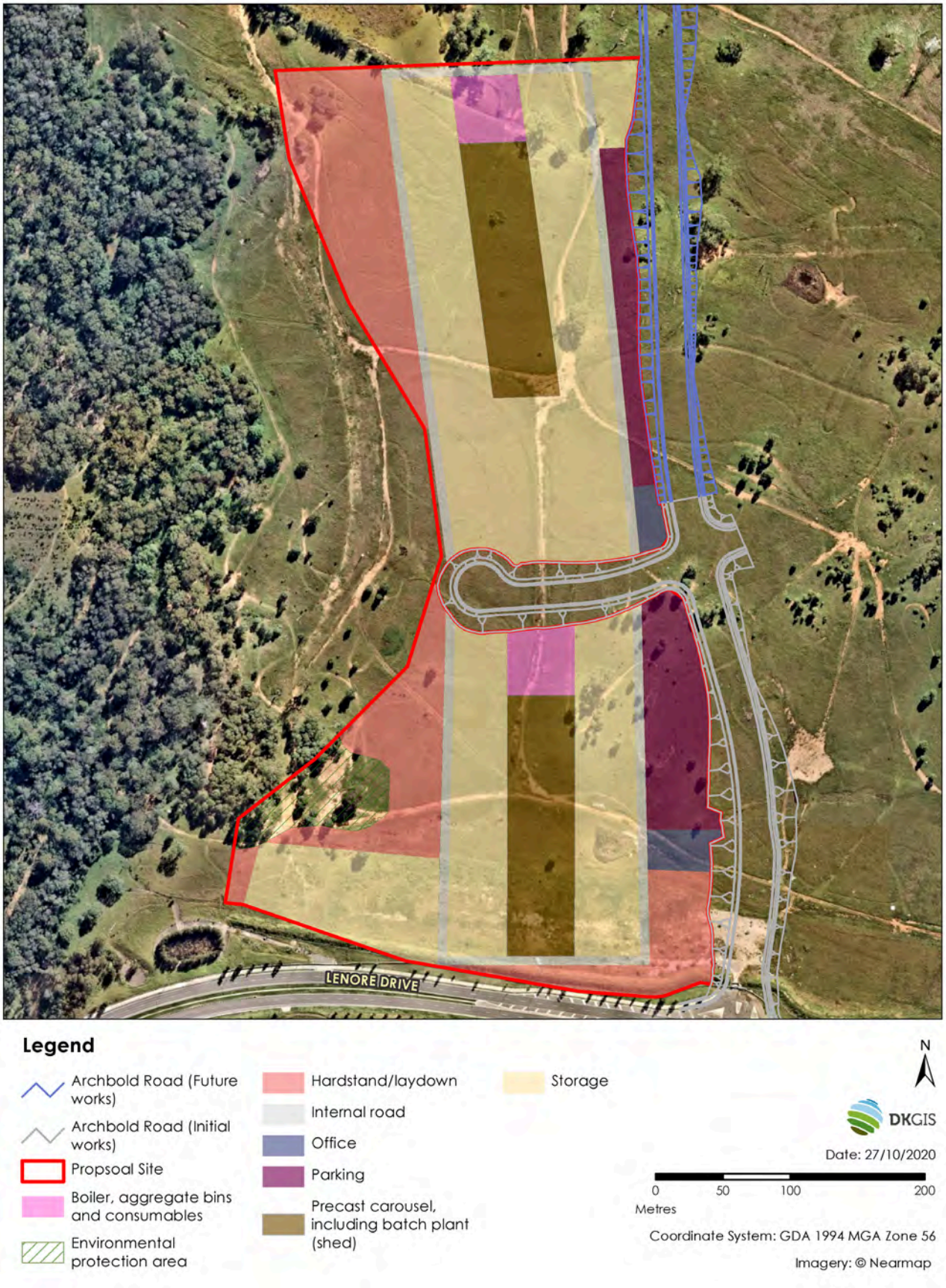
The purpose of this bushfire report is to support the Review of Environmental Factors (REF) for the proposal.

The proposal is in a designated bushfire prone area. All new development on bushfire prone land must comply with the RFS document PBP 2019. The Bushfire Hazard Assessment is a review of the proposal to ensure that the aim and objectives of PBP 2019 are met.

This assessment has been prepared by Lew Short, Principal Blackash Bushfire Consulting (Level 3 FPAA BPAD-A Certified Practitioner No. BPD-PA-16373) who is recognised by the RFS as qualified in bushfire risk assessment and has been accredited by the Fire Protection Association of Australia as a suitably qualified consultant to undertake alternative solution proposals. An external inspection (from publicly accessible areas) of the proposal site and surrounding area was completed on 4 May 2020.

**Figure 1 Site Location**

**Figure 2 Site Plan**



# 2. The Proposal

The proposal would comprise the following key features and activities:

Site preparation consisting of:

- Vegetation clearing, including the removal of about two hectares of native vegetation
- Site remediation
- Connection of utilities (e.g. power, water, sewerage, gas and communications)
- Earthworks to level the site (this may involve the use of retaining walls)
- Installation of lighting and signage

Construction and operation of two adjacent precast facilities, a northern and a southern precast facility, each being sited on about eight hectares. Each precast facility would encompass the following:

- A double-sided casting carousel
- Segment storage
- A concrete batching plant (inside shed with a height of around eight metres)
- Boiler, aggregate bins and consumables
- A laydown/hardstand area
- Offices and site amenities
- Loading and unloading and circulation space for heavy vehicles
- On-site parking for up to 60 light vehicles

Internal roads (one lane each direction) generally around the key operational areas of the facility with entrances to each facility from the Western Access Road located between the northern and southern precast facilities

Landscaping works along the frontage to Lenore Drive and about 50 metres north along Archbold Road.

## 2.1. Operation

The proposal would produce and deliver precast segments. Operational elements of the proposal would include:

- The proposal would produce precast tunnel lining segments to be transported to the Sydney Metro West tunnelling support sites

- The proposal would have a capacity to produce 730 tonnes of concrete per day and would operate up to 24 hours per day and seven days per week (with the implementation of the necessary controls for noise emissions, air quality, traffic movements, etc.)
- The total operational workforce would be around 120 personnel (60 for each facility) on the proposal site at any one time.

# 3. Legislative and policy framework

This section provides an overview of the relevant legislation, policy and guidelines as it relates to the proposal.

## 3.1. Relevant legislation

***Environmental Planning and Assessment Act, 1979 (EP&A Act): Part 5***

The application is made under Part 5 of the EP&A Act. The purpose of the Part 5 assessment system is to ensure public authorities fully consider environmental issues, including bushfire, before they undertake or approve activities that do not require development consent from a council or the Minister for Planning and Public Spaces. In this application, Sydney Metro is the Determining Authority. Where an environmental assessment is completed, referral to concurrence of agencies, such as the RFS is not required. On this basis, referral to the RFS is not required.

***Environmental Planning and Assessment Act, 1979: Section* 10.3 Bushfire Prone Land**

The designation of Bushfire Prone Land (BPL) in NSW is required under the EP&A Act (s.10.3). BPL Maps provide the trigger for the various development assessment provisions. The BPL Map is a trigger for the consideration of bushfire matters for new development. It is not intended as a detailed measure of risk. The map does not form part of the site assessment process.

***Rural Fires Act, 1997***

The Rural Fires Act establishes the NSW Rural Fire Service, defines its functions and makes provision for the prevention, mitigation and suppression of rural fires.

Section 52 of the Rural Fires Act requires Bushfire Management Committees to prepare Bushfire Risk Management Plans. The Bushfire Risk Management Plan provides a risk assessment across a fire district, which have been reviewed as part of this bushfire assessment. The proposal site is within the Cumberland Bushfire Risk Management Plan area (refer to section 3.5).

Section 63 Rural Fires Act of the RF Act requires public authorities and owners and occupiers of land to prevent bushfires and to manage land they are responsible for:

> *s. 63 Duties of public authorities and owners and occupiers of land to prevent bushfires*
>
> *(1) It is the duty of a public authority to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bushfires on, and to minimise the danger of the spread of a bushfire on or from:*
>
> *(a) any land vested in or under its control or management, or*

*(b) any highway, road, street, land or thoroughfare, the maintenance of which is charged on the authority.*

Section 63 places on ongoing bushfire management requirement on Sydney Metro to mitigate the risk of bushfire within the proposal site.

## 3.2. Relevant guidelines

***Planning for Bushfire Protection 2019*** NSW Rural Fire Service
Contains specifications for planning and building on land identified as bushfire prone.

***Standards for Asset Protection Zones*** NSW Rural Fire Service
Provides standards for the establishment and maintenance of asset protection zones.

## 3.3. Bushfire risk

With respect to property loss and fire impact, CSIRO studies have found that approximately 98% of all building loss has been found to occur on days when the Forest Fire Danger Index (FFDI) exceeded 45 (Blanchi & Lucas, 2010). The McArthur FFDI was developed in the 1960s by CSIRO scientist A. G. McArthur to measure the degree of danger of fire in Australian forests. The index combines a record of dryness, based on rainfall and evaporation, with meteorological variables for wind speed, temperature and humidity. The scale starts at 0 and tops out at an FFDI of 100. However, in recent years, FFDI above 100 have been calculated by the Bureau of Meteorology during catastrophic fire weather conditions.

The FFDI measures the degree of danger of fire in Australian vegetation. For the purposes of PBP 2019, the FFDI is required for development assessment purposes and is based on local government boundaries. PBP 2019 uses a design fire for bushfire risk assessment based on a 1:50 year fire weather scenario. Most of the state was determined as FFDI 80, however, a number of areas including the Greater Sydney, Greater Hunter, Illawarra, Far South Coast and Southern Ranges Fire Areas have higher FFDIs which are set at 100 by PBP 2019 (see Section 6 for the assessment methodology).

In events where the FFDI exceeds 50 (which is the point where a total fire ban is declared), fire suppression at any part of a fire line is virtually impossible due to the intensity and unpredictable behaviour of a fire (Leonard & Blanchi, 2012). Building design and construction, fuel management, and restriction of use of the sites during forecast bad fire weather are the only effective defence mechanisms available once the FFDI has exceeded 50 (Blanchi & Lucas, 2010; Leonard & Blanchi, 2012). These are provided by PBP 2019 and the construction requirements provided within the Australian Standard for Construction of Buildings in Bushfire Prone Areas (AS3959).

In considering risk to life, it is incumbent to examine historical bushfire-related life loss research. In 2012, the CSIRO in conjunction with the former Bushfire Corporative Research Centre undertook a comprehensive study into matters of both life and house loss utilising over 110 years (1901-2011) of data across 260 bushfire events (Blanchi et al. 2012). Over this period, a total of 825 known civilian and firefighter fatalities have occurred (Blanchi et al. 2012). Important findings of this seminal research are as follows:

- It is evident that fire weather and proximity to forest are very strong contextual drivers for defining the potential for fatalities to occur
- 85 per cent of fatalities occur within 100m of bushland
- 50 per cent of all recorded facilities have occurred on days exceeding FFDI 100 (most fatalities occur as a result of infrequent but high magnitude events)
- Late evacuation is the most common activity persons were engaged in at time of death (30.3 per cent) followed by sheltering inside a structure (24.8 per cent) and defending a property outside (22.4 per cent)
- For those instances where sufficient data is available with respect to fatalities occurring during the act of evacuation, most were trapped on roads by either fallen trees or become bogged, the remainder having run off the road due to poor visibility as a result of smoke conditions
- In terms of location of fatal exposure, 50 per cent occurred out in the open (including persons found outside structures and outside vehicles), 28 per cent occurred inside structures and in events where FFDI exceeded 100, fatalities within structures represented over 75 per cent of life loss
- The percentage of fatalities within structures appears to be increasing over time, mostly attributed to the 2009 Victorian Bushfires where 118 of the 173 fatalities occurred inside a structure
- Most fatalities occur between the hours of 3pm and 9pm – when FFDI is at its peak (3pm) and when summer cool-change winds occur. 90 per cent of fatalities occur immediately after afternoon wind changes.

In considering the above findings, there remain two key contextual matters which reflect the extent of fatalities in certain situations, including:

1. there is a direct relationship between fire intensity (as a function of FFDI) and both property and life loss, over distance from the bushland interface; and
2. the afternoon cool-wind change is likely a key phenomenon in situations where life loss occurs. These winds change the direction of the fire front, where the wide fire flank transitions to the head of the fire, creating a drastic spike in fire intensity and rate of spread over a wide distance and in a direction, which is not anticipated by the general community. These

situations can lead to higher proportions of people taking passive shelter (i.e. the window to evacuate has passed) and attempting late evacuation, as can the 'wait and see' mindset. Topographic conditions can also result in the same effect, where residents may not be aware of an approaching fire until it reaches a nearby ridgeline.

## 3.4. Land use planning and bushfire risk

Australia has a history of high consequence bushfires, which have caused loss of life, damage and disruption. Risk based land use planning provides the tolerable bushfire risk levels through documents such as PBP 2019, legislation, policy and guidelines.

Risk based land use planning has consistently been identified as one of the key means to reduce natural disaster risks to assets and communities. Improved risk based land use planning in areas that are subject to natural hazard are fundamental to developing and enhancing resilient development, critical infrastructure and communities.

The objectives of PBP 2019 articulates the criteria to determine tolerable risk to assets and people associated with 'other' development.

## 3.5. Cumberland Bushfire Risk Management Plan

The Cumberland Zone Bushfire Management Committee (BFMC) *Bushfire Risk Management Plan 2010* (Risk Plan) includes the Local Government Area/s of Blacktown, Fairfield and Penrith. The Risk Plan is a strategic document that identifies community assets at risk and sets out a five-year program of coordinated multi-agency (state and local) treatments to reduce the risk of bushfire to the assets.

The Risk Plan (p. 9) identifies the typical climate in the Cumberland Zone BFMC area (in which the proposal site in located) as warm temperate experiencing warm to hot summers and cool to mild winters with predominately summer/autumn rainfall and dry winter and spring. The bushfire season generally runs from October to March, and may occasionally be brought forward due to dry winter conditions and long cured grassland.

The prevailing weather conditions associated with the bushfire season in the Cumberland Zone BFMC area are in two parts, the dry winter with August / September winds providing potential fire conditions for the cured grassland areas, and the second is the north-westerly winds accompanied by high temperatures and low relative humidity providing weather conditions conducive for large spreading bushfires.

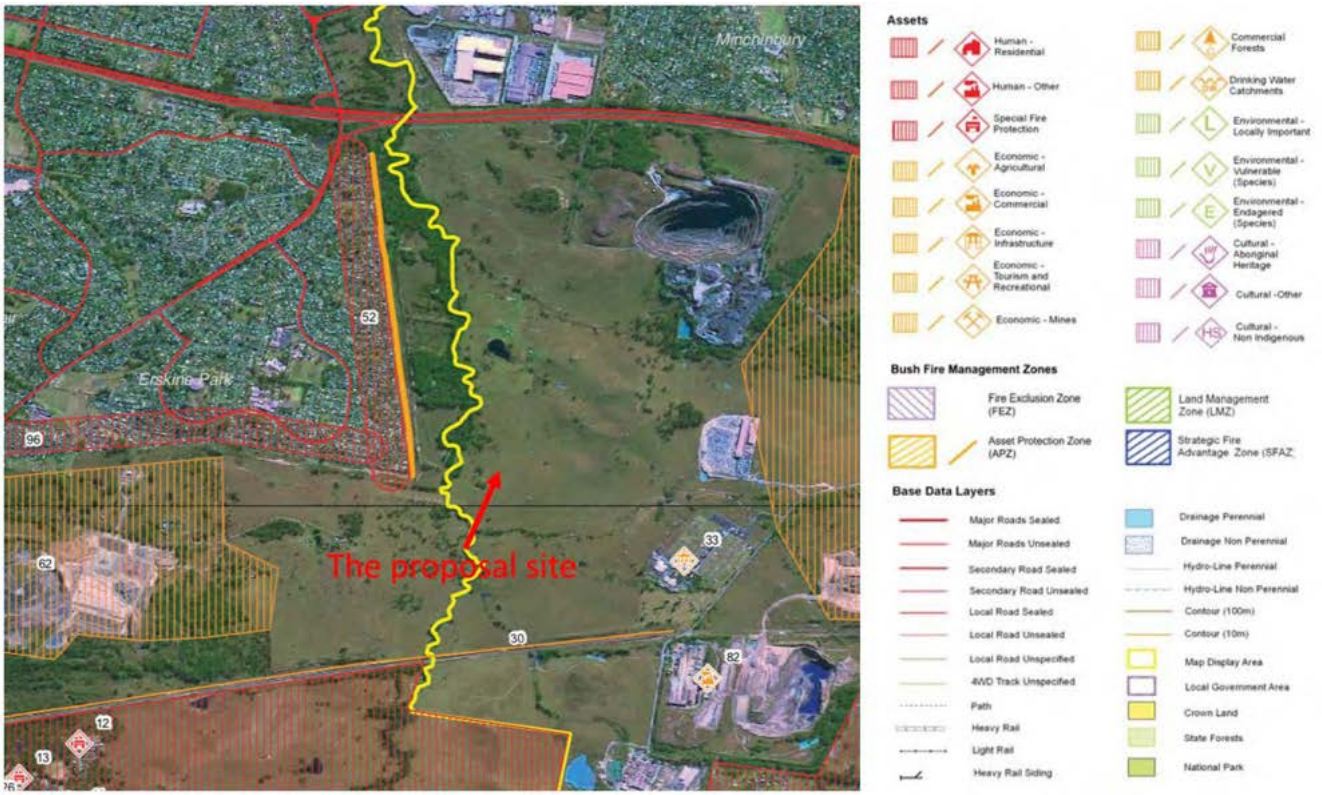
The prevailing weather conditions associated with the bushfire season in the proposal site are north-westerly winds accompanied by high day-time temperatures and low relative humidity.

The Cumberland Zone BFMC area has on average over 450 bush and grass fires per year, of which only a few are considered to be major fires (Risk Plan p. 12). The Risk Plan identifies that the main sources of ignition in the Cumberland Zone BFMC area are:

- *Illegal burning: mainly within the rural areas of all three local government areas*
- *Car dumping: the dumping of cars and setting them alight in bushland areas is a regular occurrence, mainly in the Castlereagh and Londonderry area*
- *Lightning: is generally associated with the summer thunderstorm activity and mainly affects the southern areas of the Zone, however, is known to occur in the northern parts of the Penrith LGA*
- *Deliberately lit fires: there is a high occurrence of deliberately lit fires within the Wilmot / Bidwill, Glenmore Park,* ***Ropes Creek areas****, where there are areas of bushland around and within built up areas.*

The Ropes Creek area has been identified in the Risk Plan as an area of known arson and high ignition sources. The site and surrounds are shown in Figure 4 from the Risk Plan with an asset protection zone on the western side of Ropes Creek adjacent to residential properties.

**Figure 3 Extract from Cumberland Bushfire Risk Management Plan (p. 42)**



## 3.6. Assessment framework

The proposal is seeking approval under Part 5 of the *Environmental Planning and Assessment 1979* (EP&A Act) for the construction and operation of two precast facilities and associated ancillary infrastructure. The purpose of the Part 5 assessment system is to ensure public authorities fully consider environmental issues, including bushfire, before they undertake or approve activities that do not require development consent from a council or the Minister. In this application, Sydney Metro is the Determining Authority. Where an environmental assessment is completed, referral to concurrence of agencies, such as the RFS is not required. On this basis, referral to the RFS is not required.

The identification of BPL in NSW is provided under S.10.3 of the EP&A Act. The proposal site is on designated Bushfire Prone Land and the surrounding grassland area is not managed which causes a bushfire risk. The BPL Maps provide the trigger for the consideration of bushfire matters for new development. All new development on bushfire prone land must comply with PBP 2019.

The aim of PBP 2019 is *to provide for the protection of human life and minimise impacts on property from the threat of bushfire, while having due regard to development potential, site characteristics and protection of the environment*.

The objectives are to:

- *Afford buildings and their occupants protection from exposure to a bushfire*
- *Provide for a defendable space to be located around buildings*
- *Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings*
- *Ensure that appropriate operational access and egress for emergency service personnel and occupants is available*
- *Provide for ongoing management and maintenance of BPMs; and*
- *Ensure that utility services are adequate to meet the needs of firefighters.*

PBP 2019 articulates the regulatory framework for new development in NSW, along with the relevant bushfire protection measures to be contemplated in the delivery of bushfire-resilient development design. The document provides detailed provisions for various types of development which is focussed at residential and Special Fire Protection Purpose development.

On 1 March 2020, PBP 2019 was given legislative effect and replaced Planning for Bushfire Protection 2006 (PBP 2006). The Environmental Planning and Assessment Amendment (Planning for Bush Fire Protection) Regulation 2020 under the Environmental Planning and Assessment Act 1979 came into effect on 1 March 2020.

The proposal is considered as 'other development' in PBP 2019. 'Other development' includes industrial and infrastructure development. PBP 2019 does not provide a framework for the proposal in a meaningful way as the document is focussed at residential development in Bushfire Prone Areas. However, 'other development' must only satisfy the aim and objectives of PBP 2019. This assessment includes an analysis of the hazard, threat and subsequent bushfire risk to the proposal and provides recommendations that satisfy the aims and objectives of PBP 2019.

# 4. Existing environment

## 4.1. Bushfire prone land

The proposal site has a small section at the north western corner identified as being within the 100-metre vegetation buffer of 'bushfire prone land' (see Figure 4) for the purposes of Section 10.3 of the EP&A Act. The legislative requirements for development on bushfire prone lands are applicable. Bushfire prone land maps provide a trigger for the development assessment provisions and consideration of sites that are bushfire prone.

Bushfire prone land (BFPL) is land that has been identified by Blacktown City Council and Penrith City Council, which can support a bushfire or is subject to bushfire attack. Bushfire prone land maps are prepared by Blacktown City Council and certified by the Commissioner of the NSW RFS.

Figure 4 shows the Bushfire Prone Land Map for the proposal site. The north-western portion of the proposal site is within Category 1 Bushfire Prone Land vegetation buffer (approximately 1157m²). Other areas of the proposal site are not within areas designated as being bushfire prone.

Based on the external site inspection and review of high-resolution aerial photography for the site and surrounds, the certified Bushfire Prone Map under represents the on ground bushfire hazard. Additional areas of forest and woodland vegetation within the Ropes Creek corridor and the grassland surrounding the proposal site is not managed and falls into the designation of Category 3 land. The categories of Bushfire Prone Land are designated in the NSW RFS document *Guideline for the Mapping of Bushfire Prone Land* (2015) and described below. The vegetation buffer is a requirement of the vegetation category provided, i.e. the higher the risk associated with the vegetation type, the larger the vegetation buffer.

***Vegetation Category 1***

*Vegetation Category 1 is considered to be the highest risk for bush fire. It is represented as red on the bush fire prone land map and will be given a 100m buffer. This vegetation category has the highest*

*combustibility and likelihood of forming fully developed fires including heavy ember production. Vegetation Category 1 consists of:*

- *Areas of forest, woodlands, heaths (tall and short), forested wetlands and timber plantations.*

***Vegetation Category 2***

*Vegetation Category 2 is considered to be a lower bush fire risk than Category 1 and Category 3 but higher than the excluded areas. It is represented as light orange on a bush fire prone land map and will be given a 30 metre buffer. This vegetation category has lower combustibility and/or limited potential fire size due to the vegetation area shape and size, land geography and management practices. Vegetation Category 2 consists of:*

- *Rainforests.*
- *Lower risk vegetation parcels. These vegetation parcels represent a lower bush fire risk to*
- *surrounding development and consist of:*
    - *Remnant vegetation;*
    - *Land with ongoing land management practices that actively reduces bush fire risk. These areas must be subject to a plan of management or similar that demonstrates that the risk of bush fire is offset by strategies that reduce bush fire risk; AND include:*
        - *Discrete urban reserve/s;*
        - *Parcels that are isolated from larger uninterrupted tracts of vegetation and known fire*
        - *paths;*
        - *Shapes and topographies which do not permit significant upslope fire runs towards development;*
        - *Suitable access and adequate infrastructure to support suppression by firefighters;*
        - *Vegetation that represents a lower likelihood of ignitions because the vegetation is surrounded by development in such a way that an ignition in any part of the vegetation has a higher likelihood of detection.*

***Vegetation Category 3***

*Vegetation Category 3 is considered to be medium bush fire risk vegetation. It is higher in bush fire risk than Category 2 (and the excluded areas) but lower than Category 1. It is represented as dark orange on a Bush Fire Prone Land map and will be given a 30 metre buffer. This category consists of:*

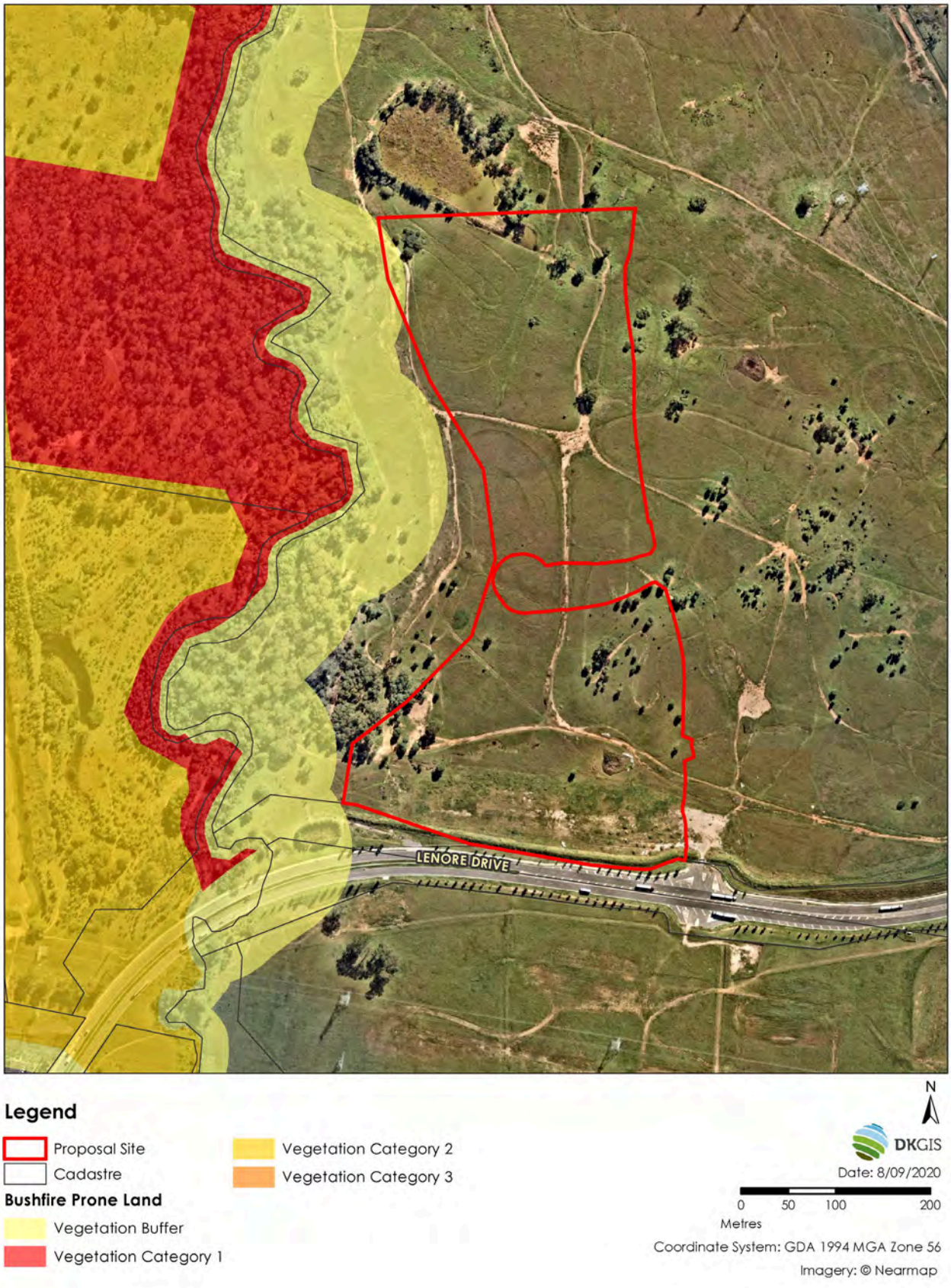
- *Grasslands, freshwater wetlands, semi-arid woodlands, alpine complex and arid shrublands.*

PBP 2019 (p. 111) notes that grass, whether exotic or native, which is regularly maintained at or below 10 centimetre in height (includes maintained lawns, golf courses, maintained public reserves, parklands, nature strips and commercial nurseries) is regarded as managed land. Managed land is

land that has vegetation removed or maintained to limit the spread and impact of bushfire. It may include existing developed land (i.e. residential, commercial or industrial), roads, golf course fairways, playgrounds or sports fields, vineyards, orchards, cultivated ornamental gardens and commercial nurseries. Most common would be gardens and lawns within curtilage of buildings. Areas within the proposal site would be managed to meet the requirements of an Asset Protection Zone (refer to section 6.3).

While the grassland surrounding the proposal site is not designated as being bushfire prone on the Bushfire Prone Land Map, it is able to carry a bushfire. As such, the unmanaged grassland areas have been treated within this Bushfire Hazard Assessment as a hazard. The unmanaged grassland areas off site, should be designated as Category 3 land by the NSW RFS where it is capable of sustaining a fire.

**Figure 4 Bushfire Prone Land** (source NSW Rural Fire Service)



# 5. Assessment methodology

PBP 2019 identifies the methodology to determine Bushfire Attack Levels (BAL) based on calculated radiant heat levels at a site. This assessment is based on mapping of vegetation formations and slope assessment in accordance with PBP 2019. This assessment is based on a desktop assessment of the site utilising the following resources:

- *Planning for Bushfire Protection* (NSW RFS, 2019)
- Aerial mapping
- Detailed GIS analysis.

Bushfire risk as influenced by fire history and future mitigation strategies (e.g. hazard reduction burning) has no bearing on the determination of bushfire protection strategies for future development at the sites. This is due to the fact that PBP 2019 assesses bushfire threat based purely on vegetation and slope (i.e. hazard and not risk), making the assumption that a fire may occur at a near worst-case scenario and with maximum fuel loads.

In undertaking the report, Blackash has followed the methodology outlined in accordance with PBP 2019. The following methodology is from PBP 2019 (p. 80) which has been used to determine the BAL at the site. The process to determine BAL is outlined below:

**To Determine Bushfire Attack Level**

***Step 1:*** *Determine vegetation formation in all directions around the building to a distance of 140 metres*

***Step 2:*** *Determine the effective slope of the land from the building for a distance of 100 metres*

***Step 3:*** *Determine the relevant FFDI for the council area in which the development is to be undertaken*

***Step 4:*** *Determine the separation distance by measuring from the edge of the unmanaged vegetation to the closest external wall of an asset*

***Step 5:*** *Match the relevant FFDI, appropriate vegetation, distance and effective slope to determine the appropriate BAL using the relevant tables in PBP 2019.*

The vegetation formations (bushfire fuels) and the topography (effective slope) combine to create the bushfire threat that may affect bushfire behaviour at the proposal site, and which determine the planning and building response of PBP 2019.

## 5.1. Fire weather

The fire weather is dictated by PBP 2019 and assumes a credible worst-case scenario and an absence of any other mitigating factors relating to aspect or prevailing winds. The FFDI measures the degree of danger of fire in Australian vegetation.

For the purposes of PBP 2019, the FFDI required to be used for development assessment purposes is based on local government boundaries. The proposal site has a FFDI of 100 as required by the RFS and PBP 2019[1].

It may be possible that days of higher FFDI may be experienced at the proposal site. This may result in fire situations where conditions challenge survivability of buildings and their occupants. The framework provided for by PBP 2019 has been used in this assessment.

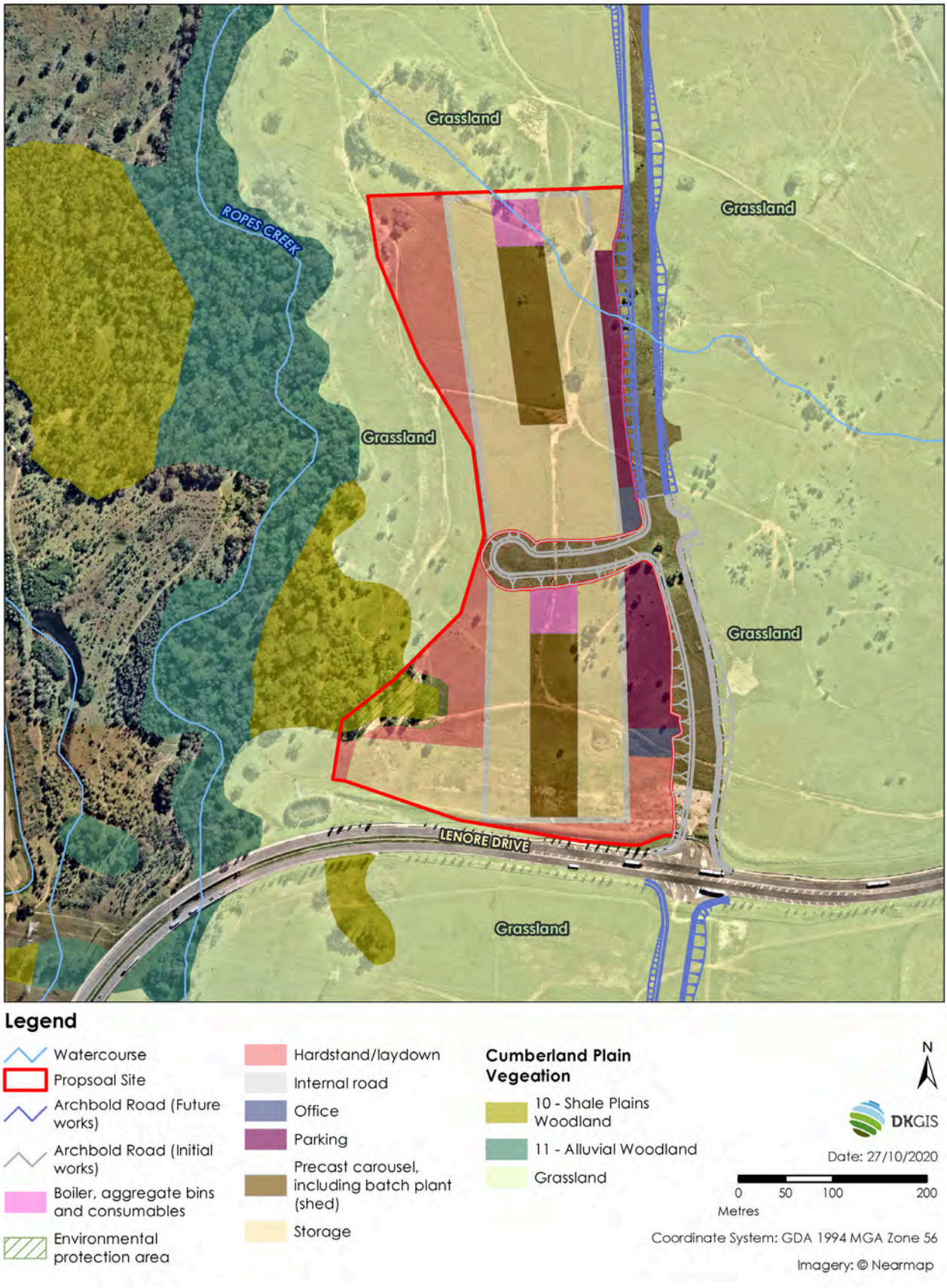
## 5.2. Vegetation

Predominant vegetation is classified by structure or formation using the system adopted by David Keith (2004) and by the general description using PBP 2019. Vegetation types give rise to radiant heat and fire behaviour characteristics. The predominant vegetation has been determined for the proposal site over a distance of at least 140 metres in all directions from the proposed site boundary or key assets on the proposal site. Where a mix of vegetation types exist, the type providing the greater hazard is said to predominate.

The land to the west of the proposal site is identified as bushfire prone land (see Figure 3) and is made up of a mix of vegetation with the most significant being dry sclerophyll forest, woodland and grassland vegetation (Figure 5).

[1] https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0007/55285/Local-government-areas-and-FDI.pdf

**Figure 5 Vegetation**



## 5.3. Slope assessment

The slope assessment (Figure 6) for the proposal site has been undertaken in the GIS analysis and is a component of determining the BAL rating for each site.

The slope is to be categorised into one of following classes (as required by PBP 2019), relative to the location of the hazard:

- all upslope vegetation (considered 0 degrees)
- >0 to 5 degrees downslope vegetation
- >5 degrees to 10 degrees downslope vegetation
- >10 degrees to 15 degrees downslope vegetation; and
- >15 degrees to 20 degrees downslope vegetation.

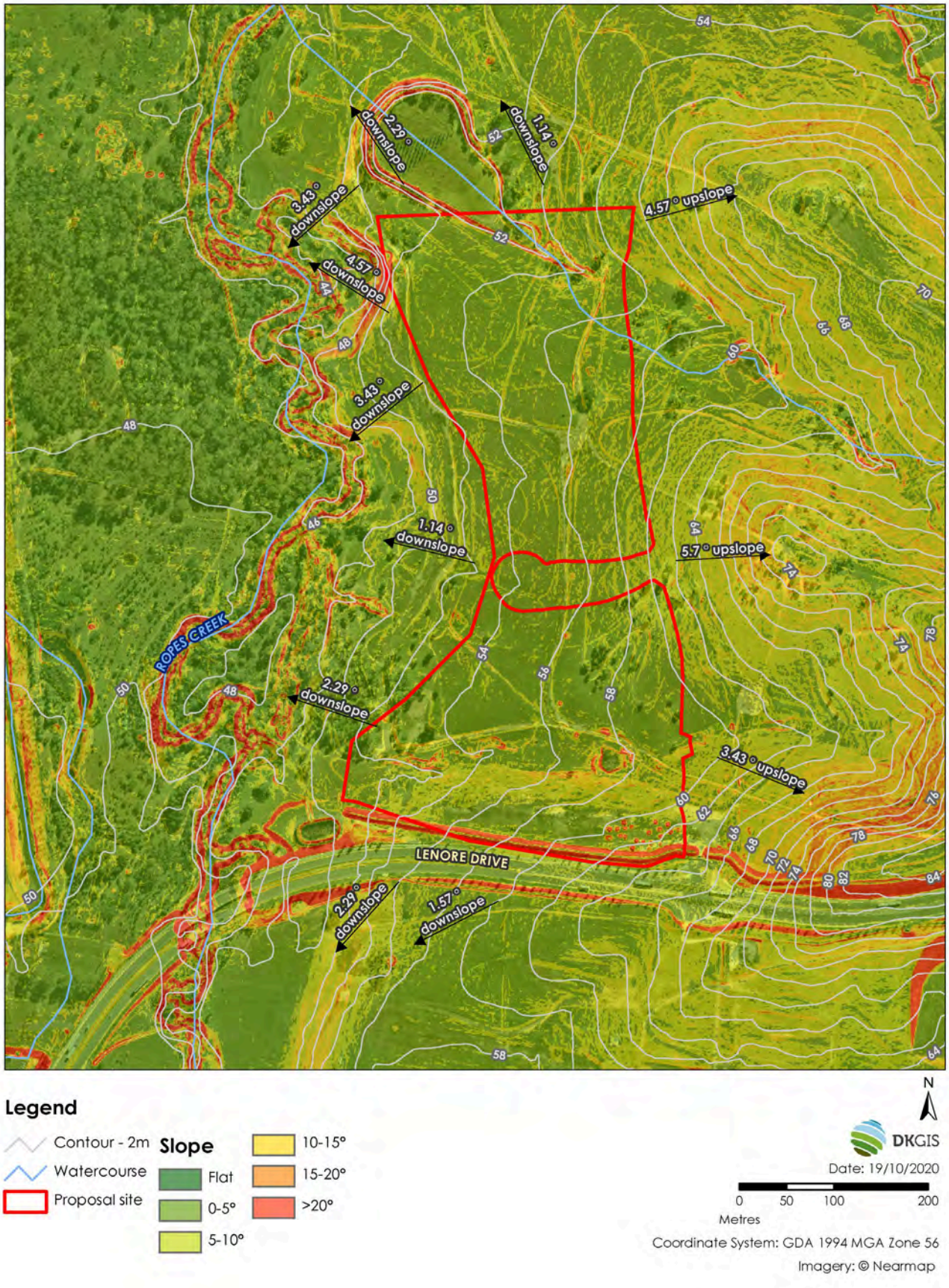
The slope of the land under the classified vegetation has a direct influence on the rate of fire spread, the intensity of the fire and the ultimate level of radiant heat flux. The effective slope is the slope of the ground under the hazard (vegetation). It is not the slope between the vegetation and the building (slope located between the asset and vegetation is the site slope).

In identifying the effective slope, it may be found that there are a variety of slopes covering different distances within the vegetation. The effective slope is considered to be the slope under the vegetation which will most significantly influence the bushfire behaviour for each aspect. This is usually the steepest slope which has been used in this assessment.

The slopes to the west of the proposal site slope gently down to Ropes Creek between 1.14 and 4.57 degrees downslope. Similar gentle slopes are present to the north of the proposal site.

Slopes to the east of the proposal site are steeper upslope and away from the site ranging from 3.43 – 5.7 degrees upslope. Slopes within the proposal site are flat with some areas of gentle gradients. These areas would be developed and are not part of the assessment of bushfire threat.

**Figure 6 Slope Assessment**



# 6. Impact assessment

## 6.1. Bushfire attack levels

The predominant (direct) threat to the proposal site is from grassfire being driven by north westerly or westerly winds into the proposal site. The risk posed by grass fires is different to that of fires in other vegetation types. Grass fires burn at a higher intensity and spread more rapidly with a shorter residence time. Embers produced by grass fires are smaller and fewer in number.

The Bushfire Attack Levels (BAL) for the proposal site have been determined in accordance with PBP 2019 and the Australian Standards for *Construction of Buildings in Bushfire Prone Areas* (AS3959).

The BAL is a means of measuring the severity of a building's or sites potential exposure to ember attack, radiant heat and direct flame contact (see Table 1).

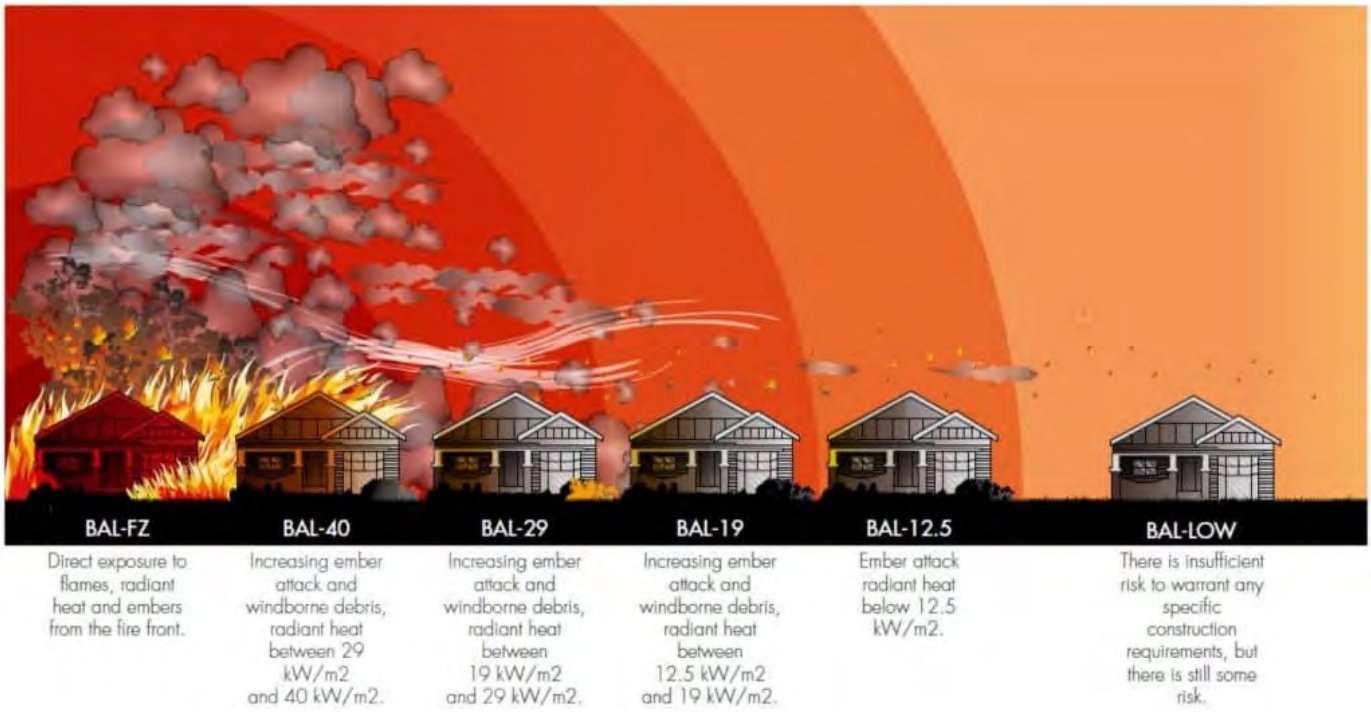
In the Building Code of Australia through AS3959, the BAL is used as the basis for establishing the requirements for construction to improve protection of building elements and to understand the radiant heat exposures for people in the open. The BAL output for the sites can be viewed with Table 2 for the effects of radiant heat. The BAL levels, the associated radiant heat flux and the predicted bushfire attack mechanisms from AS3959 are shown in Table 3. Figure 7 shows the effects of the various forms of bushfire attack.

**Table 1 Bushfire Attack Levels (source AS3959 p. 34)**

| Bushfire Attack Level | Radiant Heat Flux exposure | Description of predicted bushfire attack and levels of exposure |
|---|---|---|
| **BAL - Low** | NA | There is insufficient risk to warrant specific construction requirements |
| **BAL – 12.5** | <12.5kWm$^2$ | Ember attack |
| **BAL – 19** | >12.5kWm$^2$ - <19kWm$^2$ | Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux |
| **BAL – 29** | >19kWm$^2$ - <29kWm$^2$ | Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux |
| **BAL – 40** | >29kWm$^2$ - <40kWm$^2$ | Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux with the increased likelihood of exposure to flames |

| Bushfire Attack Level | Radiant Heat Flux exposure | Description of predicted bushfire attack and levels of exposure |
|---|---|---|
| **BAL – Flame Zone** | >40kWm$^2$ | Direct exposure to flames from the fire front in addition to radiant heat flux and ember attack. |

**Figure 7 Forms of Bushfire Attack (source cfa.vic.gov.au)**

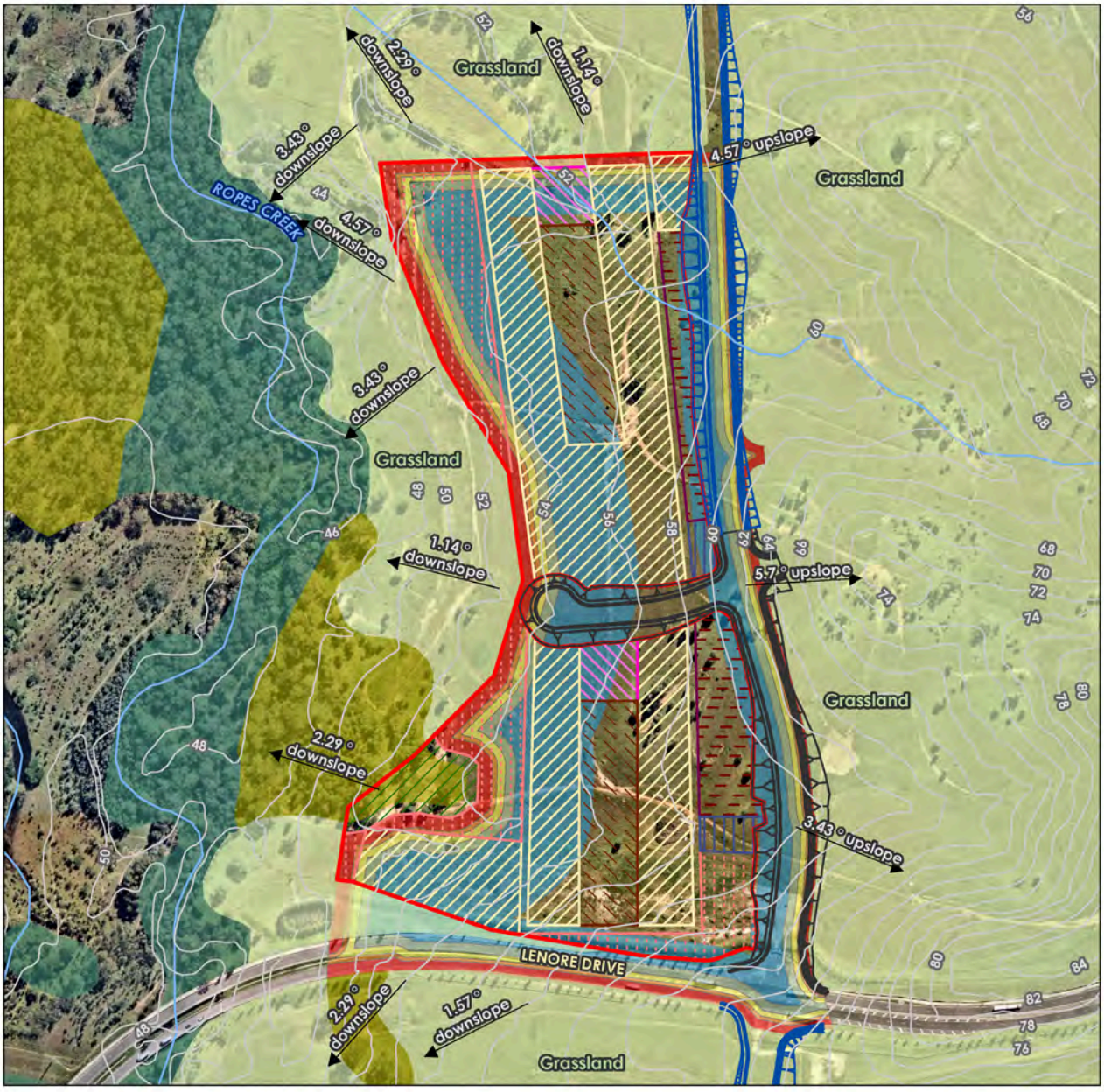



The BAL assessment (Figure 8) has been completed based on the current site boundary and the assumption that all vegetation (if any) within the proposal site would be managed as an APZ. This is with the exception of the environmental protection area which would be retained.

The assessed BAL level for each of the sites should be used to determine the vulnerability of assets and mitigation strategies that can be utilised to reduce the bushfire threat. The objectives of PBP 2019 (P. 10) requires that an appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings. The BAL has been determined for the site as shown in Figure 8. Key assets including the office are at BAL 12.5 as per Figure 8. It is understood that some key assets such as the warehouse, office and shed within the BAL 12.5 are not highly vulnerable to the impact of bushfire. By virtue of the site layout, the broader site is considered a low risk.

Any alterations to the internal design configuration of the proposal site may change the risk associated with the placement of the asset. Table 3 can be used to determine BAL levels for assets or distances of APZs to reduce or increase the level of exposure of an asset.

**Figure 8 Bushfire Attack Levels**



## 6.2. Overview of bushfire attack mechanisms

Bushfires have long remained a fundamental characteristic of the Australian bush landscape, and likewise Australians have long retained a strong affinity with bush environments. There remain a number of common factors which are associated with bushfire hazard and events and these include the incidence of fire weather, availability of fuel along with its type, structure and continuity or fragmentation, and the context of development at the bushland interface.

Bushfire attack refers to the various methods (see section 6) in which bushfire may impact upon life and property and principally encompass:

- Direct flame contact
- Ember attack
- Radiant heat flux
- Fire-driven wind
- Smoke.

In the progression of a bushfire event, these methods interact either exclusively or in concert and are explained in the following section.

### 6.2.1. Direct flame contact

Direct flame attack refers to flame contact from the main fire front, where the flame which engulfs burning vegetation is one and the same as that which assumes contact with the building. It is the highest level of bushfire attack as a consequence of direct flame contact from the fire front in addition to heat flux and ember attack.

### 6.2.2. Ember attack

The convective forces of bushfire raise burning embers into the atmosphere on prevailing winds and deposit them to the ground ahead of the fire front. Typically, ember attack occurs approximately 30 minutes prior to the arrival of the fire front and continues during the impact of the fire front and for several hours afterwards, thus it is the longest lasting impact of bushfire attack.

Ember attack is attack by smoldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.

In essence, building loss via ember attack relates largely to the vulnerabilities and peculiarities of each building, its distance from hazardous vegetation and whether an occupant (or the like) is present to actively defend it. It is estimated by the CSIRO that approximately 80 to 90 per cent of buildings lost by bushfire are lost as a result of ember attack either in isolation or in combination with radiant heat impact.

### 6.2.3. Radiant heat flux

Exposure to radiant heat remains one of the leading causes of fatalities associated with bushfire events. Measured in kilowatts per square metre ($kWm^2$), radiant heat is the heat energy released from the fire front which radiates to the surrounding environment, deteriorating rapidly over distance.

In terms of impact on buildings, radiant heat can pre-heat materials making them more susceptible to ignition, or can cause non-piloted ignition of certain materials if the energy transmitted reaches a threshold level. Radiant heat can also damage building materials such as window glazing, allowing openings into a building through which embers may enter. Radiant heat impact is an especially important factor in building-to-building ignition.

In terms of radiant heat exposure for humans, it can cause pain to unprotected skin in milder situations or life threatening and fatal injury in higher exposure thresholds. The effects of radiant heat are shown in Table 2.

**Table 2 The effects of radiant heat (NSWRFS 2006; Drysdale, 1999; CFA, 2012)**

| Radiant Heat Flux $kW/m^2$ | Observed Effect |
|---|---|
| **1** | Maximum for indefinite skin exposure |
| **3** | Hazardous conditions, fire fighters expected to operate for a short period (10 minutes) |
| **4.7** | Extreme conditions, fire fighters in protective clothing will feel pain after 60 seconds exposure |
| **6.4** | Pain after 8 seconds of skin exposure |
| **7** | Likely to be fatal to unprotected person after exposure for several minutes |
| **10** | Critical conditions, fire fighters not expected to operate in these conditions although they may be encountered. Considered to be life threatening in less than 60 seconds in protective equipment. Fabrics inside a building could ignite spontaneously with long exposure |
| **12.5 (BAL 12.5)** | Volatiles from wood may be ignited by pilot after prolonged exposure. Standard float glass could fail during the passage of a bushfire |
| **16** | Blistering of skin after 5 seconds |
| **19 (BAL 19)** | Screened float glass could fail during the passage of a bushfire |
| **29 (BAL 29)** | Ignition of most timbers without piloted ignition (3 minutes exposure) during the passage of a bushfire. Toughened glass could fail. |
| **40+** | Flame zone – exposure to direct flame contact from fire front |

### 6.2.4. Fire driven wind

The convective forces of bushfire typically result in strong to gale force fire-driven winds which in itself, can lead to building damage. The typical effects of fire driven wind include the conveyance of embers, damage from branches and debris hitting the building, as well as direct damage to vulnerable building components such as lifting roofs or roof materials and the damage / breakage of windows.

### 6.2.5. Smoke

Smoke emission remains a secondary effect of bushfire and is one which is typically not addressed by bushfire assessments. Irrespective, it is important to note the potentially severe impact of smoke emission on the human respiratory system. It can lead to difficulties in breathing, severe coughing, blurred or otherwise compromised vision, and can prove fatal. It is also important to note that toxic smoke can occur during bushfire, particularly where buildings or materials are ignited. With regard to evacuation, it can reduce visibility and create difficulties for particularly vulnerable persons.

## 6.3. Asset protection zones

An APZ is a buffer zone between a bushfire hazard and buildings. The APZ is managed progressively to minimise fuel loads and reduce potential radiant heat levels, flame, smoke and ember attack. The appropriate APZ distance is based on vegetation type, slope and the nature of the development. The APZ can include roads or land managed to be consistent with APZ standards set out in RFS document *Standards for Asset Protection Zones* (Standards for APZ).

The APZ provides a fuel-reduced, physical separation between buildings and bushfire hazards is a key element in the suite of bushfire measures and dictates the type of construction necessary to mitigate bushfire attack.

It is recommended that the proposal site is managed as an APZ as per Figure 9. Access roads, carparks, hardstand areas and the batching plants are all non-combustible and meet the requirements of an APZ. APZs widths have been determined in accordance with PBP 2019 (see Table 3).

Buildings would need to meet the requirements of Australian Standard for *Construction of Buildings in Bushfire Prone Areas* (AS3959) or risk of loss is to be understood by Sydney Metro.

APZs would be implemented in the proposal site based on the following:

- APZ (10 metres): located outside the eastern boundary of the proposal site, adjacent to the planned Archbold Road upgrade and extension, where there is a lower risk for bushfire
- APZ (12 metres): located adjacent to Lenore Drive (outside the south boundary of the proposal site), and the dam and grassland (north of the proposal site) where there is medium risk for bushfire
- APZ (16 metres): located at the western boundary of the proposal site, adjacent to the riparian vegetation along Ropes Creek and the environmental protection area at the south-western portion of the proposal site where there is a higher risk for bushfire. However, hardstand and laydown areas in the western boundary of the proposal site would effectively operate as APZs to the Ropes Creek vegetation as these areas are non-combustible.

The *Standards for APZs* require extensive modification of vegetation such that an area will not support a bushfire. An APZ is a fuel reduced area surrounding a built asset or structure. An APZ provides:

- a buffer zone between a bushfire hazard and an asset
- an area of reduced bushfire fuel that allows suppression of fire

- an area from which backburning by fire fighters may be conducted; and
- an area which allows emergency services access and provides a relatively safe area for firefighters to defend property.

The requirement for an APZ allows for vegetation and planting. However, bushfire fuels are minimised within an APZ. This is so the vegetation within the planned zone does not provide a path for the transfer of fire to the asset either from the ground level or through the tree canopy or ground vegetation.

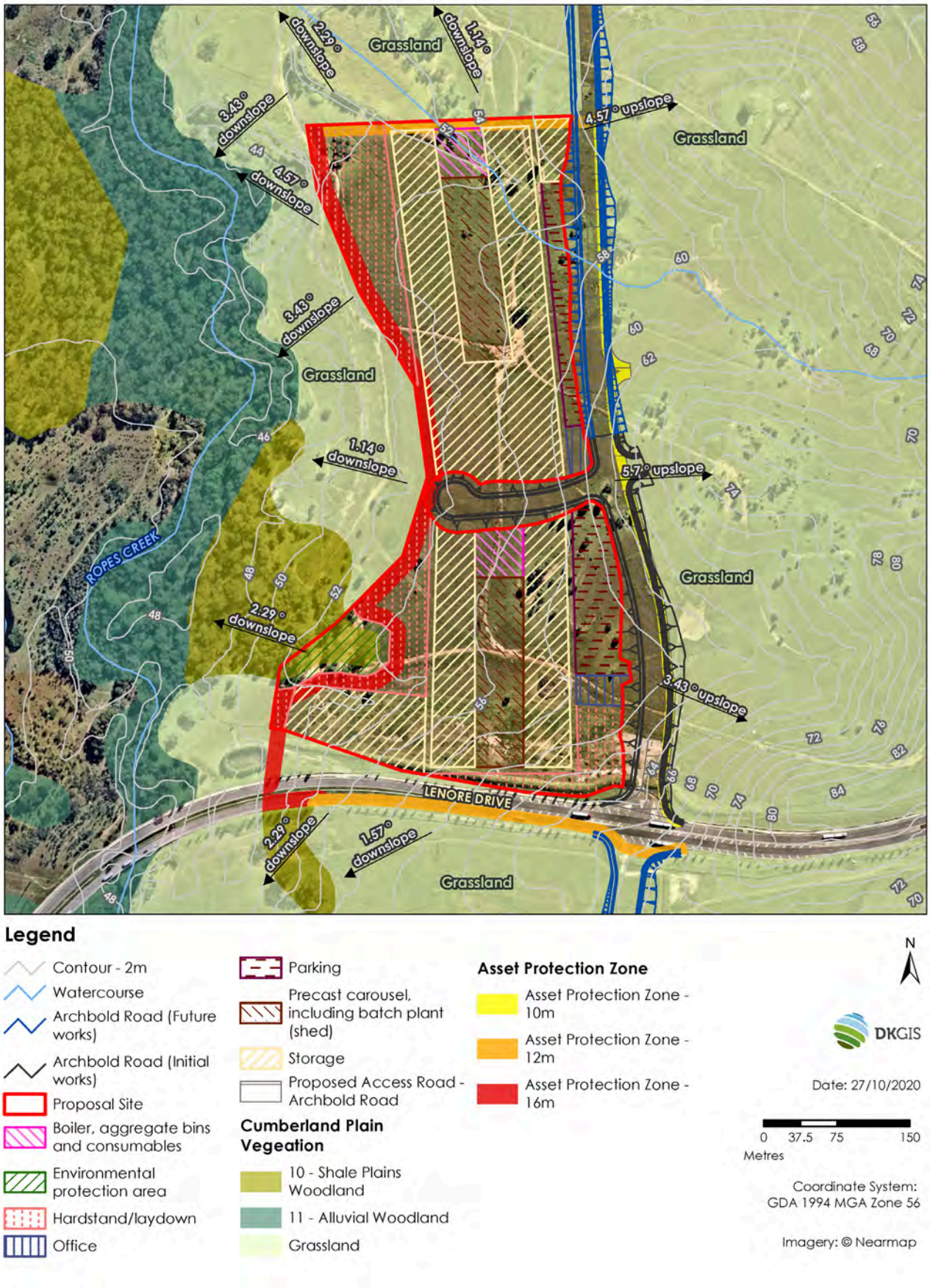
The *Standards for APZ* requirements include:

- *raking or manual removal of **fine fuels**. Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis*
- *mowing or grazing of grass. Grass needs to be kept short and, where possible, green.*
- ***removal** or pruning of trees, shrubs and understorey. The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation*
- *prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset*
- ***separate tree crowns by two to five metres***
- *a canopy should not overhang within two to five metres of a dwelling*
- *native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.*

**Table 3 Bushfire Attack Levels** (source PBP 2019. p. 92)

| KEITH VEGETATION FORMATION | | BUSH FIRE ATTACK LEVEL (BAL) | | | | |
|---|---|---|---|---|---|---|
| | | BAL-FZ | BAL-40 | BAL-29 | BAL-19 | BAL-12.5 |
| | | Distance (m) asset to predominant vegetation class | | | | |
| ALL UPSLOPE AND FLAT LAND | Rainforest | < 8 | 8 -< 11 | 11 -< 16 | 16 -< 23 | 23 -< 100 |
| | Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland | < 18 | 18 -< 24 | 24 -< 33 | 33 -< 45 | 45 -< 100 |
| | Grassy and Semi-Arid Woodland (including Mallee) | < 9 | 9 -< 12 | 12 -< 18 | 18 -< 26 | 26 -< 100 |
| | Forested Wetland (excluding Coastal Swamp Forest) | < 7 | 7 -< 10 | 10 -< 14 | 14 -< 21 | 21 -< 100 |
| | Tall Heath | < 12 | 12 -< 16 | 16 -< 23 | 23 -< 32 | 32 -< 100 |
| | Short Heath | < 7 | 7 -< 9 | 9 -< 14 | 14 -< 20 | 20 -< 100 |
| | Arid-Shrublands (acacia and chenopod) | < 5 | 5 -< 6 | 6 -< 9 | 9 -< 14 | 14 -< 100 |
| | Freshwater Wetlands | < 4 | 4 -< 5 | 5 -< 7 | 7 -< 11 | 11 -< 100 |
| | Grassland | < 8 | 8 -< 10 | 10 -< 15 | 15 -< 22 | 22 -< 50 |
| > 0 > 5 DEGREES - DOWNSLOPE | Rainforest | < 11 | 11 -< 14 | 14 -< 21 | 21 -< 29 | 29 -< 100 |
| | Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland | < 22 | 22 -< 29 | 29 -< 40 | 40 -< 54 | 54 -< 100 |
| | Grassy and Semi-Arid Woodland (including Mallee) | < 12 | 12 -< 16 | 16 -< 23 | 23 -< 32 | 32 -< 100 |
| | Forested Wetland (excluding Coastal Swamp Forest) | < 9 | 9 -< 12 | 12 -< 18 | 18 -< 26 | 26 -< 100 |
| | Tall Heath | < 13 | 13 -< 18 | 18 -< 26 | 26 -< 36 | 36 -< 100 |
| | Short Heath | < 8 | 8 -< 10 | 10 -< 15 | 15 -< 22 | 22 -< 100 |
| | Arid-Shrublands (acacia and chenopod) | < 5 | 5 -< 7 | 7 -< 11 | 11 -< 16 | 16 -< 100 |
| | Freshwater Wetlands | < 4 | 4 -< 6 | 6 -< 8 | 8 -< 12 | 12 -< 100 |
| | Grassland | < 9 | 9 -< 12 | 12 -< 17 | 17 -< 25 | 25 -< 50 |
| > 5 > 10 DEGREES - DOWNSLOPE | Rainforest | < 14 | 14 -< 18 | 18 -< 26 | 26 -< 37 | 37 -< 100 |
| | Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland | < 28 | 28 -< 36 | 36 -< 49 | 49 -< 65 | 65 -< 100 |
| | Grassy and Semi-Arid Woodland (including Mallee) | < 15 | 15 -< 20 | 20 -< 28 | 28 -< 39 | 39 -< 100 |
| | Forested Wetland (excluding Coastal Swamp Forest) | < 12 | 12 -< 16 | 16 -< 23 | 23 -< 33 | 33 -< 100 |
| | Tall Heath | < 15 | 15 -< 20 | 20 -< 29 | 29 -< 40 | 40 -< 100 |
| | Short Heath | < 9 | 9 -< 12 | 12 -< 18 | 18 -< 25 | 25 -< 100 |
| | Arid-Shrublands (acacia and chenopod) | < 6 | 6 -< 8 | 8 -< 12 | 12 -< 18 | 18 -< 100 |
| | Freshwater Wetlands | <5 | 5 -< 6 | 6 -< 10 | 10 -< 14 | 14 -< 100 |
| | Grassland | < 10 | 10 -< 13 | 13 -< 20 | 20 -< 28 | 28 -< 50 |
| > 10 > 15 DEGREES - DOWNSLOPE | Rainforest | < 17 | 17 -< 23 | 23 -< 34 | 34 -< 46 | 46 -< 100 |
| | Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland | < 36 | 36 -< 45 | 45 -< 60 | 60 -< 77 | 77 -< 100 |
| | Grassy and Semi-Arid Woodland (including Mallee) | < 19 | 19 -< 25 | 25 -< 36 | 36 -< 49 | 49 -< 100 |
| | Forested Wetland (excluding Coastal Swamp Forest) | < 15 | 15 -< 20 | 20 -< 29 | 29 -< 41 | 41 -< 100 |
| | Tall Heath | < 17 | 17 -< 22 | 22 -< 32 | 32 -< 44 | 44 -< 100 |
| | Short Heath | < 10 | 10 -< 13 | 13 -< 20 | 20 -< 29 | 29 -< 100 |
| | Arid-Shrublands (acacia and chenopod) | < 7 | 7 -< 9 | 9 -< 14 | 14 -< 20 | 20 -< 100 |
| | Freshwater Wetlands | < 5 | 5 -< 7 | 7 -< 11 | 11 -< 16 | 16 -< 100 |
| | Grassland | < 11 | 11 -< 15 | 15 -< 23 | 23 -< 32 | 32 -< 50 |
| > 15 > 20 DEGREES - DOWNSLOPE | Rainforest | < 23 | 23 -< 30 | 30 -< 42 | 42 -< 56 | 56 -< 100 |
| | Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland | < 46 | 46 -< 56 | 56 -< 73 | 73 -< 92 | 92 -< 100 |
| | Grassy and Semi-Arid Woodland (including Mallee) | < 24 | 24 -< 32 | 32 -< 44 | 44 -< 59 | 59 -< 100 |
| | Forested Wetland (excluding Coastal Swamp Forest) | < 19 | 19 -< 26 | 26 -< 37 | 37 -< 50 | 50 -< 100 |
| | Tall Heath | < 19 | 19 -< 25 | 25 -< 36 | 36 -< 49 | 49 -< 100 |
| | Short Heath | < 11 | 11 -< 15 | 15 -< 23 | 23 -< 32 | 32 -< 100 |
| | Arid-Shrublands (acacia and chenopod) | < 7 | 7 -< 10 | 10 -< 16 | 16 -< 23 | 23 -< 100 |
| | Freshwater Wetlands | < 6 | 6 -< 8 | 8 -< 13 | 13 -< 18 | 18 -< 100 |
| | Grassland | <13 | 13 -< 17 | 17 -< 26 | 26 -< 36 | 36 -< 50 |

**Figure 9 Areas to be managed as an Asset Protection Zone**



## 6.4. Access

PBP 2019 requires that the location and design of access roads enables safe access and egress for people attempting to leave the area at the same time that emergency service personnel are arriving to undertake firefighting operations. Subject to a separate approval by Transport for NSW, Archbold Road would be extended and upgraded with a new intersection at Lenore Road (approximately 350m south of the site) as part of the initial works servicing the site. Archbold Road would be two way. It is proposed that a future upgrade (future works) would provide an extension of Archbold Road to the north which would providing access to the north and the south of the proposal site. However, the timing of this future works is not known. The site will have a single entry point off Archbold Road as per Figure 2.

A perimeter road (Figure 2) is provided within the proposal site that would facilitate emergency access within and throughout the proposal site. All roads within the proposal site would be a minimum of 5.5m wide.

The following **recommendations** are provided consistent with PBP 2019 (p. 44) for design specifications for access roads within the proposal site:

- *Access roads are two-wheel drive, all-weather roads*
- *Minimum 5.5m carriageway width kerb to kerb*
- *Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient*
- *Curves of roads have a minimum inner radius of 6m*
- *Dead end roads incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end*
- *A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.*

## 6.5. Water Supply and Utilities

PBP 2019 (p. 47) requires that adequate services of water for the protection of buildings during and after the passage of a bushfire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.

The following **recommendations** regarding water are provided:

- A minimum static water supply of 20,000 litres should be provided at the proposal site for firefighting purposes. The firefighting water can be available in single tank or a number of tanks around the proposal site
- A hardened ground surface for truck access is to be supplied up to and within 4 metres of the water source
- A 65 millimetres metal Storz outlet with a gate or ball valve shall be provided as an outlet on each of the tanks
- The water tank, if located above ground, shall be of a non-combustible material
- Underground tanks shall have an access hole of 200 millimetres to allow tankers to refill direct from the tank. A hardened ground surface for truck access is to be supplied within 4 metres of the access hole
- All associated above ground fittings to the tank shall be non-combustible.

## 6.6. Evacuation and emergency management

A comprehensive Bushfire Emergency Management and Evacuation Plan should be completed for the construction and operational phase of the proposal. The bushfire evacuation procedures should be completed in accordance with NSW Rural Fire Service *Guide to Developing A Bushfire Emergency Management Plan* and meet the requirements of Australian Standard AS 3745-2010 – *Planning for Emergencies in facilities*. On-site and off-site evacuation procedures should be included.

The Cumberland *Bushfire Risk Management Plan* identifies a history of arson risk within the Ropes Creek area. As such, procedures should be put in place within the management plan for the proposal to ensure this risk is highlighted as part of the induction of people on the site and for timely notification of emergency services of fires (arson or otherwise) within the vicinity of the site.

The focus of the Bushfire Emergency Management and Evacuation Plan should be to put in place strategies that do not expose the workers to the effects of bushfire attack and focus on eliminating exposure to bushfire threat. The management team will be able to determine the safest options regarding forecast bushfire risk and providing for early evacuation from proposal site if there are fires in the vicinity.

## 6.7. Defining acceptable risk

In order to understand the nature of bushfire risks posed to the assets, people working within the sites and people using the access road to and from the site, it is critical to contemplate the elements of bushfire risk which may be relevant.

The tolerable level risk has not been determined by Blackash in this report for the sites. Tolerable risk is the readiness to bear the risk after risk treatment to achieve the overall objectives. To determine the tolerable risk, Sydney Metro should work through the bushfire risk (BAL and corresponding level of radiant heat) currently facing each of the assets within the site with a discussion about the vulnerability of assets (i.e. tolerable level of radiant heat).

The radiant heat and forms of bushfire attack can be reduced at the sites by increasing the size of the asset protection zone. This may have other knock on effects such as impacts on ecological integrity of adjoining land however, it is understood that Sydney Metro does not have the ability to undertake fuel management outside the site boundary and that mitigation measures would generally be contained within the site.

Considering the bushfire risk to the proposal site, a key risk management activity would be to not expose people to unreasonable risk. The most effective way to reduce loss of life risk is to not occupy the proposal site on above established thresholds for FFDI and fires within the surrounding landscape. This would need to occur with an understanding of the evacuation time from the sites and potential for fire to burn through the evacuation roads. Planning for bushfire evacuation is an immensely difficult task. Unlike flood and other events, bushfire events are not a 'known quantity'. There is no surety in when or where an ignition may occur, the direction is may spread, the extent of possible ember attack, etc. The impact of smoke and limited visibility in emergency situations, coupled with wind impact, can lead to issues on the tracks and roads as workers attempt to evacuate.

The evacuation planning for the construction and operational phase would be a crucial mitigation measure. A Bushfire Emergency Management and Evacuation Plan would be prepared in accordance with RFS guidelines.

# 7. Mitigation and management measures

During the construction and operational phase of the proposal site, measures must be put into place to manage ignition potential on or from the proposal site and to reduce the risk of fire impacting the site.

The following mitigation and management measures are recommended:

| No. | Impact | Management and mitigation measures |
|---|---|---|
| BF1 | Bushfire | The proposal site would be managed as an APZ. At the commencement of building works for each of the sites, The entire proposal site would be managed as an APZ as outlined within Appendix 4 of 'Planning for Bushfire Protection 2019' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. The APZ would not extend into the environmental protection area in the south-west of the site. |
| BF2 | Bushfire | Vulnerable buildings and/or critical assets (in particular warehouse, office buildings and sheds)would be constructed to appropriate BAL levels in accordance with the Australian Standard for the *Construction of Buildings in Bushfire Prone Areas* (AS3959). |
| BF3 | Bushfire | The following measures would be implemented for access roads within the proposal site:<br>1. access roads would be two-wheel drive, all-weather roads;<br>2. access roads would have a minimum 5.5 metres carriageway width kerb to kerb;<br>3. maximum grades for sealed roads would not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient;<br>4. curves of roads would have a minimum inner radius of 6 metres<br>5. dead end roads would incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end;<br>6. a minimum vertical clearance of 4 metres would be provided to any overhanging obstructions, including tree branches. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| BF4 | Bushfire | The following water supply and utilities would be installed during construction and maintained during operation of the proposal:<br>1. A minimum static water supply of 20,000 litres would be provided at the site for firefighting purposes. The firefighting water can be available in a single tank or a number of tanks around the proposal site<br>2. A hardened ground surface for truck access would be supplied up to and within 4 metres of the water source<br>3. A 65mm metal Storz outlet with a gate or ball valve would be provided as an outlet on each of the tanks<br>4. The water tank if located above ground would be of a non-combustible material<br>5. Underground tanks shall have an access hole of 200mm to allow tankers to refill direct from the tank. A hardened ground surface for truck access is to be supplied within 4 metres of the access hole.<br>6. All associated fittings to the tank shall be non-combustible. |
| BF5 | Bushfire | A comprehensive Bushfire Emergency Management and Evacuation Plan would be completed for the construction and operational phase of the proposal. The bushfire evacuation procedures would be completed in accordance with NSW Rural Fire Service *Guide to Developing A Bushfire Emergency Management Plan* and meet the requirements of Australian Standard AS 3745-2010 – *Planning for Emergencies in facilities*. |
| BF6 | Bushfire | Activities that generate sparks or excessive heat would be minimised when a total fire ban is declared by Rural Fire Service. |

# 8. Conclusion

This Bushfire Hazard Assessment has been completed for Sydney Metro for the construction and operation of two precast facilities to support the construction of the proposed Sydney Metro West.

The proposal site is partially located in designated bushfire prone area and bushfire impact is a key consideration to ensure mitigation and risk is understood to reduce the consequences of any bushfire impacts. The proposal site could be impacted by bushfire from adjoining lands.

This Report is a Bushfire Hazard Assessment that assesses the potential impacts associated with bushfire risk and provides the required information to assist Sydney Metro undertake planning for the construction and operation of the proposal.

# Appendix 1 References

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# Appendix B Review of Environmental Factors Addendum Report

# Sydney Metro West
# Eastern Creek Precast Facility

## Review of Environmental Factors
## Addendum Report

March 2021

Cover: A precast facility used on the Sydney Metro City & Southwest project.

# Executive Summary

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The proposal is located in Eastern Creek within the Blacktown City Council local government area. The proposal would be located on Lenore Drive, Eastern Creek (the proposal site). The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other.

Sydney Metro, a NSW Government agency, is the proponent and a determining authority for this proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

A Review of Environmental Factors (REF) was prepared to describe the proposal, document potential impacts of the proposal on the environment and detail the management and mitigation measures to be implemented. The REF was publicly exhibited from 16 November 2020 to 4 December 2020 to allow stakeholders, including members of the public, to provide input to the project assessment and determination process. An Addendum Report is required due to design changes (for water management infrastructure) and an associated increase to the construction footprint (which has been extended to the north of the proposal site).

This Addendum Report helps fulfil the requirements of Section 5.5 of the EP&A Act; namely that Sydney Metro examines and takes into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposed activity.

This Addendum Report has been informed by key technical papers, which provide detailed assessment of specific environmental issues relevant to the amended proposal. These technical reports form appendices to this Addendum Report.

## The amended proposal

The proposal design as described in Chapter 5 of the exhibited REF included the provision of water management infrastructure such as rainwater tanks to capture rainwater from sheds, appropriate onsite stormwater and flood detention facilities, and a water recycling facility. Since exhibition of the REF, further hydraulic assessment and drainage modelling have been carried out to inform the detailed design process for the management of surface water and stormwater runoff across the amended proposal site. This assessment used inputs including the direction of fall (resulting in the direction for water runoff) and associated runoff flows across the proposal site to identify the appropriate size and location of water management infrastructure that would be required during construction and operation of the proposal. As a result of the constraints of the proposal site, such water management (for storage and water quality improvement) infrastructure would be required to be located immediately outside of the proposal site however, still within the land leased by Sydney Metro from the Office of Strategic Lands for the purpose of the proposal.

The natural fall of the northern precast site is to the north, with runoff draining towards an existing farm dam. Locating the water management infrastructure to the north would minimise the volume of earthworks and grading required, and provide an opportunity to utilise the existing farm dam. Therefore, two basins are proposed:

- A detention basin to manage stormwater flows across the proposal site

- A bioretention basin to manage water quality of surface water and stormwater runoff.

The proposed basins would both be located to the north of the northern precast site, and would require amendment to the proposal site boundary (the amended proposal site). The locations of the proposed basins, and the amended proposal site are shown on Figure 0-1.

The proposal and the amended proposal are outlined in Section 2 (Amendments to the proposal) of this Addendum Report.

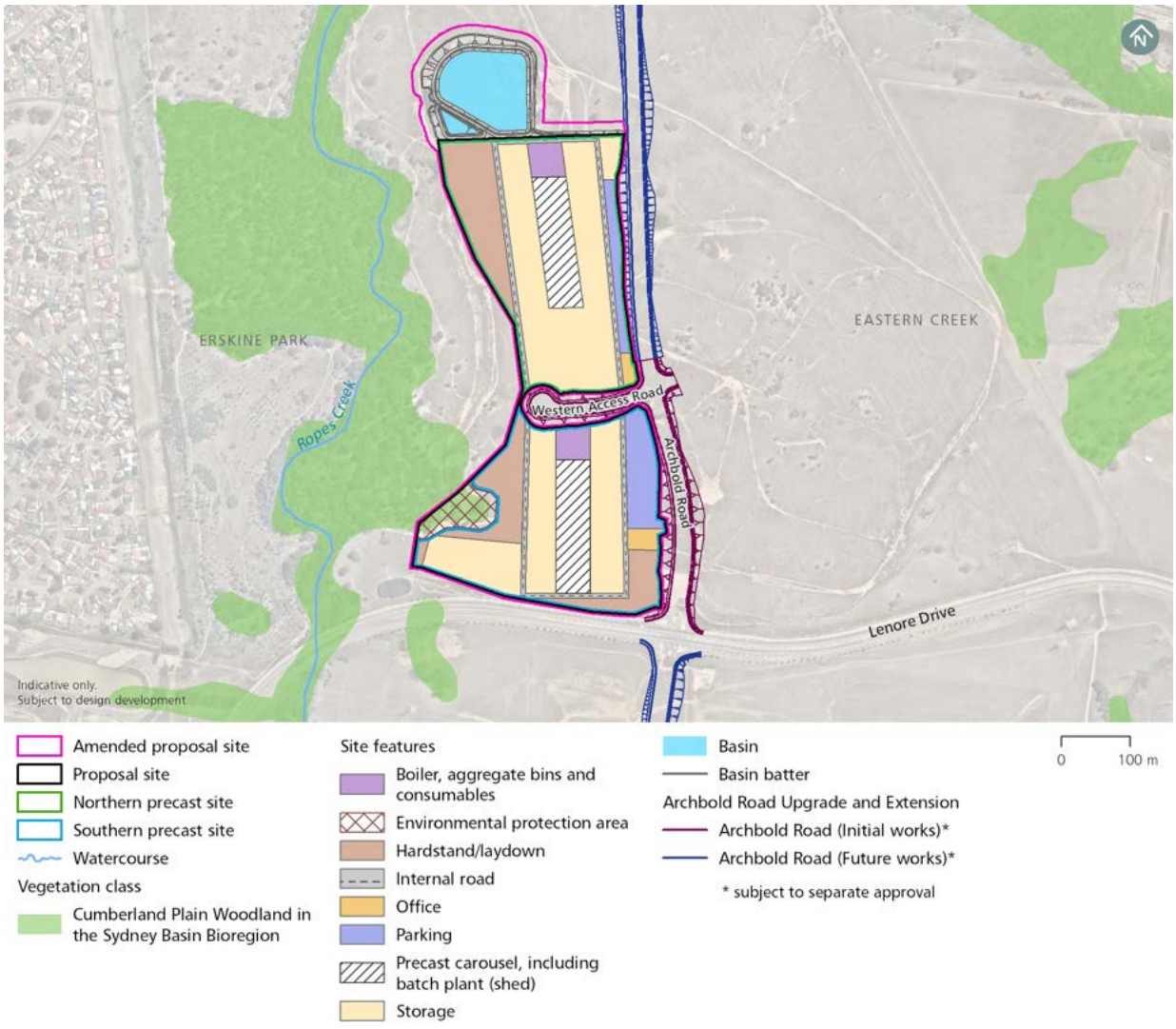


**Figure 0-1: The amended proposal site layout**

## Environmental impact assessment

In addition to the potential impacts identified in the exhibited REF, the below key issues have been reassessed given that the proposal site boundary has been modified to include two basins within the northern part of the amended proposal site as outlined in Figure 0-1.

Key potential impacts associated with the amended proposal include:

- **Non-Aboriginal heritage:** There are no listed items of heritage significance identified within or near the amended proposal site. As such, the amended proposal would not impact any listed heritage item. The amended proposal site has some potential to impact on archaeological relics associated with the Chatsworth Estate at the northern part of the

amended proposal site which are expected to meet the threshold for local significance. In addition, the proposal has potential to impact on archaeological remains which are not expected to meet the threshold for local significance (identified within the north-east corner of the amended proposal site).The remainder of the amended proposal site has been assessed as having nil to low potential for archaeological remains associated with the Chatsworth Estate. Where possible, excavation works during construction would avoid areas with potential archaeological remains. If necessary, a s140 Excavation Permit granted under section 141 of the *Heritage Act 1977* would be obtained from Heritage NSW prior to the commencement of excavation works

- **Aboriginal heritage:** Earthworks undertaken during construction would result in partial to total removal of an additional three Aboriginal sites identified within the amended proposal site. The addition of the northern part of the amended proposal site increases the total proposal impacts to thirteen sites (previously ten sites within the exhibited REF). A portion of the registered extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) within the amended proposal site would be impacted by construction activities. The amended proposal contains three newly identified sites, including RCAS 13 (AHIMS ID 45-5-5441), RCIF 3 (AHIMS ID 45-5-5442) and RCIF 4 (AHIMS ID 45-5-5443), which would result in a total loss of value as a result of the amended proposal. Archaeological test excavation would be undertaken for the amended proposal site to confirm the geographic extent of the identified Aboriginal sites
- **Biodiversity:** Construction of the amended proposal would require clearing of an additional 1.06 hectares of native vegetation and threated species habitat. A subset of the total area within the amended proposal site includes the River-Flat Eucalypt Forest and Cumberland Plain Woodlands, which are listed under the *Biodiversity Conservation Act 2016* (BC Act) as an endangered and critically endangered community, respectively. The River-Flat Eucalypt Forest vegetation has been assessed against the conservation advice for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) newly listed River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria (effective on 15 December 2020). Vegetation within the northern part of the amended proposal site does not meet the minimum condition thresholds and therefore is not eligible to be included in the EPBC Act. This additional area increases the total proposal impacts to 2.98 hectares (previously 1.92 hectares within the exhibited REF) of native vegetation. In addition, forty-nine individuals of *Grevillea juniperina* subsp. *juniperina* (listed as vulnerable under the BC Act) identified within the northern part of the amended proposal site would be impacted by the amended proposal. Additional biodiversity impacts do not change the overall findings of the exhibited REF. Therefore, no offsets are required for the amended proposal under the BC Act or the EPBC Act. Additional management and mitigation measures would be implemented as part of the amended proposal to reduce and avoid potential impacts on biodiversity as discussed in Section 3.7 (Biodiversity).

## Benefits of the amended proposal

The amended proposal would support the delivery of the proposed Sydney Metro West and provide capacity to meet the precast segment production requirements identified during the detailed construction planning phase of that project. It would also deliver social and economic benefits by providing around 120 jobs during construction and around 120 jobs during the operation of the proposal. The amended proposal would be designed and managed to provide operational efficiencies and to appropriately mitigate impacts on the surrounding environment and local community.

With the implementation of the proposed mitigation measures in Chapter 4 (Revised management and mitigation measures), any potential environmental impacts of the proposal

and amended proposal would be adequately mitigated and managed and are therefore not considered to be significant.

## Justification and conclusion

The assessments in the exhibited REF and this Addendum Report have been taken into account and it is concluded that the amended proposal is not likely to significantly affect the environment.

Should the amended proposal proceed, any potential associated impacts would be appropriately managed in accordance with the mitigation measures outlined in this Addendum Report and the exhibited REF, and any conditions imposed in the Determination Report.

The amended proposal would not affect Commonwealth land or have a significant impact on any matters of national environmental significance, and therefore a referral of the amended proposal for a controlled activity determination under the EPBC Act would not be required.

On balance, the benefits of the proposal would outweigh its impacts, and the amended proposal is considered to be justified.

The exhibited REF has considered and assessed potential impacts in accordance with Clause 228 of the EP&A Regulation and the requirements of the EPBC Act (refer to Chapter 8 (Environmental impact assessment)), and Appendix A (Consideration of Environmental Factors and Matters of National Environmental Significance).

Based on the assessment contained in the exhibited REF, it is considered that the proposal is not likely to have a significant impact upon the environment or any threatened species, populations or communities. Accordingly, an EIS is not required, nor is the approval of the Minister for Planning and Public Spaces. The amended proposal would not significantly change those impacts.

## Next steps

This report, along with the exhibited REF, the Determination Report and any other relevant information, will be used by Sydney Metro to assess and determine the amended proposal.

After consideration of the assessments in the exhibited REF and this report, Sydney Metro will determine whether or not the amended proposal should proceed and will inform the community and stakeholders of the decision. This report will be made publicly available on the Sydney Metro website along with the Determination Report for the amended proposal.

If Sydney Metro determines to proceed with the amended proposal, it would be designed, constructed and operated in accordance with the proposal description and management and mitigation measures outlined in the exhibited REF and this Addendum Report.

If Sydney Metro determines to proceed with the amended proposal, Sydney Metro would continue to consult with the community and stakeholders prior to and during construction and operation of the amended proposal.

# Contents

# 1 Introduction

*This introduction outlines the background to the proposal, the purpose of this report and the next steps in the determination of the proposal.*

## 1.1 Background

The proposed Sydney Metro West involves the construction and operation of about 24 kilometres of underground metro rail between Westmead and Sydney CBD. Stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Sydney CBD. Construction of the project is already underway.

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The proposal is in Eastern Creek within the Blacktown City Council local government area. The proposal would be located on Lenore Drive, Eastern Creek (the proposal site). The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other.

The precast facilities do not form part of the Sydney Metro West Critical State Significant Infrastructure planning application (SSI-10038), which would be assessed and determined separately.

Sydney Metro, a NSW Government agency, is the proponent and a determining authority for this proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

A Review of Environmental Factors (REF) was prepared to describe the proposal, document potential impacts of the proposal on the environment and detail the mitigation measures to be implemented. The REF was publicly exhibited from 16 November 2020 to 4 December 2020 to allow stakeholders, including members of the community, to provide feedback on the proposal for consideration in the assessment and determination process.

## 1.2 Purpose of this report

The purpose of this Addendum Report is to outline the proposed design changes to the proposal since the exhibition of the REF and present the associated environmental impact assessment of these changes.

This Addendum Report helps to fulfil the requirements of Section 5.5 of the EP&A Act; namely that Sydney Metro examines and takes into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposed activity.

The structure and content of this report is outlined in Table 1-1.

This Addendum Report has been informed by key technical papers, which provide detailed assessment of specific environmental issues relevant to the proposal. These technical reports form appendices to this Addendum Report.

**Table 1-1: Structure and content of this Addendum Report**

| Chapter | Description |
|---|---|
| Chapter 1 – Introduction | Outlines the background of the proposal (as exhibited) and the process for determination. |
| Chapter 2 – Amendments to the proposal | Provides a description of the amended proposal and highlights changes to the proposal as exhibited in the REF. |
| Chapter 3 – Environmental impact assessment | Provides an environmental screening assessment of the potential impacts of the amended proposal on noise and vibration, landscape and visual character, traffic, transport and access, non-Aboriginal heritage, Aboriginal heritage, flooding, soils, surface water and groundwater, contamination, biodiversity, air quality, bushfire risk, resource use and waste management, land use, property and socio-economic, and cumulative impacts. Environmental matters requiring further consideration are identified and assessed. |
| Chapter 4 – Revised management and mitigation measures | Provides a complete list of management and mitigation measures for the amended proposal, highlighting any changes to those measures as exhibited. |
| Chapter 5 – Conclusion | Provides the conclusion of this report. |
| Chapter 6 – References | Lists the references used to prepare this report. |
| Chapter 7 – Glossary | Provides definitions for technical and proposal-specific terms used in this report. |

## 1.3 Next steps

This report, along with the exhibited REF, the Determination Report and any other relevant information, will be used by Sydney Metro to assess and determine the amended proposal.

After consideration of the assessments in the REF and this report and the response to submissions received, Sydney Metro will determine whether or not the proposal should proceed and will inform the community and stakeholders of the decision. This report will be made publicly available on the Sydney Metro website along with the Determination Report for the proposal.

If the proposal is determined to proceed, it would be designed, constructed and operated in accordance with the project description and management and mitigation measures outlined in the exhibited REF, this report and any conditions of approval.

Sydney Metro will continue to consult with the community and stakeholders prior to and during construction and operation of the proposal.

# 2 Amendments to the proposal

*This chapter provides a description of the changes to the proposal as exhibited in the Review of Environmental Factors.*

## 2.1 The exhibited proposal

The proposal as described in Chapter 5 of the exhibited REF comprises the following key features and activities:

- Site preparation consisting of:
  - Vegetation clearing, including the removal of about two hectares of native vegetation
  - Site remediation
  - Connection of utilities (e.g. power, water, sewerage, gas and communications)
  - Earthworks to level the site (this may involve the use of retaining walls)
  - Installation of lighting and signage
- Construction and operation of two adjacent precast facilities, a northern and a southern precast facility, each being sited on about eight hectares. Each precast facility would encompass the following:
  - A double-sided casting carousel
  - Segment storage
  - A concrete batching plant (inside shed with a height of around eight metres)
  - Boiler, aggregate bins and consumables
  - A laydown/hardstand area
  - Offices and site amenities
  - Loading and unloading and circulation space for heavy vehicles
  - On-site parking for up to 60 light vehicles
- Internal roads (one lane each direction) generally around the key operational areas of the facility with entrances to each facility from the Western Access Road located between the northern and southern precast facilities
- Landscaping works along the frontage to Lenore Drive and about 50 metres north along Archbold Road.

The proposal would be temporary, operating for an approximate timeframe of four to five years, subject to the delivery strategy and construction program for Sydney Metro West.

The proposal site would be subdivided to create two separate lots, one for each precast facility.

The proposal does not include the construction of the surrounding road network (planned Archbold Road upgrade and extension and the construction of the Western Access Road), which would be undertaken by other parts of Transport for NSW under a separate approval.

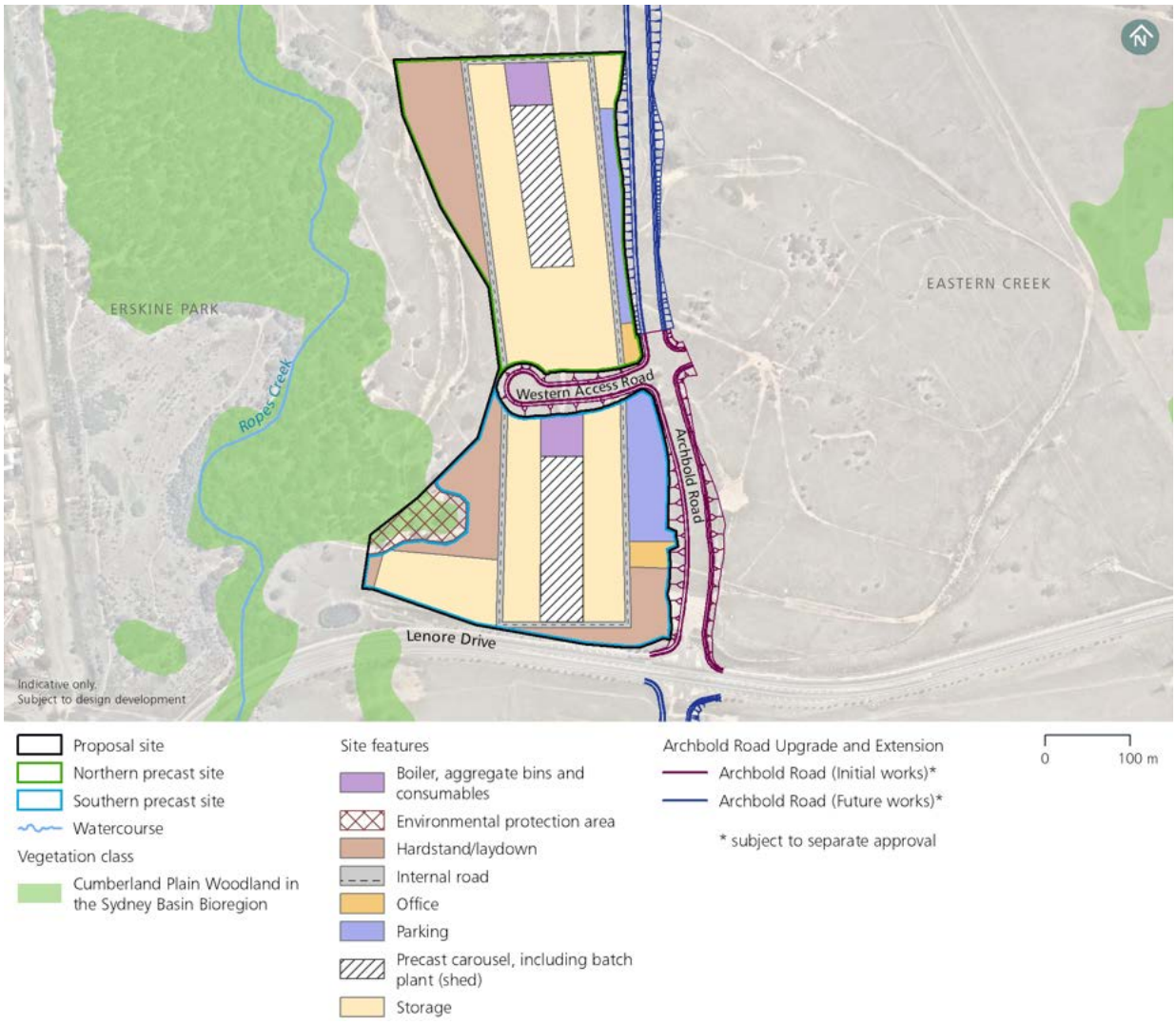


**Figure 2-1: Indicative site layout of the proposal as exhibited**

## 2.2 The amended proposal

The proposal design as described in Chapter 5 of the exhibited REF included the provision of water management infrastructure such as rainwater tanks to capture rainwater from sheds, appropriate onsite stormwater and flood detention facilities, and a water recycling facility. Since exhibition of the REF, further hydraulic assessment and drainage modelling have been carried out to inform the detailed design process for the management of surface water and stormwater runoff across the amended proposal site. This assessment used inputs including the direction of fall and associated runoff flows across the proposal site to identify the appropriate size and location of water management infrastructure that would be required during construction and operation of the proposal.

As a result of the spatial constraints of the proposal site, such water management infrastructure would be required to be located immediately outside of the proposal site. The natural fall of the northern precast site is to the north, with runoff draining towards an existing farm dam. Locating the water management infrastructure to the north would minimise the

volume of earthworks and grading required and provide an opportunity to utilise the existing farm dam.

Therefore, two basins are proposed:

- A detention basin to manage stormwater flows across the proposal site
- A bioretention basin to manage water quality of surface water and stormwater runoff.

The proposed basins would both be located to the north of the northern precast site and would require amendment to the proposal site boundary (the amended proposal site). The locations of the proposed basins and the amended proposal site boundary are shown on Figure 2-2.

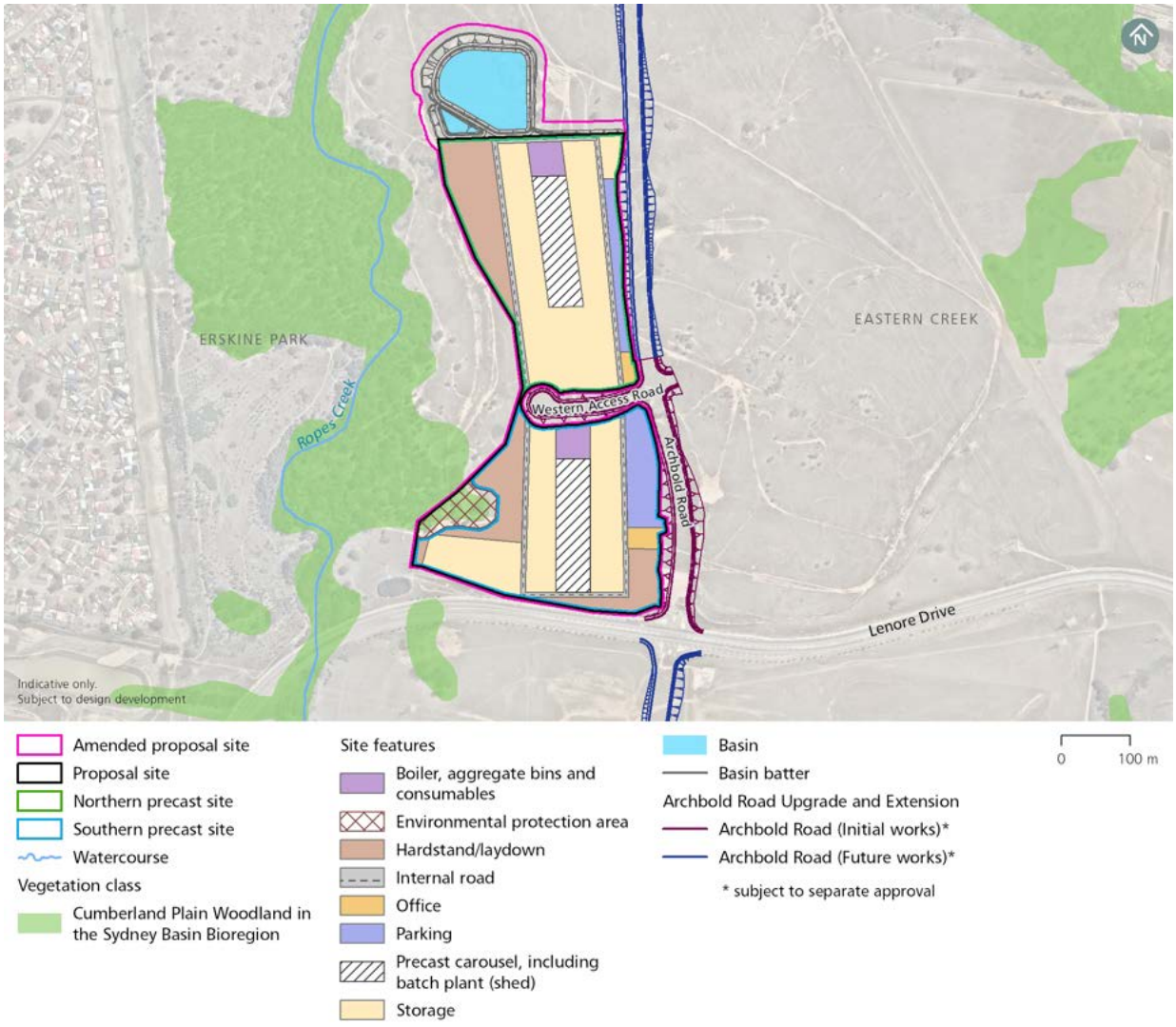


**Figure 2-2: The amended proposal site layout**

## 2.2.1 Drainage and stormwater design

As part of the detailed drainage design, surface water runoff and stormwater would flow north along the boundary of the proposal site. A mix of perimeter swales and pit and pipe systems would direct flows into the proposed basins. These basins would have a combined volume of 3,500 cubic metres and a maximum depth of 0.65 metres, serving a total catchment of 7.7 hectares.

During periods of low flow, runoff would be directed into the smaller bioretention basin, where water would be discharged through an outfall pipe and ultimately drain to Ropes Creek. The smaller bioretention basin would be lined with vegetation to capture stormwater runoff, remove contaminants, and reduce runoff frequency. The outfall has been designed to ensure that stormwater discharged into Ropes Creek (from the amended proposal site and surrounds) is generally consistent between the existing and proposed conditions. The larger detention basin would be used during periods of high flow. It has been sized using DRAINS modelling software and designed for the two year average recurrence interval (ARI) and one per cent annual exceedance probability (AEP) events representative of the biggest and smallest design event. In the events of greater than the 100 year flows, a weir located on the western wall of the basin would allow overflows in a controlled manner that would drain to Ropes Creek.

The stormwater management infrastructure design has been based on the objectives and principles of Water Sensitive Urban Design. It has been prepared taking into consideration the following pollutant reduction targets:

- 90% reduction in Gross Pollutants
- 85% reduction in Total Suspended Solids
- 65% reduction in Total Phosphorous
- 45% reduction in Total Nitrogen
- 90% reduction in Total Hydrocarbons.

The use of these targets would likely improve the water quality of discharges from the amended proposal site compared to pre-development flows. The exhibited REF identified the receiving environment of Ropes Creek to be of poor water quality given the existing moderately to highly degraded condition.

Given the existing environment, discharges of the amended proposal site would also work towards achieving the ANZECC criteria for Ropes Creek (as identified in Section 8.8.3 of the exhibited REF) where receiving environments currently do not meet the ANZECC guidelines.

### 2.2.2 Construction

Construction activities for the proposed basins would include:

- Vegetation clearing including the removal of about 1.06 hectares of additional native vegetation as discussed in Section 3.7 (Biodiversity)
- Bulk earthworks, including alteration of the existing farm dam at this location
- Landscaping and planting associated with stabilisation of batter slopes and lining of the bioretention basin
- Site remediation.

The sides of the proposed basins would be reinforced earth batters that would require the importation of structural fill material for construction, as the material excavated across the proposal site would not be of a suitable composition. Indicative earthwork volumes for the amended proposal are provided in Table 2-1. However, given the refinements to the earthworks methodology since the exhibition of the REF, there has been a reduction in the volume of imported fill required. The vehicles associated with the delivery of imported fill for the construction of the proposed basins would be accommodated in the construction vehicle numbers previously assessed within the exhibited REF.

### Table 2-1: Indicative earthworks volumes

| Type | Indicative volume for the proposal as exhibited ($m^3$) | Indicative volume for the amended proposal ($m^3$) |
|---|---|---|
| Total cut | 11,500 | 52,000 |
| Total fill | 141,500 | 168,000 |
| Imported fill | 130,000 | 116,000 |

The majority of the construction methodology for the amended proposal remains as described in Chapter 5 of the exhibited REF. These construction works would be undertaken in accordance with the construction staging identified with the exhibited REF. However, some changes are required associated with the construction of the proposed basins. Table 2-2 provides a summary of the relevant aspects of construction, highlighting these changes from the exhibited REF.

### Table 2-2: Construction parameters of the amended proposal

| Aspect of construction | Change from exhibited REF | Description |
|---|---|---|
| Construction programme | No | Construction is proposed to commence in early 2021 and be completed by the end of 2022, with a total duration of around 20 months, as described in Section 5.2.4 of the exhibited REF. |
| Construction hours | No | Work would generally take place within standard construction hours, as described in Section 5.2.12 of the exhibited REF. |
| Construction workforce | No | Peak workforce is anticipated to be up to around 60 workers at each separate facility (120 total) as described in Section 5.2.5 of the exhibited REF. |
| Construction plant and equipment | No | Plant and equipment would be as indicatively provided in Section 5.2.6 of the exhibited REF. |
| Construction haulage routes to and from the proposal site | No | Vehicles would use Lenore Drive, Old Wallgrove Road and Wallgrove to access the site from the M7 as described in Section 5.2.9 of the exhibited REF. |

| Aspect of construction | Change from exhibited REF | Description |
|---|---|---|
| Construction vehicle numbers | No | Indicative vehicle numbers are 11 light vehicles per hour, and 10 heavy vehicles per hour, as described in Section 5.2.9 of the exhibited REF. |
| Construction compounds | No | All temporary construction compounds would be located within the proposal site, as described in Section 5.2.1 of the exhibited REF. |
| Resources, materials and sourcing | Yes | Refinement of the earthworks methodology including that associated with construction of the proposed basins would result in a reduction of about 14,000m$^3$ imported fill material required for the amended proposal compared to the exhibited REF. |
| Waste | No | Waste would be managed as described in Section 5.2.8 of the exhibited REF. |
| Water management | Yes | Additional detail of the drainage and stormwater management design has been developed, which includes two basins to manage stormwater runoff across the amended proposal site. Additional potential impacts associated with the construction and operation of these basins have been assessed in Chapter 3 (Environmental impact assessment) of this report. |
| Utilities | No | No additional utility connections are proposed to those described in Section 5.2.11 of the exhibited REF. |
| Construction footprint | Yes | The construction footprint has increased by about 2.5 ha to a total of about 18.5 ha. Additional potential impacts associated with this increase have been assessed in Chapter 3 (Environmental impact assessment) of this report. |
| Property acquisition | No | The additional land required for the amended proposal would be leased from the Office of Strategic Lands. No property acquisition is required. |

### 2.2.3 Operation

The amended proposal would not result in considerable operational changes to the precast facilities, in that water management infrastructure was included within the proposal, as identified within Section 5.3.1 of the exhibited REF. The amended proposal incorporates a specific location (outside of the proposal site) and further defines the extent and size of the water management infrastructure that was envisaged to adequately manage stormwater runoff at the amended proposal site.

The amended proposal would not change the operational workforce (Section 5.3.3 of the exhibited REF), traffic management (Section 5.3.4 of the exhibited REF) or maintenance (Section 5.3.6 of the exhibited REF) identified in the exhibited REF for the proposal. The operational ancillary infrastructure (Section 5.3.5 of the exhibited REF) including lighting, signage and fencing would also be extended to the amended proposal site.

# 3 Environmental impact assessment

*This chapter provides an environmental impact screening to determine whether further environmental impact assessment is required and then presents the findings of the additional assessment of the potential impacts that may occur from the amended proposal.*

## 3.1 Environmental screening assessment

This section considers the potential for change to the impacts assessed for the proposal (within the exhibited REF) and whether further assessment of each issue is required.

Consideration of each environmental issue as assessed for the proposal was carried out to determine the potential for change to the impacts and, therefore, whether further assessment of the potential impacts of the amended proposal are required.

A screening assessment of the potential change in impacts for the amended proposal is provided in Table 3-1.

**Table 3-1: Environmental screening assessment – Amended proposal**

| Issue | Potential change in impact? | Description |
|---|---|---|
| Noise and vibration | Yes | The amended proposal would include additional construction activities to the north of the proposal site, which could introduce additional noise and vibration impacts to residential and other sensitive receivers. Sensitive receivers are generally located some distance from the amended proposal site, including the residential area of Erskine Park about 375 metres to the west and the commercial/industrial area of Eastern Creek about 800 metres to the south and east.<br><br>There would be no change to construction or operational vehicles (number or routes) and therefore there is no potential for changes to traffic noise to the surrounding sensitive receivers.<br><br>The operation of the proposed basins is not expected to result in additional noise, in that no work (with the exception of minor maintenance) is anticipated to be undertaken.<br><br>An assessment of potential changes to construction noise and vibration impacts associated with the amended proposal is provided in Section 3.2. |

| Issue | Potential change in impact? | Description |
|---|---|---|
| Traffic, transport and access | No | Traffic, transport and access impacts from the amended proposal would be consistent with those assessed in the exhibited REF.<br><br>The amended proposal would not change the number of vehicle movements to and from the proposal site during construction and operation, as assessed in the exhibited REF. The amended proposal would also not change haulage routes with vehicles travelling from the amended proposal site in an eastern direction consistent with the exhibited REF.<br><br>The amended proposal would not result in any changes in terms of workforce, vehicle numbers, parking arrangements, and access and egress to the proposal site during both construction and operation.<br><br>An additional assessment of potential changes to traffic, transport and access impacts associated with the amended proposal is not considered necessary. |
| Landscape and visual character | Yes | The amended proposal would require construction activities to the north of the proposal site and would introduce new built ground level infrastructure at this location. In addition, there would be removal of some trees and vegetation for the construction of the amended proposal.<br><br>An additional assessment of potential changes to landscape character and visual amenity impacts associated with the amended proposal is provided in Section 3.3. |
| Non-Aboriginal heritage | Yes | There are no listed heritage items identified within the amended proposal site. Therefore, the amended proposal would not directly impact on any additional non-Aboriginal heritage items.<br><br>However, there is potential for indirect non-Aboriginal heritage impacts as the proposal site overlaps with the outbuildings of the former Chatsworth Estate in the north-eastern corner of the amended proposal site.<br><br>An additional assessment of potential changes to non-Aboriginal heritage impacts associated with the amended proposal is provided in Section 3.4. |

| Issue | Potential change in impact? | Description |
|---|---|---|
| Aboriginal heritage | Yes | The amended proposal would require excavation in new areas (the amended proposal site) which have Aboriginal heritage potential.<br><br>An additional assessment of potential changes to Aboriginal heritage impacts associated with the amended proposal is provided in Section 3.5. |
| Land use, property and socio-economic | No | The majority of the amended proposal site, like the proposal site, is undeveloped land, zoned for industrial use under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (WSEA SEPP). About 0.18 hectares of the north-west corner of the amended proposal site would be located on land zoned as RE1 (Public recreation). This land would be used for the construction and operation of water management infrastructure comprising the proposed basins for the amended proposal. The amended proposal site is owned by the Office of Strategic Lands and would be leased by Sydney Metro. Therefore, the use of the amended proposal site would not impact on any developed or privately owned land. No works would take place within land zoned as E2 (Environmental conservation) under the *Blacktown Local Environmental Plan 2015*.<br><br>Further, there would be no change to the workforce required for both construction and operation of the amended proposal and therefore the positive economic impact identified within the exhibited REF (for the proposal) would remain.<br><br>The amended proposal would not considerably change the environmental impacts identified for the proposal and management and mitigation measures would be further implemented to reduce any impacts on the surrounding community.<br><br>An additional assessment of potential changes to land use, property and socio-economic impacts associated with the amended proposal is not considered necessary. |
| Flooding | No | The amended proposal site is not located within the probable maximum flood (PMF) of Ropes Creek at the west. The existing overland flow path (from the east of the proposal site) would be altered and diverted around the proposal site (as identified within the exhibited REF). As a result, there would be no change to overland flows via the flow path to the basin for the amended proposal.<br><br>In addition, the amended proposal would include flood detention storage (one of the basins) for the purpose of |

| Issue | Potential change in impact? | Description |
|---|---|---|
| | | mitigating the potential negative impact on peak flood flows discharged to Ropes Creek from the proposal. This is expected to result in a neutral or slightly positive impact.<br><br>As the construction and operational activities for the amended proposal are generally consistent the impacts assessed in the exhibited REF, the amended proposal would not introduce any additional flooding or hydrology impacts and the mitigation measures identified in the exhibited REF would be applied to the amended proposal.<br><br>An additional assessment of potential changes to flooding or hydrology impacts associated with the amended proposal is not considered necessary. |
| Soils and surface water quality | No | The construction activities for the amended proposal are generally consistent with the proposal assessed in the exhibited REF. However, additional earthworks would be undertaken within a location not identified within the exhibited REF (the northern part of the amended proposal site). These additional earthworks would be managed through the implementation of the management and mitigation measures identified for the proposal.<br><br>An additional assessment of potential changes to soil and surface water quality impacts associated with the amended proposal is not considered necessary. |
| Groundwater | No | The amended proposal would involve excavation including the extension of an existing dam to the north of the amended proposal site. These excavation works would involve a maximum depth of about two metres which is consistent with the exhibited REF. Excavation is anticipated to generally occur in areas of relatively higher elevation with deeper depths to groundwater.<br><br>An additional assessment of potential changes groundwater impacts associated with the amended proposal is therefore not considered necessary. |

| Issue | Potential change in impact? | Description |
|---|---|---|
| Contamination | Yes | The amended proposal would involve excavation to the north of the amended proposal site which may increase contamination risks.<br><br>An additional assessment of potential contamination impacts associated with the amended proposal is provided in Section 3.6. |
| Biodiversity | Yes | The amended proposal would require the removal of additional vegetation to the north of the amended proposal site. Additional biodiversity impacts do not change the overall findings of the exhibited REF. Therefore, no offsets are required for the amended proposal under the BC Act or the EPBC Act.<br><br>An additional assessment of potential changes to biodiversity impacts associated with the amended proposal is provided in Section 3.7. |
| Resource use and waste management | No | The amended proposal would not introduce any new waste streams, although it would result in a minor increase to the volume of waste (including excavated material, spoil and potential contaminated waste) generated during construction.<br><br>The mitigation measures identified in the exhibited REF for the proposal would be applied to the amended proposal and would be sufficient to manage the increase in waste volumes.<br><br>An additional assessment of potential changes to waste management impacts associated with the amended proposal is not considered necessary. |

| Issue | Potential change in impact? | Description |
|---|---|---|
| Air quality | No | The construction activities for the amended proposal are generally consistent to those assessed in the exhibited REF (for the proposal). Therefore, with the implementation of the management and mitigation measures, the construction impacts of the amended proposal are not considered to change from the proposal.<br><br>The amended proposal would include two basins which would not introduce any additional air quality impacts during operation. Potential impacts from the operation of the amended proposal would be mitigated with the measures identified within the exhibited REF.<br><br>An additional assessment of potential changes to air quality impacts associated with the amended proposal is not considered necessary. |
| Bushfire | No | The amended proposal site is not located within bushfire prone land and the existing environmental conditions of the amended proposal site are consistent with those identified for the proposal site.<br><br>No vulnerable buildings and/or critical assets would be constructed as part of the amended proposal. As a result, specific asset protection zones (APZs) for the proposed basins are not required. In addition, the amended proposal would not result in any changes to the established APZs for the proposal site and therefore, no additional bushfire protection measures would be required.<br><br>An additional assessment of potential changes to bushfire impacts associated with the amended proposal is not considered necessary. |

| Issue | Potential change in impact? | Description |
|---|---|---|
| Sustainability, climate change and greenhouse gases | No | The amended proposal would not introduce any new sustainability impacts, although there could be some minor increases in the volumes of excavated materials and the associated greenhouse gas emissions. Further to this, no additional risks associated with climate change impacts are anticipated as a result of the amended proposal.<br><br>This increase is not considered to result in a material change to the assessment undertaken in the exhibited REF. The mitigation measures identified for the proposal would be applied to the amended proposal and would be sufficient to manage any potential impacts.<br><br>In addition, the proposal would be delivered under Sydney Metro's Construction Environmental Management Framework and the Sydney Metro West Sustainability Plan as noted in the exhibited REF. These would also apply to the amended proposal.<br><br>An additional assessment of potential changes to sustainability impacts associated with the amended proposal is not considered necessary. |
| Cumulative impacts | No | The amended proposal would not change the distance to other projects within the immediate surrounding area (the planned upgrade and extension of Archbold Road, the proposed extension to Honeycomb Drive (Archbold Road connection), and the Eastern Creek Resource Recovery Facility.<br><br>The amended proposal is not expected to have any additional cumulative impacts to those identified within the exhibited REF.<br><br>The amended proposal would remain consistent with the local strategies and plans for the proposal and would not result in any additional cumulative impacts associated with the implementation of this documentation.<br><br>An additional assessment of potential changes to cumulative impacts associated with the amended proposal is not considered necessary. |

## 3.2 Noise and vibration

The following section presents the noise and vibration assessment carried out to determine any changes to the potential impacts identified in the exhibited REF as a result of the amended proposal. The methodology described in Section 8.1 of the exhibited REF remains applicable to the amended proposal and has been used in the following assessment.

The amended proposal site would require an increase to site establishment works to prepare the ground and form earthworks in the additional basin area. Notwithstanding this, there would be no change to plant and equipment or the general methodology for construction. The activities comprising the *Site Establishment* construction scenario as used in the assessment are shown in Table 3-2 and have been reassessed to include the amended proposal site.

**Table 3-2: Site establishment construction scenario description**

| Activity | Description |
|---|---|
| Vegetation | Clearing the amended proposal site of existing vegetation, trees, soil and debris.<br><br>Prior to construction a range of mitigation measures will be implemented including pre-clearing surveys and establishment of exclusion zones. Further information on proposed management and mitigation measures is included in Section 4.2. |
| Earthworks | Bulk earthworks including excavation, compaction and haulage of materials. |
| Utilities | Installation of power, water, sewerage, etc. |

The amended proposal does not include any changes to traffic volumes during construction or operation. Therefore, there would be no change to the construction road traffic noise assessment provided within Appendix C of the exhibited REF (Noise and Vibration Technical Paper). The amended proposal would not alter operational aspects of the proposal and therefore an additional operational impact assessment for noise is not required.

### 3.2.1 Existing environment

The existing environment of the proposal site, including noise catchment areas (NCAs) and locations of sensitive receivers is as described in Section 8.1.2 of the exhibited REF. Although the amended proposal site extends further north than the proposal site, there are no additional receivers that were not already considered in the noise and vibration assessment presented in the exhibited REF. The nearest receivers to the amended proposal site are the residential receivers around 375 metres to the west, as identified in the exhibited REF.

### 3.2.2 Potential impacts

#### Construction noise

The construction noise assessment for the worst-case construction scenario for the amended proposal are presented in Table 3-3, along with the results of the assessment presented in the

REF. The assessment shows that the worst-case construction noise levels for the amended proposal are expected to be consistent with the predictions in the exhibited REF.

Should activities for the other previously modelled construction scenarios (for example, landscaping as an element of the *Commissioning* construction scenario) be carried out during construction of the proposed basins, the associated noise levels would be less than those worst-case levels set out in Table 3-3.

**Table 3-3: Predicted worst case construction noise impacts - standard construction hours**

| NCA | NML (dBA) | Predicted worst-case $LA_{eq(15minute)}$* Noise Level (dBA) - Site Establishment | | | | | |
|---|---|---|---|---|---|---|---|
| | | Proposal (exhibited REF) | | | Amended proposal | | |
| | | Vegetation clearance | Earthworks | Utilities | Vegetation clearance | Earthworks | Utilities |
| **Residential - Daytime** | | | | | | | |
| NCA01 | 47 | 47 | 50 | 34 | 47 | 50 | 34 |
| NCA02 | 51 | <30 | <30 | <30 | <30 | <30 | <30 |
| NCA03 | 47 | N/A – no residential receivers in this NCA | | | | | |
| NCA04 | 47 | N/A – no residential receivers in this NCA | | | | | |
| **Commercial - Daytime** | | | | | | | |
| NCA01 | 70 | 39 | 42 | <30 | 39 | 42 | <30 |
| NCA02 | 70 | 32 | 35 | <30 | 32 | 35 | <30 |
| NCA03 | 70 | 40 | 43 | <30 | 40 | 43 | <30 |
| NCA04 | 70 | 39 | 42 | <30 | 39 | 42 | <30 |

**LAeq(15minute) is the 'energy average noise level' considered over a 15-minute period. This parameter is used to assess potential construction noise impacts.*

Table 3-3 shows that there is no change to the predicted worst-case noise levels for the amended proposal when compared to the proposal assessed in the exhibited REF. The earthworks phase of construction would result in the worst-case noise levels for the amended proposal. As identified in the exhibited REF, this worst-case predicted noise level is 50 decibels (dBA), which is comparable to the existing noise levels in the noise catchment area. This noise level would be below annoyance levels with the potentially affected buildings. Therefore, this exceedance of the noise management level (NML) is considered to be of low significance.

The predicted noise contours for the earthworks activities of the proposal as exhibited in the REF and the amended proposal are shown on Figure 3-1 and Figure 3-2, respectively. Compared to the noise contours for the proposal as exhibited in the REF, the noise contours relating to the amended proposal extend marginally further to the north of the amended proposal site. However, the majority of this additional affected area is undeveloped industrially zoned land and open space (Ropes Creek). Construction noise levels from the amended proposal are predicted to marginally increase at front row receivers to the north-west of the proposal in NCA01. However, the noise levels at this location would be lower than the worst-case noise levels, which are at the receivers located 375 metres to the immediate west of the amended proposal site.

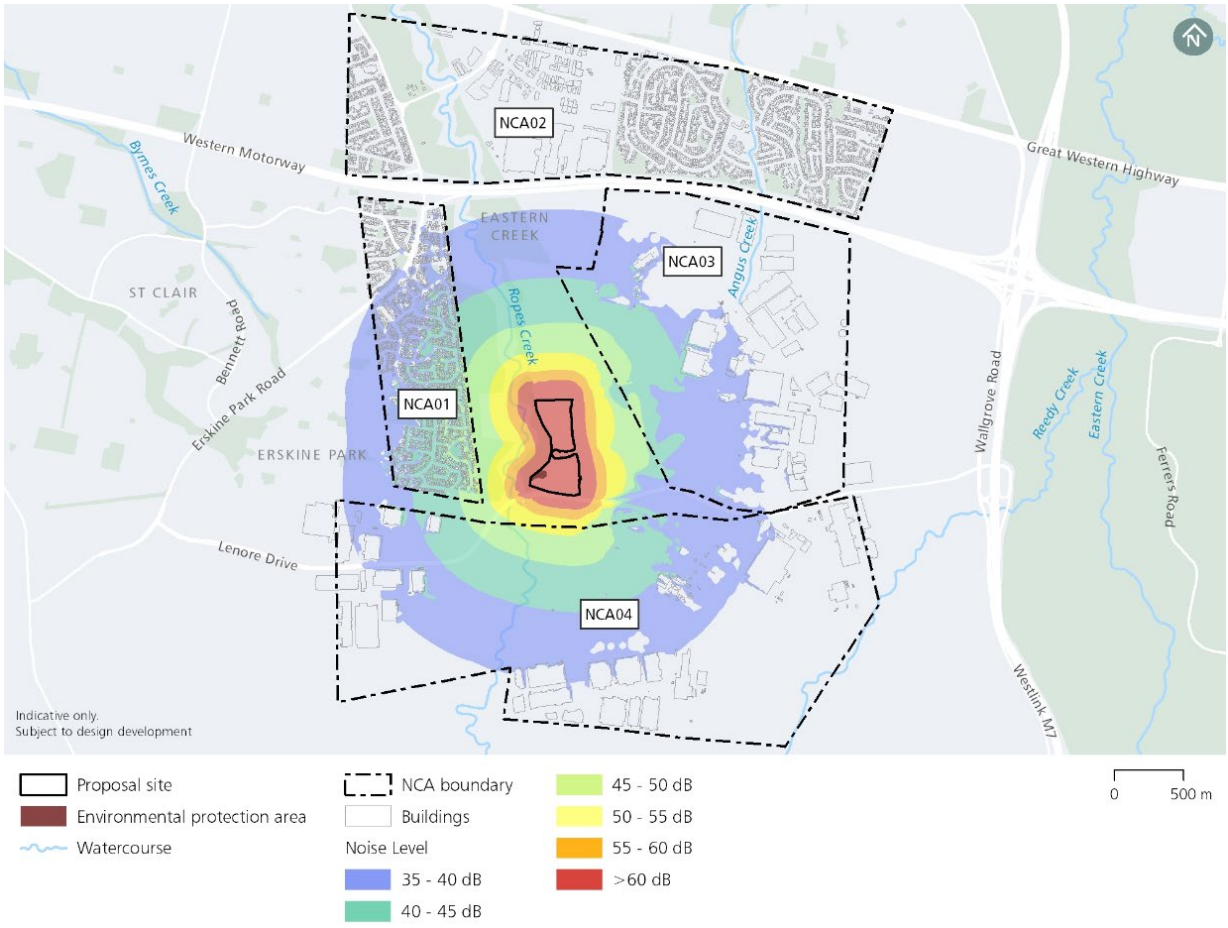


**Figure 3-1: Predicted construction noise level contours during earthworks (exhibited REF)**

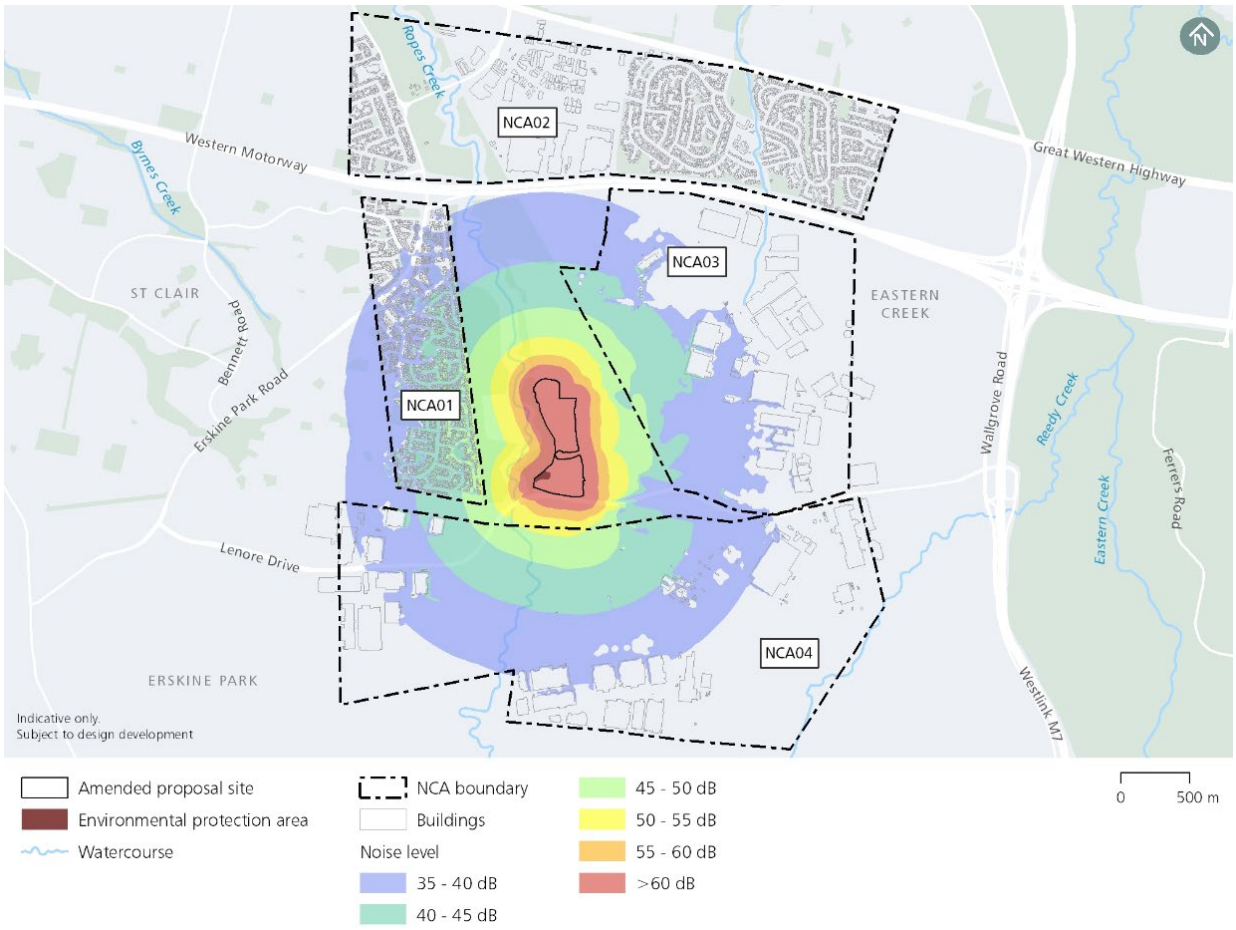


**Figure 3-2: Predicted construction noise level contours during earthworks (amended proposal)**

There are no new exceedances associated with the amended proposal. Therefore, the construction noise impacts of the amended proposal are consistent with the impacts identified in Section 8.3.1 of the exhibited REF.

#### Construction vibration

Potential vibration impacts from vibration intensive works during construction of the amended proposal would be negligible at the nearest receivers, as identified in the exhibited REF.

### 3.2.3 Management and mitigation measures

The proposed management and mitigation measures for potential noise and vibration impacts associated with the amended proposal remain as described in Section 8.1.5 of the exhibited REF and are reproduced in Table 4-1 of this Addendum Report.

## 3.3 Landscape and visual character

The following summarises the outcomes of a review of the landscape and visual character assessment contained within the exhibited REF. The methodology described in the exhibited REF is applicable to the amended proposal and has been used in the following assessment to determine any changes to the landscape character and visual impact levels identified in the exhibited REF as a result of the amendment to the proposal.

### 3.3.1 Existing environment

The existing landscape and visual environment of the proposal site is as described in Section 8.3.2 of the exhibited REF. The amended proposal site boundary includes an existing dam with some scattered trees and vegetation around its perimeter.

While there is an additional area to the north of the site included in the amended proposal boundary, there are no additional visual receivers. This is because the visual catchment of the amended proposal site, which is substantially limited by the surrounding landform and existing vegetation, would not be noticeably increased by the additional site area.

The proposal site and amended proposal site have a neighbourhood landscape sensitivity. As described in the exhibited REF, neighbourhood sensitivity refers to a landscape feature valued and appreciated primarily by a small number of residents as it provides a seat or resting place, passive recreation and/or some shade and shelter in a local street (e.g. street trees in a local context).

### 3.3.2 Potential impacts

#### Construction

Landscape impacts

The overall landscape impact during construction would remain as negligible.

The additional area of the amended proposal site is not open to public use and therefore there would not be a reduction in access to open space. The removal of some existing vegetation and trees would be required to construct the proposed basins. While the amended proposal would include some vegetation within and around the proposed basins, there would be less tree canopy cover in this area of the site with the expanded area of water. Overall, there would be a noticeable reduction in the quality of this landscape, which is of neighbourhood sensitivity, resulting in a negligible landscape impact during construction.

Visual impact

There would continue to be temporary negligible to minor adverse potential visual impacts during construction.

The amended proposal site would not expand the visual catchment noticeably, as such there would continue to be a relatively limited visual catchment to the proposal due to the local landform and existing vegetation.

Views from the M4 Motorway in the north are limited by distance, intervening vegetation, and the undulating landform. The amended proposal site is not visible from the industrial areas to the east and to the north-east.

Views from the residential areas of Erskine Park, west of the amended proposal site, would also be screened by the vegetation along Ropes Creek. The proposed works associated with the amendment are not likely to be visible from the more elevated residential areas of Erskine Park, however, if taller equipment is glimpsed above the intervening vegetation, this change would be absorbed into the background of these views which includes existing transmission lines and other built elements.

There would not be a view of the proposed basins from Lenore Drive as this area is over 500 metres from the road and the structures proposed for the site would intervene, blocking the amended area of the site from view.

The proposed additional works would generally be scheduled during standard construction hours. Where construction works are required at night, there would continue to be a negligible temporary visual impact. Any minor lighting associated with the amended proposal site works would be absorbed into the broader industrial setting, resulting in no perceived reduction in the amenity of views in the local area, which are of moderate sensitivity.

Overall, it is not expected that there would be any additional visual impacts relating to construction of the amendments to the proposal. In views from the residential areas to the west the amended proposal site would be screened by existing vegetation along Ropes Creek, and intervening landform and vegetation limit views to the amended proposal site from the M4 Western Motorway in the north and industrial areas to the east. The amended proposal site would not be seen in views from Lenore Drive in the south due to intervening elements of the amended proposal.

#### Operation

Landscape impacts

During operation there would continue to be a negligible landscape impact from the proposal as exhibited in the REF to the amended proposal.

While the proposed basins would have a similar character to the existing dam, and the somewhat more engineered form of the basins would be integrated into the landscape with low vegetation over time, there would be less tree canopy cover. Overall, there would be a noticeable reduction in the quality of the landscape, which is of neighbourhood sensitivity, resulting in a negligible landscape impact during operation.

Visual impact

During operation there would be negligible to minor adverse potential visual impacts as a result of the amended proposal which is unchanged from the exhibited REF. This is due to the relatively limited visual catchment of the amended proposal site, with local landform and existing vegetation limiting views to the amended proposal site, and the natural characteristics of the proposed bioretention basin and extension to the existing northern dam being consistent with the character of the existing landscape.

At night, the operation of the proposal would continue to have a minor adverse visual impact, as identified in the exhibited REF, as there would not be any additional lighting associated with the amended proposal site.

### 3.3.3 Management and mitigation measures

The proposed management measures for potential landscape and visual character impacts associated with the amended proposal remain as described in Section 8.3.4 of the exhibited REF and are reproduced in Table 4-1 of this Addendum Report.

## 3.4 Non-Aboriginal heritage

The following section presents the non-Aboriginal heritage assessment carried out to determine any changes to the potential impacts identified in the exhibited REF as a result of the amended proposal. The methodology described in Section 8.4.1 of the exhibited REF remains applicable to the amended proposal and has been used in the following assessment.

A search of nominated heritage places was undertaken on 8 December 2020. No listed heritage items are located within or in the vicinity of the amended proposal site. In addition, no nominated heritage places or items are located within or in the vicinity of the amended proposal site.

A site inspection of the amended proposal site was undertaken on 9 December 2020 to identify potential unlisted heritage items and identify evidence of archaeological remains.

### 3.4.1 Existing environment

The existing environment and historical context of the proposal site is as described in Section 8.4.2 of the exhibited REF. The existing environment and historical context of the amended proposal site is consistent with the environment as described in the exhibited REF for the proposal site.

Surface archaeological remains associated with the shed and yard complex were identified at the north eastern corner outside the amended proposal site. These include a sandstone paved yard surface feature, sandstone edging, several former fence lines, concrete structures and surface remains of a cistern/well. These surface remains would not be impacted by the amended proposal. However, dense vegetation may have shielded other potential archaeological remains associated with the Chatsworth Estate, and further archaeological remains may be present underground within the amended proposal site.

#### Archaeological potential

As assessed in the exhibited REF, archaeological potential has been divided into the following three historical categories:

- **Phase one** – early land use and grants (c1819 – mid-19th century)
- **Phase two** – horticultural and agricultural development, the Chatsworth Estate (mid-19th century – mid-20th century)
- **Phase three** – cattle grazing and current landscape (mid-20th century – present).

The amended proposal site has been assessed as having low to moderate potential to contain locally significant archaeological remains associated with Phase two (see Figure 3-3).

Potential archaeological remains may include evidence of undocumented agricultural outbuildings, landscaping and water management. However, as described in Section 8.4.3 of the exhibited REF, these remains are unlikely to demonstrate historical or aesthetic significance. Further to this, potential archaeological remains are unlikely to hold research potential or be considered rare. These archaeological remains may reach the threshold for local significance if they are intact and remain in situ.

Potential archaeological remains associated with Phase three are likely to be present within the amended proposal site. However, these remains are not expected to reach the threshold for local significance as they do not fulfil the NSW Heritage Significance Criteria.

A summary of archaeological potential and significance of potential remains is illustrated in Figure 3-3 and outlined in Table 3-4.

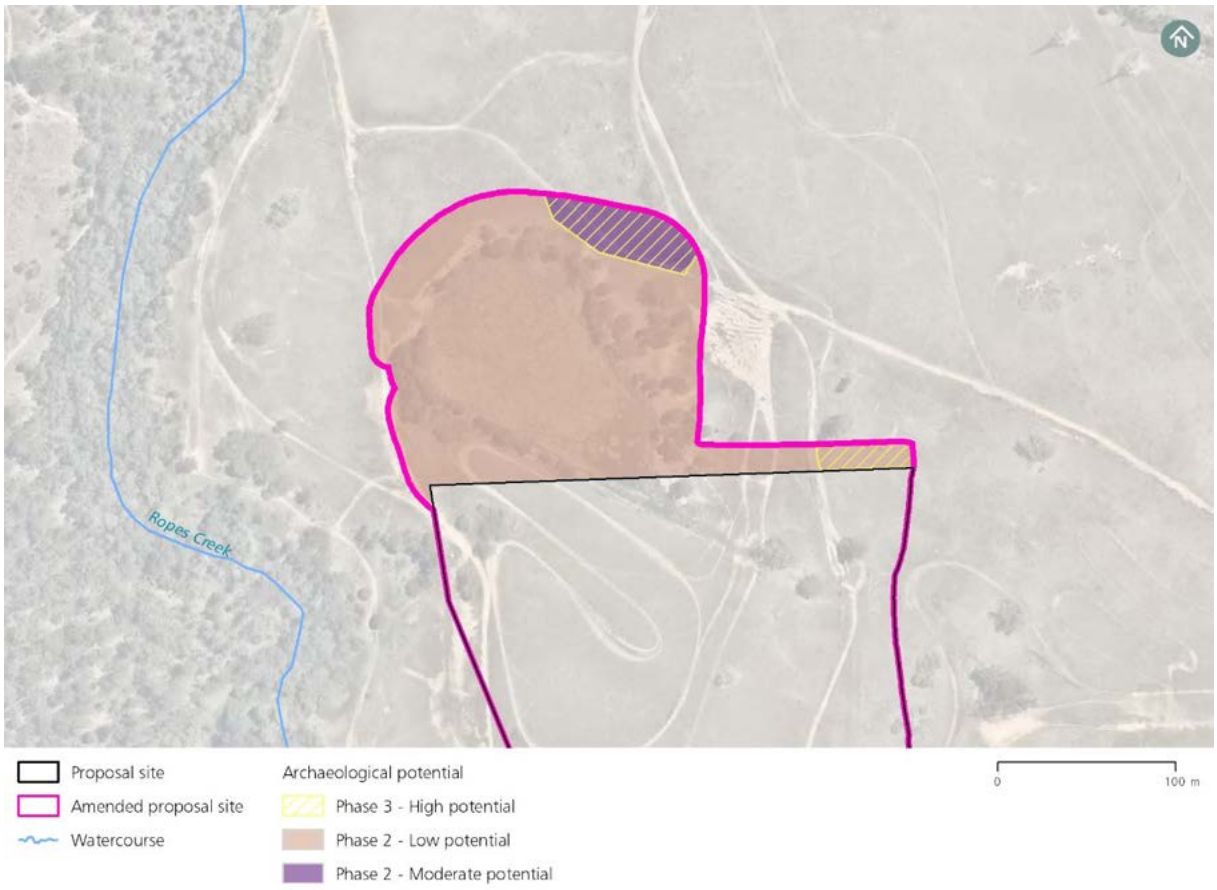


**Figure 3-3: Areas of archaeological potential relating to Phases two and three within the amended proposal site**

**Table 3-4: Summary of archaeological potential and heritage significance**

| Phase | Potential remains | Significance | Potential | Considered Relics under the *Heritage Act 1977* |
|---|---|---|---|---|
| **Phase one (c1819 – mid-19th century)** | General land clearance, low intensity pastoral / agricultural uses | N/A | Nil | N/A |
| **Phase two (mid-19th century – mid-20th century)** | Chatsworth outbuildings | Local | Moderate | Yes, if associated with artefact bearing deposits |
| | Chatsworth Nursery | Local | Low | Yes, if associated with artefact bearing deposits |

| Phase | Potential remains | Significance | Potential | Considered Relics under the *Heritage Act 1977* |
|---|---|---|---|---|
| **Phase three (mid-20th century – present** | Farm buildings and yards | Nil | High | No |

### 3.4.2 Potential impacts

#### Heritage impact assessment

There are no listed heritage items identified in or within the vicinity of the amended proposal site. As such, there would be no physical or visual impacts to known heritage items as a result of the amended proposal and no impacts from vibration or settlement.

#### Archaeological impact assessment

The amended proposal site overlaps with the outbuildings of the former Chatsworth Estate, paddocks and well/cistern associated with a former shed and yard complex in the north-eastern corner of the proposal site, as well as a small rubbish dump. The Chatsworth Estate is associated with the nineteenth century rural development (Phase 2) of the area and is considered to be of local significance. Potential archaeological remains associated with the shed and yard complex (Phase 3) are not expected to reach the threshold for local significance.

The remainder of the amended proposal site has been assessed as having nil to low potential for archaeological remains. Potential archaeological remains which may be identified across the remainder of the amended proposal site are not expected to reach the threshold for local significance.

#### Statement of heritage impact

As noted above, there are no listed or unlisted items of heritage significance identified within or within the vicinity of the amended proposal site. As such, consistent with the exhibited REF, there would be no physical and visual impact as a result of the amended proposal.

The amended proposal site has been assessed as having moderate potential to contain intact archaeological remains associated with the development of the Chatsworth Estate and Nursery, and high potential to contain archaeological evidence of former agricultural buildings associated with Phase 3. Should intact archaeological remains of Phase 2 be identified, these would reach the local significance threshold. Should intact archaeological relics in the form of artefact-bearing deposits associated with Phase 2 be identified, these would be considered locally significant archaeological 'relics' and protected under the relics provision of the *Heritage Act 1977*. The assessment has also identified that all other archaeological remains within the amended proposal site are unlikely to meet the threshold for local significance.

A statement of heritage impact has been prepared with reference to the NSW Heritage Division guidelines (NSW Heritage Office, 2002) as outlined in Table 3-9.

**Table 3-5: Statement of heritage impact for the amended proposal**

| Development | Discussion |
|---|---|
| **What aspects of the proposal respect or enhance the heritage significance of the amended proposal site?** | The amended proposal site is situated in a location which avoids locally significant structural remains associated with the former Chatsworth Estate homestead to the north. No heritage items have been identified as subject to visual impacts associated with the amended proposal. |
| **What aspects of the proposal could have a detrimental impact on the heritage significance of the amended proposal site?** | The amended proposal has the potential to impact on archaeological remains within the north and north-eastern corners of the amended proposal site. Archaeological remains associated with the former Chatsworth Estate within the northern portion of the amended proposal site area are expected to reach the threshold for local significance. However, no listed heritage items have been identified within the amended proposal site. |
| **Have more sympathetic options been considered and discounted?** | The amended proposal is expected to have a physical impact on locally significant archaeological outbuildings (Chatsworth Estate) and remains (Chatsworth Nursery) within the northern portion of the amended proposal site.<br><br>Remains associated with the locally significant Chatsworth homestead are located directly north of the amended proposal site and would be avoided. |

### 3.4.3 Management and mitigation measures

The proposed management measures for potential non-Aboriginal heritage impacts associated with the amended proposal remain as described in Section 8.4.4 of the exhibited REF and are reproduced in Table 4-1 of this Addendum Report.

Non-Aboriginal heritage impacts on potential archaeological remains associated with the Chatsworth Estate should be minimised and managed. Therefore, additional management and mitigation measures outlined in Table 3-6 would be implemented to reduce and avoid impacts to potential archaeological remains within the amended proposal site. New management and mitigation measures are shown in **bold, underlined text**.

**Table 3-6: Management and mitigation measures - Non-Aboriginal heritage**

| No. | Impact | Management and mitigation measures |
|---|---|---|
| NAH2 | Archaeological monitoring and s140 Excavation Permit | Excavation works would aim to avoid the area of moderate potential for locally significant archaeological relics associated with the Chatsworth Estate homestead where possible.<br><br>Should excavation works in this area be unavoidable, a program of archaeological monitoring would be implemented. If necessary, a s140 Excavation Permit granted under section 141 of the *Heritage Act 1977* would be obtained from Heritage NSW prior to the commencement of excavation works. |
| NAH3 | Archaeological Methodology and Research Design | Any application for an Excavation Permit under the *Heritage Act 1977* would be accompanied by an Archaeological Methodology and Research Design (AMRD). The AMRD would outline the archaeological potential and significance of the area to be impacted and assess the impact of the proposed excavation works on those resources. The AMRD would provide appropriate methodologies for investigation, protection and/or avoidance of archaeological remains. |

## 3.5 Aboriginal heritage

The following section presents the Aboriginal heritage assessment carried out to determine any changes to the potential impacts identified in the exhibited REF as a result of the amended proposal. The methodology described in Section 8.5.1 of the exhibited REF remains applicable to the amended proposal and has been used in the following assessment.

An archaeological survey of the amended proposal site was carried out on 9 December 2020 to make observations of the current site conditions and adjacent site land uses with respect to Aboriginal heritage potential. The archaeological survey was also undertaken to reinspect any previous registered Aboriginal sites, record any previously unidentified Aboriginal sites and identify areas of Potential Archaeological Deposit (PAD) that may be present in areas that have had no or minimal disturbance.

### 3.5.1 Existing environment

The existing environment of the proposal site is as described in Section 8.5.2 of the exhibited REF. The existing environment of the amended proposal site is consistent with the environment as described in the exhibited REF for the proposal site.

There are no additional AHIMS sites within the amended proposal site to those mapped and described based on the AHIMS search completed for the exhibited REF. The amended proposal site extends over a larger proportion of one recorded Aboriginal site, Blacktown Southwest 7 (AHIMS ID 45-5-0559).

The archaeological survey for the amended proposal site is shown in Figure 3-4.

Three newly identified Aboriginal sites were identified within the amended proposal site, RCAS 13, RCIF 3 and RCIF 4 as described in Table 3-7.

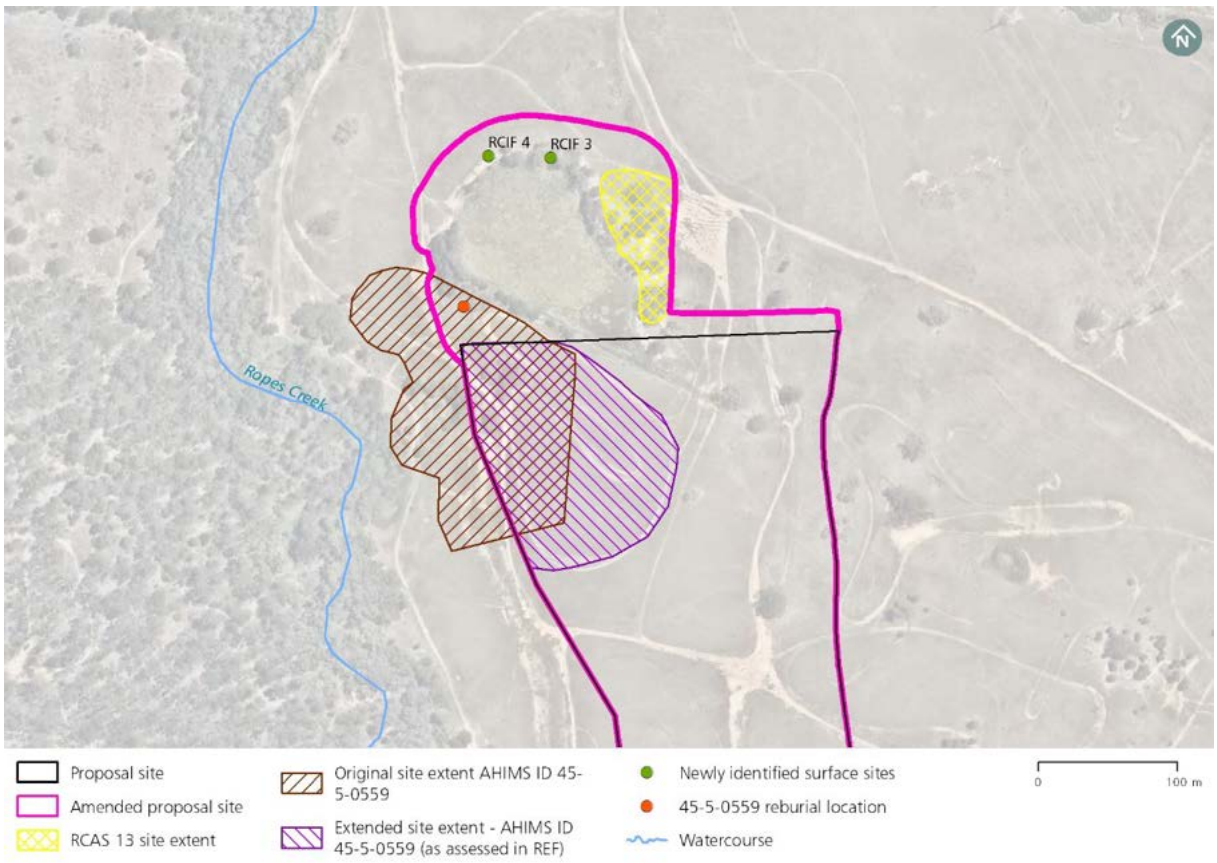


**Figure 3-4: Survey units within the amended proposal site**

### Aboriginal sites recorded during investigations

Recorded Aboriginal sites and additional sites identified during the archaeological survey within or partially within the northern part of the amended proposal site are outlined in Table 3-7. This included one previously recorded site and three newly identified sites.

**Table 3-7: Recorded Aboriginal sites and additional sites**

| Site name | Site type | Location | Description |
|---|---|---|---|
| **Previously recorded site** | | | |
| Blacktown Southwest 7 (AHIMS ID 45-5-0559) | Artefact scatter | Partially within the amended proposal site | The extent of the site was reassessed during the site survey. Portions of the site within the addendum survey area were heavily vegetated and included regrowth vegetation at the boundary of the existing large dam at the north of the amended proposal site. No Aboriginal objects were identified within the registered site. |

| Site name | Site type | Location | Description |
|---|---|---|---|
| **Newly identified sites** | | | |
| RCAS 13 (AHIMS ID 45-5-5441) | Artefact scatter, PAD | Within the amended proposal site | This newly identified site is adjacent to the large dam within the amended proposal site. The surface exposure is located within a very gently sloped landform which does not appear to have been modified during construction of the existing dam. The exposure appears to have been utilised by vehicles suggesting that the area is likely to have been subject to some level of post depositional movement. The site was identified as an area of PAD due to surface artefacts within a similar landform context to Blacktown Southwest 7 (AHIMS ID 45-5-0559). A total of 10 artefacts were identified on the ground surface at RCAS 13 (AHIMS ID 45-5-5441). |
| RCIF 3 (AHIMS ID 45-5-5442) | Isolated find | Within the amended proposal site | This site was identified on an artificial dam wall located about 2 metres above the surrounding ground surface. The artefact is comprised of a silcrete flake fragment. |
| RCIF 4 (AHIMS ID 45-5-5443) | Isolated find | Within the amended proposal site | This site was located within a talus slope at the north-western side of the large dam. The surface of the slope was largely comprised of ironstone gravels. The artefact is comprised of a medial flake fragment. |

### Aboriginal archaeological significance assessment

A summary of archaeological significance for the above additional Aboriginal sites within the amended proposal site is presented in Table 3-8.

**Table 3-8: Summary of archaeological significance**

| Site name and AHIMS ID | Research potential | Representative value | Rarity | Education potential | Overall archaeological significance |
|---|---|---|---|---|---|
| Blacktown Southwest 7, (AHIMS ID 45-5-0559) | Moderate-high | High | High | High | High |
| RCAS 13 (AHIMS ID 45-5-5441) | Moderate | Moderate | Moderate | Moderate | Moderate |
| RCIF 3 (AHIMS ID 45-5-5442) | Low | Low | Low | Low | Low |
| RCIF 4 (AHIMS ID 45-5-5443) | Low | Low | Low | Low | Low |

### Aboriginal cultural significance

No specific areas of cultural significance were identified during the site survey which was undertaken with a representative of Deerubbin Local Aboriginal Land Council. Further assessment of the cultural significance of proposal site would be undertaken during preparation of the Archaeological Cultural Heritage Assessment Report for the proposal.

## 3.5.2 Potential impacts

### Construction

Earthworks undertaken during construction would result in partial to total removal of Aboriginal sites identified within the amended proposal site. A portion of the registered extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) within the amended proposal site would be partially impacted by construction activities. The newly identified site including RCAS 13 (AHIMS ID 45-5-5441), RCIF 3 (AHIMS ID 45-5-5442) and RCIF 4 RCIF 4 (AHIMS ID 45-5-5443) would result in a total loss of value as a result of the amended proposal. These three newly identified Aboriginal sites would increase the total proposal impacts to thirteen sites (previously ten sites within the exhibited REF).

A summary of impacts on identified additional Aboriginal sites is outlined Table 3-9.

**Table 3-9: Summary of impacts on identified Aboriginal sites**

| Name and AHIMS ID | Type of harm | Degree of harm | Consequence of harm |
|---|---|---|---|
| Blacktown Southwest 7, (AHIMS ID 45-5-0559) | Direct | Partial | Partial loss of value |
| RCAS 13 (AHIMS ID 45-5-5441) | Direct | Total | Total loss of value |
| RCIF 3 (AHIMS ID 45-5-5442) | Direct | Total | Total loss of value |
| RCIF 4 (AHIMS ID 45-5-5443) | Direct | Total | Total loss of value |

#### Operation

The amendments to the proposal would not result in any additional potential Aboriginal heritage impacts during operation of the precast facilities as earthworks and site establishment would be restricted to the construction phase.

### 3.5.3 Management and mitigation measures

With the exception of management and mitigation measure AH1, the proposed management and mitigation measures for potential Aboriginal heritage impacts associated with the amended proposal remain as described in Section 8.5.4 of the exhibited REF and reproduced in Table 4-1 of this Addendum Report. AH1 has been amended to accommodate the additional Aboriginal sites impacted by the proposal, as listed in Table 3-10. Changes to mitigation measures are shown in **bold, underlined text**.

**Table 3-10: Management and mitigation measures (amended) – Aboriginal heritage**

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **AH1** | Test excavation | Archaeological test excavation would be limited to the **amended** proposal site and undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010a) to confirm the geographic extent of RCIF 2 (AHIMS ID 45-5-3159), Blacktown Southwest 11 (AHIMS ID 45-5-0559), area of PAD identified within Ropes Creek Artefact Scatter 09 (AHIMS 45-5-5355), **Blacktown Southwest 7 (AHIMS ID 45-5-0559) and RCAS 13 (AHIMS ID 45-5-5441)**.<br><br>Test excavation would be limited to areas subject to potential impacts by the proposal, and outside the area already salvaged and subject to impacts by the St Mary's Wastewater System Augmentation project. Archaeological test excavation would be undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010a). |

## 3.6 Contamination

The following section presents the assessment carried out to determine any changes to the potential impacts identified in the exhibited REF as a result of the amended proposal. The methodology described in Section 8.10.1 of the exhibited REF remains applicable to the amended proposal and has been used in the following assessment.

A site inspection of the amended proposal site was carried out on 9 December 2020 to make observations of the current site conditions and adjacent site land uses with respect to contamination potential. As part of the contamination assessment carried out in preparation of the exhibited REF, the review of historic mapping and publicly available information included the whole of the amended proposal site, and additional review was not required.

### 3.6.1 Existing environment

The existing environment of the proposal site is as described in Section 8.10.2 of the exhibited REF. The site inspection of the amended proposal site identified the following sources of potential contamination:

- Isolated occurrences of fly tipped (illegal dumping) waste materials
- Filling (material of unknown quality) used for the bund of the existing farm dam located within the amended proposal site (as identified in the exhibited REF)
- Sediments within the existing farm dam located within the amended proposal site (as identified in the exhibited REF).

The locations of these potential contamination sources, along with those identified as within the proposal site in the exhibited REF, are shown on Figure 3-5.

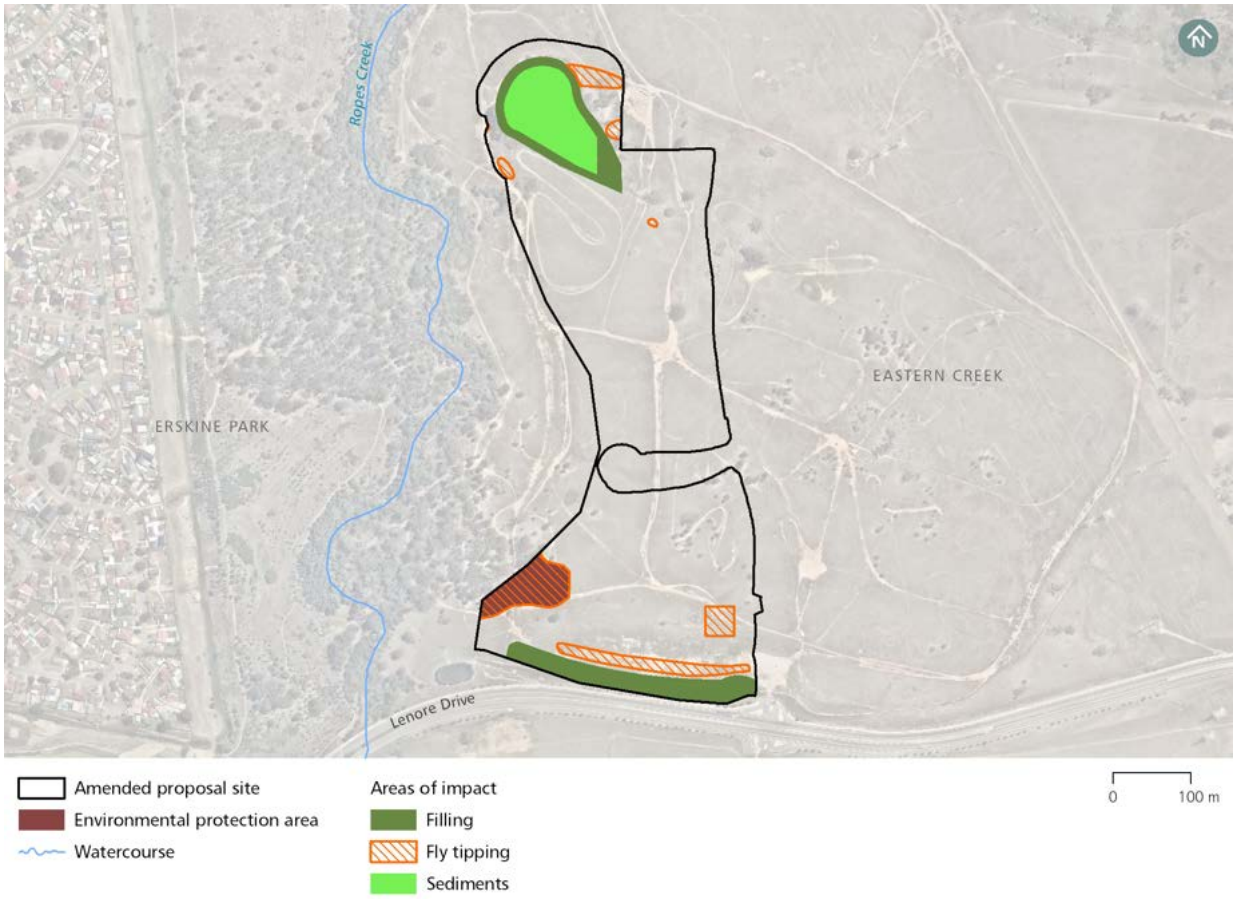


**Figure 3-5: Key areas of potential contamination within the amended proposal site**

## 3.6.2 Potential impacts

### Construction

The exposure of any contaminated materials during construction of the amended proposal may increase the potential for contaminant mobilisation and may create additional exposure pathways to sensitive receivers (including environmental receptors), surface water bodies and groundwater bodies.

If earthworks during construction of the amended proposal intersect identified areas of potential contamination without appropriate management and/or remediation, similar impacts (in relation to human and ecological health, contamination of spoil and contaminated groundwater discharge) for the proposal, have the potential to occur.

The potential sources of contamination identified within the additional area of land as having moderate potential contamination risk include:

- Filling (material of unknown quality) used for the bund of the existing farm dam
- Sediments within the existing farm dam
- Fly tipping (illegal dumping) of wastes.

These potential sources of contamination were also identified within the proposal site, as described in the exhibited REF. An overview of these potential contamination risks is provided in Table 8-40 of the exhibited REF, which assessed these sources as having moderate

potential contamination risk during construction. However, with further investigation and appropriate management of these potential contamination risks, the overall risk is considered low.

There were no other additional potential contamination risks that were not previously identified in the exhibited REF. Therefore, there is no change as a result of the amended proposal to the overall level of potential contamination risk identified in Section 8.10.3 of the exhibited REF.

#### Operation

The amendments to the proposal would not result in any additional potential contamination impacts during operation of the precast facilities. Due to the implementation of site management controls, the likelihood of a major spill incident occurring is negligible, and the impact of accidental spills or leaks would be low. All surface water runoff would be captured on site during operation and managed so that any discharge leaving the amended proposal site would not adversely pollute nearby land or waterways. Therefore, the potential contamination impacts during operation of the amended proposal remain as described in the Section 8.10.3 of the exhibited REF.

### 3.6.3 Management and mitigation measures

The proposed management measures for potential contamination impacts associated with the amended proposal remain as described in Section 8.10.4 of the exhibited REF and are reproduced in Table 4-1 of this Addendum Report.

## 3.7 Biodiversity

The following section presents the biodiversity assessment carried out to determine any changes to the potential impacts identified in the exhibited REF as a result of the amended proposal. The methodology described in Section 8.11.1 of the exhibited REF remains applicable to the amended proposal and has been used in the following assessment.

An ecological survey was undertaken on 9 December 2020 within the northern part of the amended proposal site (where the proposed basins would be located). Database searches have not been redone and the information documented in the exhibited REF and supporting Biodiversity Assessment Report (BAR) is still relevant.

### 3.7.1 Existing environment

The existing environment of the proposal site is as described in Section 8.11.2 of the exhibited REF. The existing environment of the amended proposal site is consistent with the environment as described in the exhibited REF for the proposal site. Any changes to the existing environment in relation to the amended proposal site are discussed below and illustrated in Figure 3-6.

#### Plant Community Types

The northern part of the amended proposal site contains the same three Plant Community Types (PCTs) identified within the proposal site:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)
- Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)

- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

These PCTs (Figure 3-6) are mostly in poor condition, existing as regenerating canopy over exotic dominated grasses. The remainder of the vegetated areas are classed as exotic grassland.

### Threatened Ecological Communities

Two threatened ecological communities (TECs) listed under the *Biodiversity Conservation Act 2016* (BC Act) were identified in the amended ecological study area and include:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as critically endangered under the BC Act)
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered under the BC Act).

The River-Flat Eucalypt Forest vegetation was also assessed against the conservation advice for the EPBC Act newly listed River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria. Vegetation within the northern part of the amended proposal site did not meet the minimum condition thresholds and therefore is not eligible to be included in the EPBC Act TEC.

The distribution of TECs is mapped in Figure 3-6.

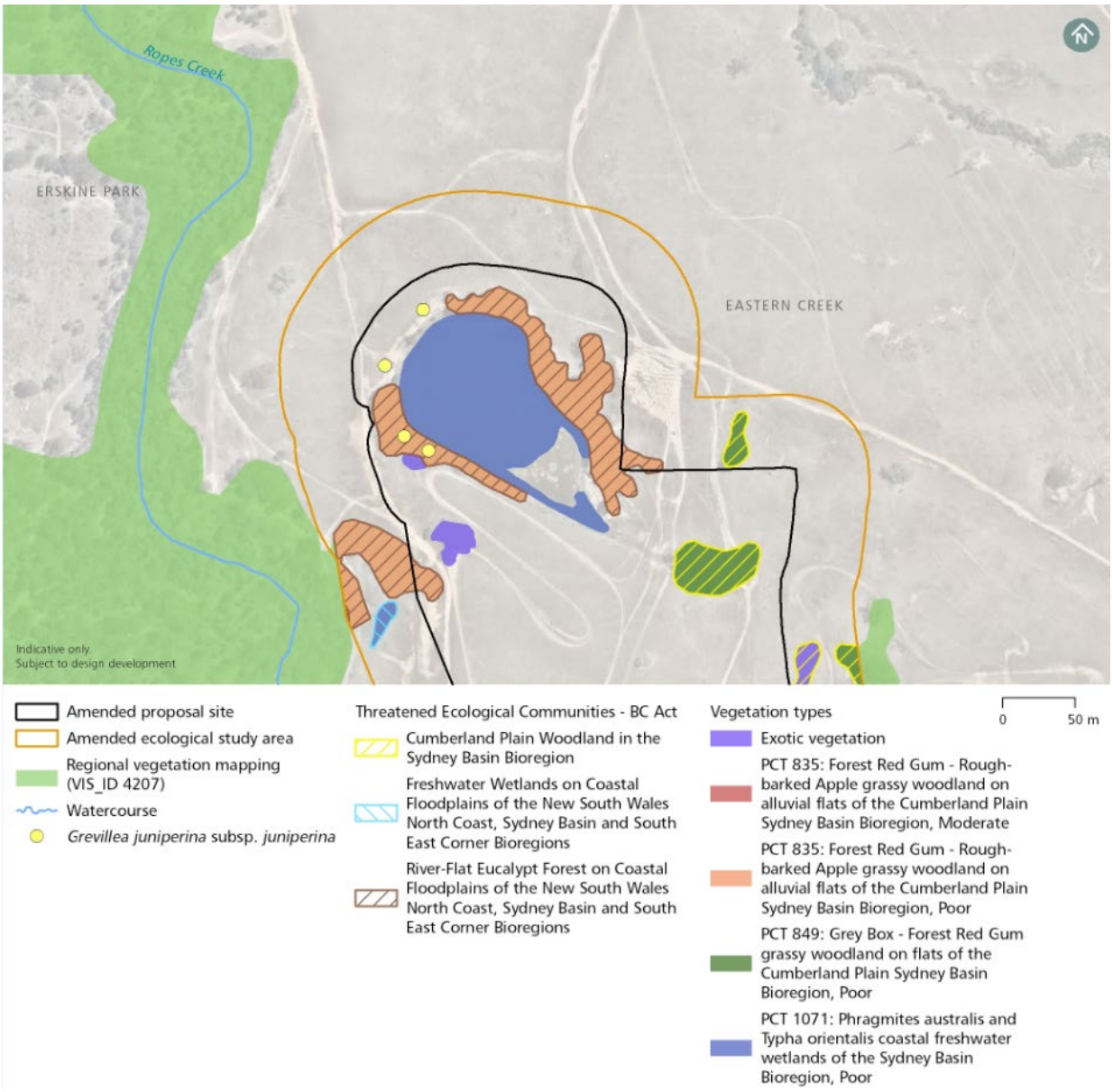


**Figure 3-6: Biodiversity values in the northern part of the amended proposal site**

### Threatened species and populations

#### *Grevillea juniperina* subsp. *juniperina*

Forty-nine individuals of *Grevillea juniperina* subsp. *juniperina* (listed as vulnerable under the BC Act) were identified in four clusters within the northern part of the amended proposal site. Most of these plants are small juveniles (Figure 3-7 and Figure 3-8) that have likely been seeded by the larger mature plants around the existing dam. As seen in Figure 3-6, all plants were identified along the banks of the existing dam in the amended proposal site.

**Figure 3-7: *Grevillea juniperina* subsp. *juniperina* mature plant located around the existing northern dam bank of the amended ecological study area and within the amended proposal site**

**Figure 3-8: *Grevillea juniperina* subsp. *juniperina* juvenile plants (enclosed in red squares) location around the existing northern dam bank of the amended ecological study area and within the amended proposal site**

#### Green and Golden Bell Frog

The existing dam and grassy edges contain suitable foraging and dispersal habitat for the Green and Golden Bell Frog (listed as endangered under the EPBC Act and BC Act) as discussed in the exhibited REF. Suitable habitat has been identified as the extent of *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071). In accordance with the findings of the exhibited REF, the dam is not considered to be suitable breeding habitat for this species.

#### Cumberland Plan Land Snail

Rubbish piles (from fly tipping (illegal dumping)) were identified within the northern part of the amended proposal site which represent suitable habitat for the Cumberland Plain Land Snail. However, no live snails or shells were found in the rubbish piles within the north part of the

amended proposal site. As described in the exhibited REF, these rubbish piles are located within low condition woodland, which is unlikely to provide suitable habitat for this species.

**Threatened aquatic species**

As discussed in the exhibited REF, the existing dam does not have characteristics suitable for any of the threatened fish species known or predicted to occur in the locality.

**Matters of National Environmental Significance**

The River-Flat Eucalypt Forest vegetation has been assessed against the conservation advice for the EPBC Act newly listed River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria (effective on 15 December 2020). However, as discussed in the Addendum Biodiversity Assessment Report (Addendum BAR) (Appendix C), this TEC does not meet key diagnostic characteristics and minimum condition thresholds (patch size and biotic thresholds) required for its conservation. Therefore, it is not eligible to be included in the EPBC Act TEC.

Of the migratory species identified from database searches, only the Fork-tailed Swift and White-throated Needletail are considered moderately likely to fly over the northern part of the amended proposal site but would not use it as habitat.

### 3.7.2 Potential impacts

#### Construction

**Loss of native vegetation and habitat**

Three PCTs would be subject to additional direct impacts from the amended proposal, including 1.06 hectares of clearing, comprising two TECs. This additional area increases the total proposal impacts to 2.98 hectares (previously 1.92 hectares within the exhibited REF) of clearing as shown in Table 3-11. As noted in the Addendum BAR, additional biodiversity impacts do not change the overall findings of the exhibited REF. Therefore, no offsets are required for the amended proposal under the BC Act or the EPBC Act.

**Table 3-11: Potential impacts to PCTs and TECs within the amended proposal site**

| PCT | TEC status | Potential impact | | |
|---|---|---|---|---|
| | | Exhibited REF impacts (ha) | Additional impacts (ha) | Total amended proposal site (ha)* |
| Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) | River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered, BC Act) | 0.07 | 0.38 | 0.45 |

| PCT | TEC status | Potential impact | | |
|---|---|---|---|---|
| | | Exhibited REF impacts (ha) | Additional impacts (ha) | Total amended proposal site (ha)* |
| Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) | Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered, BC Act) | 1.74 | 0.003 | 1.74 |
| Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) | N/A | 0.11 | 0.68 | 0.79 |
| **Total** | | **1.92** | **1.06** | **2.98** |

**Excludes the environmental protection area.*

As noted above, the amended proposal would result in an additional direct impact to forty-nine *Grevillea juniperina* subsp. *juniperina plants* growing around the existing dam. There would be no other additional direct impacts to threatened species from the amended proposal.

**Loss of fauna habitat**

Table 3-12 provides an overview of potential direct impacts of the amended proposal to potential habitat of threatened fauna species.

**Table 3-12: Potential impacts to fauna within the amended proposal site**

| Species | BC Act status | EPBC status | Potential impact | |
|---|---|---|---|---|
| | | | Additional impacts to exhibited REF | Total amended proposal site |
| Green and Golden Bell Frog (*Litoria aurea*) | Endangered | Endangered | Removal of an additional 0.68 ha of potential non-breeding habitat. | Removal of a total of 0.79 ha of potential non-breeding habitat. This would represent a small proportion of similar quality habitat present in the broader locality. |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | Vulnerable | Vulnerable | Removal of an additional 0.38 ha of suitable foraging habitat. | Removal of a total of 2.19 ha of suitable foraging habitat. No breeding habitat (camps) would be impacted. |
| **Insectivorous bats (cave-roosting)** | | | | |
| Little Bent-winged Bat (*Miniopterus australis*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of suitable foraging habitat. | Removal of a total of 2.98 ha of suitable foraging habitat.<br>The amount of habitat removal is relatively small in comparison to the amount of higher quality habitat available in the broader locality. |
| Large Bent-winged Bat (*Miniopterus orianae oceanensis*) | Vulnerable | Not listed | | |
| Southern Myotis (*Myotis macropus*) | Vulnerable | Not listed | | |

| Species | BC Act status | EPBC status | Potential impact | |
|---|---|---|---|---|
| | | | Additional impacts to exhibited REF | Total amended proposal site |
| **Insectivorous bats (hollow-roosting)** | | | | |
| Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of suitable foraging habitat. | Removal of a total of 2.98 ha of suitable foraging habitat and four hollow-bearing trees.<br>The amount of habitat removal is relatively small in comparison to the amount of higher quality habitat available in the broader locality. |
| Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) | Vulnerable | Not listed | | |
| Greater Broad-nosed Bat (*Scoteanax rueppellii*) | Vulnerable | Not listed | | |
| Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) | Vulnerable | Not listed | | |
| **Woodland birds** | | | | |
| Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of suitable foraging habitat. | Removal of a total of 2.19 ha of suitable foraging habitat.<br>The amount of habitat removal is relatively small when the amount of available habitat in the broader locality is considered. |
| Varied Sittella (*Daphoenositta chrysoptera*) | Vulnerable | Not listed | | |

| Species | BC Act status | EPBC status | Potential impact | |
|---|---|---|---|---|
| | | | Additional impacts to exhibited REF | Total amended proposal site |
| **Nectarivorous birds** | | | | |
| Little Lorikeet (*Glossopsitta pusilla*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of foraging habitat. | Removal of a total of 2.19 ha of foraging habitat and four hollow-bearing trees.<br>The amount of habitat removal is relatively small when the amount of available habitat in the broader locality is considered. |
| Swift Parrot (*Lathamus discolor*) | Endangered | Critically endangered | | |
| **Large predatory birds** | | | | |
| Little Eagle (*Hieraaetus morphnoides*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of foraging habitat. | Removal of a total of 2.19 ha of foraging habitat. However, no high-quality habitat is present within the amended ecological study area and this species may only visit the amended ecological study area on occasion to hunt.<br>The amount of habitat removal is small when the amount of available habitat in the broader locality is considered. |
| Square-tailed Kite (*Lophoictinia isura*) | Vulnerable | Not listed | | |
| Powerful Owl (*Ninox strenua*) | Vulnerable | Not listed | | |
| Masked Owl (*Tyto novaehollandiae*) | Vulnerable | Not listed | | |

### Assessments of significance

Assessments of significance against both the BC Act and EPBC Act concluded that a significant impact to any threatened species is considered unlikely. This is consistent with the findings of the exhibited REF.

Further details of the revised assessments of significance under the EPBC Act and BC Act are provided in the Addendum Biodiversity Assessment Report (Appendix C).

### Aquatic impacts

The amended proposal would increase impacts on aquatic habitat compared to the proposal assessed in the exhibited REF. This increased impact is through a larger part of the dam being impacted by the amended proposal. However, the aquatic habitat is generally in poor condition due to previous development and agricultural activity within the catchment which has resulted in changes to hydrological conditions, increased input of nutrients, sedimentation and weed invasion.

The aquatic habitat in the northern part of the amended proposal site meets the description for Class 4 (unlikely fish habitat). As such, there would be no impacts to sensitive or key fish habitats as a result of the amended proposal.

### Fauna injury or mortality

The existing dam would need to be dewatered for the construction of the proposed basins in the amended proposal site. There is a possibility that native fish, turtle and frog species have colonised these dams. If present, these species would need to be captured and relocated into a similar aquatic environment to which they were found by suitably qualified aquatic ecologists under a Fisheries Permit issued by the NSW Department of Primary Industries.

### Other indirect impacts

The amended proposal is unlikely to significantly change the assessment of indirect construction impacts identified in the exhibited REF.

However, the amended proposal has the potential to result in the spread of exotic species during dewatering of, and vegetation clearing near, the existing dam at the northern part of the amended proposal site. *Salvinia molesta* was identified in the existing dam and is listed as a Weed of National Significance (WoNS) that spreads by inappropriate disposal of plant fragments.

In addition, the predatory fish species Eastern Gambusia (*Gambusia holbrooki*) was identified within the existing dam during surveys undertaken for the REF BAR. Management and mitigation measures would be undertaken to ensure *Gambusia holbrooki* are not spread into Ropes Creek during dewatering activities.

## Operation

Most of the impacts of the proposal would occur during the construction phase. As such, the potential operational impacts identified in the exhibited REF remain unchanged with the amended proposal site.

The only potential increase in likelihood of operational impacts of the proposed basins would occur through the inadvertent release of sediment-laden wastewater into Ropes Creek in the event the proposed basins overflow. However, this would only likely occur during extreme weather events and the dam design includes a weir for flows greater than the one percent

AEP. Therefore, this is unlikely to cause any water quality impacts as the first flush pollutants would be highly diluted before being naturally discharged over the weir.

### 3.7.3 Management and mitigation measures

The proposed management measures for potential biodiversity impacts associated with the amended proposal remain as described in Section 8.11.4 of the exhibited REF and are reproduced in Table 4-1 of this Addendum Report.

Additional management and mitigation measures outlined in Table 3-13 would be implemented to reduce and avoid potential impacts on biodiversity within the amended proposal site. New management and mitigation measures are shown in **bold, underlined text**.

**Table 3-13: Additional management and mitigation measures - Biodiversity**

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **B15** | **Potential impact to surrounding vegetation and threatened ecological communities** | **The translocation of the forty-nine individuals of *Grevillea juniperina* subsp. *Juniperina* around Ropes Creek would be investigated and implemented if feasible and reasonable.** |
| **B16** | **Potential impacts related to fauna injury and mortality** | **A suitably qualified aquatic ecologist would be present during the dewatering of the northern dam. If native fish, turtle and/or frog species are found, they would be relocated into a similar aquatic environment by a trained aquatic ecologist under a Fisheries Permit issued by the Department of Primary Industries. Sydney Metro would apply for a Fisheries Permit, if required.** |
| **B17** | **Potential impacts from the spread of exotic species** | **Water removed from the existing dam during dewatering would be filtered for *Salvinia molesta* and *Gambusia holbrooki* before releasing into surrounding environments to minimise the potential for spreading of these exotic species.** |

# 4 Revised management and mitigation measures

*This chapter provides the complete set of environmental management measures for the proposal, highlighting any changes since the Review of Environmental Factors.*

## 4.1 Environmental management systems and plans

Environmental issues associated with the construction and operation of the amended proposal would be managed using the Sydney Metro environmental management system, as described in Section 9.1 of the exhibited REF.

Sydney Metro has developed and successfully implemented a range of documents to set out the management approach during construction of its projects. These documents would be applied, as relevant, to the construction and operation of the precast facilities, as outlined in Section 9.2 of the exhibited REF.

These management documents include:

- Construction Environmental Management Framework
- Construction Noise and Vibration Standard
- Construction Traffic Management Framework.

## 4.2 Revised management and mitigation measures

The list of management and mitigation measures presented in Section 9.3 of the exhibited REF has been updated with consideration given to the environmental impacts identified within this Addendum Report. Five new measures have been added, and the wording of one existing measure has been adjusted.

The full set of revised environmental management measures to be implemented during the construction and operation of the amended proposal are listed in Table 4-1. This table supersedes the measures presented in the exhibited REF. New management and mitigation measures or additions to existing measures are shown in **bold, underlined text**.

**Table 4-1: Compiled management and mitigation measures**

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **Noise and vibration** | | |
| **NV1** | Construction noise and vibration | During construction, receivers that would potentially be affected by noise and/or vibration from the works would be appropriately notified before the relevant works start. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **NV2** | Construction airborne noise | Noise monitoring at the most affected receiver(s) would be undertaken at the start of construction works to check the levels are as predicted and to confirm that the standard mitigation measures are adequate, further mitigation measures would be considered and implemented where feasible and reasonable. |
| **Traffic and transport** | | |
| **T1** | Traffic incidents | In the event of a traffic-related incident, coordination would be carried out with Transport Coordination and/or other parts of Transport for NSW. |
| **T2** | Emergency vehicles access | Access to properties for emergency vehicles would be provided at all times. |
| **T3** | Road safety | All trucks would enter and exit the proposal site in a forward direction, where feasible and reasonable. |
| **T4** | Staff parking | All staff parking would be provided on-site and not on surrounding local streets. |
| **T5** | Road safety | The driver induction process would include safety awareness in relation to all road users, particularly pedestrians and cyclists at the proposal site access point at Archbold Road/Lenore Drive during construction. |
| **Landscape and visual character** | | |
| **LV1** | Visual impacts - construction | Where feasible and reasonable, the elements within the construction site would be located to minimise visual impacts (for example storing materials and machinery behind fencing). |
| **LV2** | Landscape and visual impact – operation | Sheds would be finished in a colour which aims to minimise visual impacts, if visible from areas external to the site. |
| **LV3** | Lighting impacts during operation | Lighting of the sites would be orientated to minimise glare and light spill impacts on adjacent receivers in accordance with AS4282:2019. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **Aboriginal heritage** | | |
| **AH1** | Test excavation | Archaeological test excavation would be limited to the **amended** proposal site and undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010a) to confirm the geographic extent of RCIF 2 (AHIMS ID 45-5-3159), Blacktown Southwest 11 (AHIMS ID 45-5-0559), area of PAD identified within Ropes Creek Artefact Scatter 09 (AHIMS 45-5-5355), **Blacktown Southwest 7 (AHIMS ID 45-5-0559) and RCAS 13 (AHIMS ID 45-5-5441)**.<br><br>Test excavation would be limited to areas subject to potential impacts by the proposal, and outside the area already salvaged and subject to impacts by the St Mary's Wastewater System Augmentation project. Archaeological test excavation would be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010a). |
| **AH2** | Consultation | As part of the preparation of the test excavation methodology and ACHAR, comprehensive Aboriginal stakeholder consultation would be carried out in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010b) and the *National Parks and Wildlife Regulation 2019*. |
| **AH3** | Aboriginal heritage | An AHIP would be submitted to the NSW DPC for those portions of the proposal site subject to impacts once test excavation is completed. The AHIP application would be supported by an ACHAR and test excavation report. |
| **AH4** | Overlapping impact | Sydney Metro would liaise with Transport for NSW regarding overlapping impacts to Aboriginal site AIF-06 (AHIMS ID 45-5-4599) and coordinating further assessment and management. |
| **AH5** | Unexpected finds | In the event that suspected Aboriginal ancestral remains are exposed during construction, the requirements of Section 3.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010) would be implemented. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **Non-Aboriginal heritage** | | |
| **NAH1** | Unexpected finds | An Unexpected Finds Procedure, to be implemented in the event that potential non-Aboriginal heritage objects are exposed during construction, would be prepared that complies with the *Heritage Act 1977*. |
| **NAH2** | **Archaeological monitoring and s140 Excavation Permit** | **Excavation works would aim to avoid the area of moderate potential for locally significant archaeological relics associated with the Chatsworth Estate homestead where possible.**<br>**Should excavation works in this area be unavoidable, a program of archaeological monitoring would be implemented. If necessary, a s140 Excavation Permit granted under section 141 of the *Heritage Act 1977* would be obtained from Heritage NSW prior to the commencement of excavation works.** |
| **NAH3** | **Archaeological Methodology and Research Design** | **Any application for an Excavation Permit under the *Heritage Act 1977* would be accompanied by an Archaeological Methodology and Research Design (AMRD). The AMRD would outline the archaeological potential and significance of the area to be impacted and assess the impact of the proposed excavation works on those resources. The AMRD would provide appropriate methodologies for investigation, protection and/or avoidance of archaeological remains.** |
| **Flooding** | | |
| **F1** | Potential increase in mainstream peak flood flows | Detailed design of the proposal site would include provision of appropriate onsite stormwater detention/flood detention facilities to cater for events up to and including the 1% AEP event. |
| **F2** | Potential geomorphic impacts due to changed flow regime in low flows and frequent flood event | Detailed design of the proposal site would include the provision of appropriate on-site stormwater detention/flood detention facilities. Outlet sizing would be designed to satisfactorily mitigate potential increases in peak flows in frequent events. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **F3** | Potential impacts on overland flooding and drainage conditions | Detailed design of the proposal site would include the provision of appropriate flow diversion channels or culverts for management of external flows. |
| **F4** | Potential impacts on overland flooding and drainage conditions | Detailed design would integrate with the planned Archbold Road upgrade and extension cross drainage and road drainage outlets. |
| **F5** | Potential impacts on overland flooding and drainage conditions | Detailed design would provide appropriate scour protection works at channel/culvert discharge points to Ropes Creek. |
| **F6** | Potential impacts on the proposal resulting from flooding | Detailed design would provide filling to a height of at least 0.5m above Ropes Creek 1% AEP flood level. |
| **Soils and surface water** | | |
| **SW1** | Soil salinity | Prior to ground disturbance in high probability salinity areas, testing would be carried out to determine the presence of saline soils. If salinity is encountered, excavated soils would not be reused or it would be managed in accordance with Book 4 Dryland Salinity: Productive Use of Saline Land and Water (NSW DECC, 2008). Erosion controls would be implemented in accordance with Blue Book (Landcom, 2004). |
| **SW2** | Potential erosion and sedimentation | Erosion and sediment measures would be implemented in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004) and Volume 2D (NSW DECCW, 2008), commonly referred to as the 'Blue Book'. Additionally, any water collected from the proposal site would be appropriately treated and discharged to avoid any potential contamination or local stormwater impacts.<br><br>Temporary sediment basins would be designed in accordance with Managing Urban Stormwater: Soils and Construction and Managing Urban Stormwater, Volume 2D: Main Road Construction (DECC, 2008). |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **SW3** | Wastewater discharge | Prior to discharge, wastewater would be treated to a level that is compliant with the ANZECC/ARMCANZ (2000) and ANZG (2018) default guidelines for 95 per cent species protection.<br><br>For the purposes of this management measure, during operation wastewater is defined as process water from operation of the precast facility and does not include surface runoff or stormwater. |
| **Contamination** | | |
| **C1** | Management of low risk contamination | For areas that have been identified as having moderate contamination impact potential, a further review of data would be performed.<br><br>Should the additional data review confirm that contamination is likely to have a very low or low impact potential, the areas would then be managed in accordance with the Soil and Water Management Plan for the proposal. This would typically occur where there is minor, isolated contamination that can be readily remediated through standard construction practices such as excavation and off-site disposal. |
| **C2** | Detailed Site Investigation | Where data from the additional data review (mitigation measure C1) is insufficient to understand the impact of contamination, a Detailed Site Investigation would be carried out in accordance with the NEPM (2013) and other guidelines made or endorsed by the NSW EPA.<br><br>The areas requiring Detailed Site Investigation would be confirmed following the additional data review (C1), however on the basis of the PSCI, it is anticipated that a Detailed Site Investigation would be required to characterise fill materials, and sediment from dam / retention pond for on-site reuse and/or off-site disposal. Fly tipped wastes and deposited wastes (from former land use) would need to be characterised for off-site disposal. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **C3** | Remediation | Where data from additional data review (mitigation measure C1) or the Detailed Site Investigation (mitigation measure C2) confirms that contamination would have a moderate to very high risk, a Remedial Action Plan (RAP) would be developed for the area of the construction footprint.<br><br>The RAP would detail the remediation works required to mitigate impacts from contamination throughout and following completion of construction. The RAP would be prepared in accordance with relevant NSW EPA guidelines and where applicable, detail remediation methodologies in accordance with Australian Standards and other relevant government guidelines and codes of practice.<br><br>Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land.<br><br>The requirements for a RAP and remediation would be confirmed following the additional data review (mitigation measure C1) and Detailed Site Investigation (mitigation measure C2). |
| **C4** | Site audit statement | Where contamination is highly complex, such as significant groundwater contamination; contamination associated with vapour; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction, an accredited Site Auditor would review and approve the RAP and would develop a Site Audit Statement and Site Audit Report upon completion of remediation. The requirement for a Site Audit Statement would be confirmed following preparation of the RAP (mitigation measure C3). |
| **C5** | Residual contamination following construction | Ongoing management and monitoring measures would be documented in an appropriate form and implemented for any areas where minor, residual contamination remains following construction. |
| **C6** | Accidental leaks or spills – operation | The operational environmental management plan (OEMP) for the proposal would include an Emergency Response Plan (or equivalent) which would specify the procedure to be followed in the event of a spill, including the notification requirements and use of absorbent material to contain the spill. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **C7** | Contaminated soil - operation | Where contaminated soils are to remain on-site, an appropriate OEMP would be prepared and implemented. The OEMP would include relevant ongoing management requirements developed in accordance with the NEPM (2013) and relevant guidelines made or approved by the NSW EPA. Measures may include but are not limited to, including procedures for excavation works, inspections and audits. |
| **C8** | Contaminated groundwater | Potential impacts from existing groundwater contamination (if present) during operation of the proposal would be managed through management and mitigation measures such as:<br>• Emplacement of appropriate topographic / drainage controls to minimise seepage and ponding of water across the site<br>• Drainage from sealed areas would be directed to stormwater drains (e.g. pipes, swales) via gross pollutant traps and sediment basins (if necessary) to mitigate potential impacts from sediments or wastes on receiving environments. |
| **Biodiversity** | | |
| **B1** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, the limits of the work zone, areas for parking and turning of vehicles and plant equipment would be clearly and accurately marked out. These areas would be located so that vegetation disturbance is minimised as much as possible and the drip-line of trees avoided. |
| **B2** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, exclusion zones would be identified and established around all vegetation to be retained, such as the environmental protection area in the west of the proposal site. Periodic monitoring would be undertaken to ensure all controls are in place and no inadvertent impacts are occurring. |
| **B3** | Potential impact to surrounding vegetation and threatened ecological communities | Materials, plant, equipment, work vehicles and stockpiles would be placed to avoid damage to surrounding vegetation and outside tree driplines. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **B4** | Potential impact to surrounding vegetation and threatened ecological communities | Prior to construction, personnel would be informed of the environmentally sensitive aspects of the proposal site, including plans for impacted and adjoining areas showing vegetation communities, important flora and fauna habitat areas, and locations where threatened species, populations or ecological communities have been recorded. Construction personnel would be made aware that any native fauna species encountered must be allowed to safely leave the proposal site where possible and a local wildlife rescue organisation or appropriately experienced ecologist must be called for assistance where necessary. |
| **B5** | Potential impact to surrounding vegetation and threatened ecological communities | Where possible, hollows would be cut out of hollow-bearing trees and re-established in large trees to the west of the proposal site to mitigate the loss of hollow habitat on fauna. |
| **B6** | Potential impacts to the Cumberland Plain Land Snail | Pre-clearing surveys for the Cumberland Plan Land Snail would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing to translocate any individuals that may be inhabiting areas that would be cleared or disturbed. This includes all areas of dumped rubbish across the proposal site. |
| **B7** | Potential impacts to the Cumberland Plain Land Snail | Prior to construction, exclusion zones would be established around Cumberland Plain Land Snails habitat in the environmental protection area. All personnel would be inducted to understand the exclusion zone to limit the potential of trampling snails |
| **B8** | Potential impacts to the Cumberland Plain Land Snail | Large woody debris cleared within the proposal site would be relocated into habitat to the west of the proposal site. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **B9** | Potential impacts to the Green and Golden Bell Frog | Pre-clearing surveys for the Green and Golden Bell Frog would be undertaken by a suitably qualified ecologist within 48 hours prior to the commencement of clearing and dewatering of potential habitat to ensure that individuals have not inhabited the site. A suitably qualified ecologist would also be present during the dewatering of the habitat. A stop work in the immediate vicinity would be implemented if this species is identified on the proposal site, and then further consideration of approach to management of individuals on proposal site through consultation with a Green and Golden Bell Frog expert. |
| **B10** | Potential impacts to the Green and Golden Bell Frog | Any work in and around the suitable habitat during clearing would follow the Hygiene Protocol for the Control of Disease in Frogs (Department of Environment and Climate Change 2008b) to reduce the potential for introduction and spread of Chytrid fungus. |
| **B11** | Potential impacts from introduction and spread of weeds | Weed control would be undertaken by suitably qualified and/or experienced personnel. This may include:<br>• Manual weed removal in preference to herbicides<br>• Replacing non-target species removed/killed as a result of weed control activities<br>• Protecting non-target species from spray drift<br>• Using only herbicides registered for use within or near waterways for the specific target weed<br>• Applying herbicides during drier times when the waterway level is below the high-water mark<br>• Not applying herbicide if it is raining or if rain is expected<br>• Mixing and loading herbicides, and cleaning equipment away from waterways and drains. |
| **B12** | Potential impacts from introduction and spread of weeds | During construction, weed management would be undertaken in areas affected by construction prior to any clearing works in accordance with the *Biosecurity Act 2015* to ensure they are not spread to the surrounding environment; including during transport disposal off-site to a licenced waste disposal facility. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **B13** | Potential impacts from introduction and spread of weeds | All weeds, propagules, other plant parts and/or excavated topsoil material that is likely to be infested with weed propagules that are likely to regenerate would be treated on site or bagged, removed from site and disposed of at a licensed waste disposal facility. |
| **B14** | Potential impacts from introduction and spread of plant pathogens | During construction, all vehicles driving to and from the proposal site would follow a protocol to prevent the spread or introduction of phytophthora, namely vehicles would be clean, including the tyres and any equipment. |
| **B15** | **Potential impact to surrounding vegetation and threatened ecological communities** | **The opportunity to translocate the forty-nine individuals of *Grevillea juniperina* subsp. *Juniperina* around Ropes Creek would be investigated and implemented if feasible and reasonable.** |
| **B16** | **Potential impacts related to fauna injury and mortality** | **A suitably qualified aquatic ecologist would be present during the dewatering of the northern dam. If native fish, turtle and/or frog species are found, they would be relocated into a similar aquatic environment by a trained aquatic ecologist under a Fisheries Permit issued by the Department of Primary Industries. Sydney Metro would apply for a Fisheries Permit, if required.** |
| **B17** | **Potential impacts from the spread of exotic species** | **Water removed from the existing dam during dewatering would be filtered for *Salvinia molesta* and *Gambusia holbrooki* before releasing into surrounding environments to minimise the potential for spreading of these exotic species.** |
| **Resource use and waste management** | | |
| **WR1** | Compliance with legislative and policy requirements | All waste would be assessed, classified, managed, transported and disposed of in accordance with the *Waste Classification Guidelines and the Protection of the Environment Operations (Waste) Regulation 2014.* |
| **WR2** | Waste minimisation | Waste would be minimised by accurately calculating materials brought to the proposal site and limiting materials packaging. |
| **WR3** | Waste management | 100 per cent of usable spoil from construction would be reused, in accordance with the Sydney Metro spoil management hierarchy. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **WR4** | Reuse and recycling | Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities. |
| **WR5** | Waste tracking | A materials tracking system would be implemented for material transferred to offsite locations such as licensed waste management facilities. |
| **WR6** | Reuse and recycling | At least 95 per cent of inert and non-hazardous construction waste, excluding spoil, and at least 50 per cent of office waste would be recycled or alternatively beneficially reused. |
| **Air quality** | | |
| **AQ1** | Dust impacts during construction | The following best-practice dust management measures would be implemented during construction works:<br>• Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather<br>• Adjust the intensity of activities based on measures and observed dust levels and weather forecasts<br>• Minimise the amount of materials stockpiled and position stockpiles away from surrounding receivers<br>• Regularly inspect dust emissions and apply additional controls as required. |
| **AQ2** | Dust impacts during operation | The following best-practice dust management measures would be implemented during operation:<br>• Ensure that loads are covered and that haulage vehicles are cleaned to remove any loose debris before leaving the site<br>• Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather<br>• Position long-term stockpiles away from surrounding receivers<br>• Regularly inspect and where necessary clean sealed haulage roads to remove tracked materials. |
| **AQ3** | Exhaust emissions during construction and operation | Plant and equipment would be maintained in a proper and efficient manner. Visual inspections of emissions from plant would be carried out as part of pre-acceptance checks. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **AQ4** | Airborne hazardous materials uncovered during construction | The following best-practice measures would be implemented to manage airborne hazardous materials during construction:<br>• Temporary coverings or odour suppressing agents would be applied to excavated areas where appropriate<br>• Removal and disposal of hazardous materials would be undertaken in accordance with the relevant requirements in the *Work Health and Safety Act 2011*, *Work Health and Safety Regulation 2017* and any applicable guidelines. |
| **Bushfire** | | |
| **BF1** | Bushfire protection measures | The proposal site would be managed as an Asset Protection Zone (APZ). The entire proposal site would be managed as an APZ as outlined within Appendix 4 of 'Planning for Bush Fire Protection 2019' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. The APZ would not extend into the environmental protection area in the south-west of the site. |
| **BF2** | Bushfire protection measures | Vulnerable buildings and/or critical assets would be constructed to appropriate BAL in accordance with the Australian Standard for the Construction of Buildings in Bushfire Prone Areas (AS3959). |
| **BF3** | Bushfire protection measures | The following measures would be implemented for access roads within the proposal site:<br>• Access roads would be two-wheel drive, all-weather roads<br>• Minimum 5.5 metre carriageway width kerb to kerb<br>• Maximum grades for sealed roads would not exceed 15 degrees and an average grade of not more than 10 degrees, or other gradient specified by road design standards, whichever is the lesser gradient<br>• Curves of roads would have a minimum inner radius of 6 metres<br>• Dead end roads would incorporate a minimum 12 metre outer radius turning circle, and would be clearly sign posted as a dead end<br>• A minimum vertical clearance of 4 metres would be provided to any overhanging obstructions, including tree branches. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **BF4** | Bushfire protection measures | The following water supply and utilities would be installed during construction and maintained during operation of the proposal:<br>• A minimum static water supply of 20,000 litres for firefighting purposes. The firefighting water can be available in a single tank or a number of tanks around the proposal site<br>• A hardened ground surface for truck access up to and within 4 metres of the water source<br>• A 65 millimetre metal Storz outlet with a gate or ball valve would be provided as an outlet on each of the tanks<br>• If the water tank is located above ground it would be of a non-combustible material<br>• If the water tank is located underground, it would have an access hole of 200 millimetres to allow tankers to refill direct from the tank.<br>• All associated fittings to the tank would be non-combustible. |
| **BF5** | Bushfire protection measures | Bushfire Emergency Management and Evacuation Plans would be developed for the construction and operation of the proposal. The bushfire evacuation procedures would be completed in accordance with NSW Rural Fire Service Guide to Developing A Bushfire Emergency Management Plan and meet the requirements of Australian Standard AS 3745-2010 – Planning for Emergencies in facilities. |
| **BF6** | Bushfire protection measures | Activities that generate sparks or excessive heat would be minimised when a total fire ban is declared by Rural Fire Service. |
| **Sustainability, climate change and greenhouse gas** | | |
| **SCC1** | Sustainability implementation | Sustainability initiatives would be incorporated into the detailed design and construction to support the achievement of the Sydney Metro West sustainability objectives. |
| **SCC2** | Sustainability implementation | Best practice level of performance would be achieved using market leading sustainability rating tools during construction and operation. |
| **SCC3** | Greenhouse gas emissions | 25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction and operation of the proposal would be offset. |

| No. | Impact | Management and mitigation measures |
|---|---|---|
| **SCC4** | Greenhouse gas emissions | An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a baseline inventory calculated at the detailed design stage. |
| **SCC5** | Climate change risks | Climate change risk treatments would be confirmed and incorporated into the detailed design. |
| **Cumulative impacts** | | |
| **CI1** | Cumulative impacts | Co-ordination and consultation with the following stakeholders would occur where required to manage the interface of projects under construction at the same time:<br>• Other parts of Transport for NSW<br>• Department of Planning, Industry and Environment<br>• Utility providers<br>• Construction contractors.<br>Co-ordination and consultation with these stakeholders would include:<br>• Provision of regular updates to the detailed construction program, construction sites and haul routes<br>• Identification of key potential conflict points with other construction projects<br>• Developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve:<br>– Adjustments to the Sydney Metro construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of other construction projects<br>– Co-ordination of traffic management arrangements between projects. |

# 5 Conclusion and next steps

*This chapter provides a conclusion to this Addendum Report and outlines the next steps in the process for determination of the proposal.*

## 5.1 Conclusion

An Addendum Report is required due to design changes (for water management infrastructure) and an associated increase to the construction footprint (which has been extended to the north of the proposal site). This Addendum Report helps fulfil the requirements of Section 5.5 of the EP&A Act; namely that Sydney Metro examines and takes into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposed activity.

The assessments in the exhibited REF and this Addendum Report have been taken into account and it is concluded that the amended proposal is not likely to significantly affect the environment.

Consequently, an EIS is not required to be prepared under Division 5.1 of the EP&A Act. It is also considered that the proposed activity does not trigger the need for referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The following amendments to the proposal (the amended proposal) as exhibited in the REF include:

- A detention basin to manage stormwater flows across the proposal site
- A bioretention basin to manage water quality of surface water and stormwater runoff.

The proposed basins would both be located to the north of the proposal site and would require amendment to the proposal site boundary as outlined in previous sections of this Addendum Report.

The changes in potential impacts associated with the amended proposal compared to those described in the exhibited REF have been identified in Section 2 (Amendments to the proposal) and assessed in Chapter 3 (Environmental impact assessment) of this Addendum Report. The changes to potential impacts as a result of the proposed amendments would include:

- Potential increased non-Aboriginal heritage impacts, which include potential impacts on archaeological relics associated with the Chatsworth estate and nursery. These relics are expected to reach the threshold for local significance and would be subject to physical impacts by the amended proposal. Where possible, excavation works during construction would avoid areas with potential archaeological remains. If necessary, a s140 Excavation Permit granted under section 141 of the *Heritage Act 1977* would be obtained from Heritage NSW prior to the commencement of excavation works
- The partial to total removal of four Aboriginal sites identified within the amended proposal site, which include a portion of the registered extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559), as well as three newly identified sites within the amended proposal site (including RCAS 13 (AHIMS ID 45-5-5441), RCIF 3 (AHIMS ID 45-5-5442) and RCIF 4 (AHIMS ID 45-5-5443)). This amended proposal increases the total proposal impacts to thirteen sites (previously ten sites within the exhibited REF)

- Clearing of about 1.06 hectares of native vegetation, increasing the total impacts of the amended proposal to 2.98 hectares. Additional biodiversity impacts do not change the overall findings of the exhibited REF. Therefore, no offsets are required for the amended proposal under the BC Act or the EPBC Act.

The potential changes in impacts identified would not result in any unacceptable impacts and revised management and mitigation measures have been proposed where required.

The environmental impact assessment (exhibited REF and this Addendum Report) is recommended to be approved subject to the revised management and mitigation measures contained in Section 4 of this Addendum Report.

## 5.2 Next steps

This report, along with the exhibited REF, the Determination Report and any other relevant information, will be used by Sydney Metro to assess and determine the amended proposal.

After consideration of the assessments in the exhibited REF and this report, Sydney Metro will determine whether or not the amended proposal should proceed and will inform the community and stakeholders of the decision. This report will be made publicly available on the Sydney Metro website along with the Determination Report for the amended proposal.

If Sydney Metro determines to proceed with the amended proposal, it would be designed, constructed and operated in accordance with the project description and management and mitigation measures outlined in the exhibited REF, this Addendum Report and any conditions imposed in the Determination Report.

If Sydney Metro determines to proceed with the amended proposal, Sydney Metro would continue to consult with the community and stakeholders prior to and during construction and operation of the amended proposal.

# 6 References


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ANZECC/ARMCANZ, 2019, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand,* Accessed from: http://waterquality.gov.au/anz-guidelines

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NSW Environment Protection Authority NSW, 2014a, *Waste Classification Guidelines*, NSW Environment Protection Authority, Sydney.

NSW Heritage Office, 2002, *Statement of Heritage Impact* guideline, contained within the *NSW Heritage Manual*.

NSW Rural Fire Service, 2019, *Planning for Bushfire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Homeowners*.

NSW Rural Fire Service, 2006, *Planning for Bushfire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Homeowners*.

Sydney Metro West Eastern Creek Precast Facilities – Review of Environmental Factors (Sydney Metro, 2020) and supporting documentation, including:

- Appendix B – Noise and Vibration Technical Paper (SLR, 2020)
- Appendix C – Traffic and Transport Assessment (Jacobs, 2020)
- Appendix D – Landscape and Visual Impact Assessment (Iris, 2020)
- Appendix E – Statement of Heritage Impact (Artefact, 2020)
- Appendix F – Archaeological Survey Report (Artefact, 2020)
- Appendix G – Hydrology and Flooding Technical Paper (Jacobs, 2020)
- Appendix H – Preliminary Site Contamination Investigation (Jacobs, 2020)
- Appendix I – Biodiversity Assessment Report (Jacobs, 2020)
- Appendix J – Bushfire Risk Assessment (Blackash Bushfire Consulting, 2020).

# 7 Glossary

| Term | Definitions |
|---|---|
| amended proposal (the) | The construction and operation of two separate, adjacent precast facilities, the northern and southern precast facilities, including boiler, aggregate bins and consumables, hardstand/laydown areas, offices, parking, pre-cast carousel including batch plant, sheds, and basins for on-site water management. |
| amended proposal site (the) | Site located at Lenore Drive opposite Old Wallgrove Road, Eastern Creek (including area for proposed basins) as shown in Figure 0-1. |
| AEP | annual exceedance probability |
| AMRD | Archaeological Methodology and Research Design |
| APZs | Asset protection zones |
| ARI | average recurrence interval |
| BC Act | *Biodiversity Conservation Act 2016* |
| dBA | decibel |
| EP&A Act | *(NSW) Environmental Planning and Assessment Act 1979* |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* |
| $LA_{eq(15minute)}$ | The 'energy average noise level' considered over a 15-minute period. This parameter is used to assess potential construction noise impacts. |
| NCA | noise catchment area |
| NML | noise management level |
| Northern precast site | Site of the proposed precast facility at the north of the proposal site with an approximate area of 8 ha |
| OEMP | Operational Environmental Management Plan |
| PAD | Potential Archaeological Deposit |

| Term | Definitions |
|---|---|
| PCTs | Plant Community Types |
| PMF | Probable maximum flood level |
| proponent (the) | Sydney Metro |
| proposal (the) | The construction and operation of two separate, adjacent precast facilities, the northern and southern precast facilities, including boiler, aggregate bins and consumables, hardstand/laydown areas, offices, parking, pre-cast carousel including batch plant, and sheds. |
| proposal site (the) | Site located at Lenore Drive opposite Old Wallgrove Road, Eastern Creek |
| RAP | Remedial Action Plan |
| REF | Review of Environmental Factors |
| REF ASR | Aboriginal Survey Report submitted with the exhibited REF |
| REF BAR | Biodiversity Assessment Report submitted with the exhibited REF |
| REF SoHI | Statement of Heritage Impact submitted with the exhibited REF |
| TECs | Threatened Ecological Communities |
| WSEA SEPP | *State Environmental Planning Policy (Western Sydney Employment Area) 2009* |
| WoNS | Weeds of National Significance |

# Appendix A  Addendum Statement of Heritage Impact

# Sydney Metro West
# Eastern Creek
# Precast Facilities

## Addendum Statement of Heritage Impact

Report to Sydney Metro

Blacktown LGA

February 2021

artefact

Artefact Heritage
ABN 73 144 973 526
Level 4, Building B
35 Saunders Street
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au

## Document history and status

| Revision | Date issued | Reviewed by | Approved by | Date approved | Review type | Revision type |
|---|---|---|---|---|---|---|
| 1 | 18 December 2020 | Josh Symons | Josh Symons | 18 December 2020 | First draft | First draft |
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| Final | 23 February 2021 | Josh Symons | Josh Symons | 23 February 2021 | Final | Final |

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| **Author:** | Jessica Horton |
| **Project manager:** | Alyce Haast |
| **Name of organisation:** | Artefact Heritage Services Pty Ltd |
| **Name of project:** | Sydney Metro West Eastern Creek Precast Facilities |
| **Name of document:** | Sydney Metro West Eastern Creek Precast Facilities – SoHI |
| **Document version:** | Final |

# CONTENTS

# FIGURES

# TABLES

# 1.0 INTRODUCTION

## 1.1 Proposal background

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The proposal is in Eastern Creek within the Blacktown City Council local government area. The proposal would be located on Lenore Drive, Eastern Creek (the proposal site). The precast facilities, which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other.

Sydney Metro, a NSW Government agency, is the proponent and a determining authority for this proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979*.

A Review of Environmental Factors (REF) was prepared to describe the proposal, document potential impacts of the proposal on the environment and detail the management and mitigation measures to be implemented. A Statement of Heritage Impact (SoHI) was carried out to support the exhibited REF (exhibited SoHI). The exhibited REF (and exhibited SoHI) was publicly exhibited from 16 November 2020 to 4 December 2020 to allow stakeholders, including members of the public, to provide input to the project assessment and determination process.

The precast facilities do not form part of the Sydney Metro West Critical State Significant Infrastructure planning application (SSI-10038), which would be assessed and determined separately.

## 1.2 Proposed amendments to the proposal

The proposal design as described in Chapter 5 of the exhibited REF included the provision of water management infrastructure such as rainwater tanks to capture rainwater from sheds, appropriate onsite stormwater and flood detention facilities, and a water recycling facility. Since the exhibition of the REF, further hydraulic assessment and drainage modelling have been carried out to inform the detailed design process for the management of surface water and stormwater runoff across the amended proposal site. This assessment has identified the need for two basins required to be located outside of the proposal site due to their size and the direction of fall across the proposal site.

The proposed basins would both be located to the north of the northern precast site and would require amendment to the proposal site boundary (the amended proposal site). The locations of the basins, and the amended proposal site boundary are shown on Figure 1 and Figure 2. An Addendum to the exhibited REF has been prepared to document the amendments to the proposal and any changes in the potential impacts. A full description of the amended proposal is provided in Section 2 of the Addendum Report.

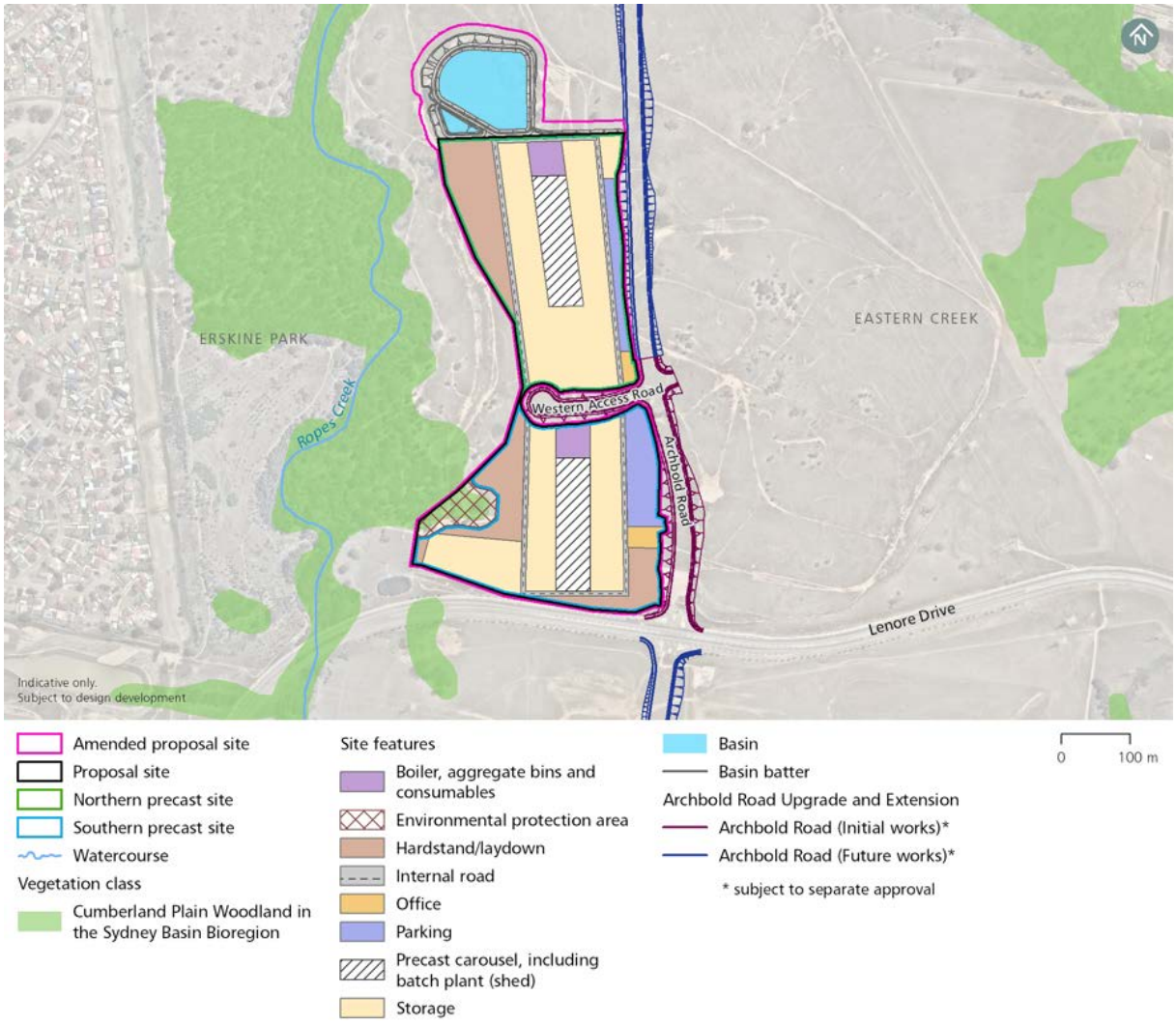


**Figure 1: The amended proposal site layout**

## 1.3 Purpose of this report

This Addendum SoHI is one of a number of technical papers that form part of the Addendum Report. The purpose of this Addendum SoHI is to identify and assess the changes to or additional impacts as a result of the proposed amendments to the exhibited proposal in relation to non-Aboriginal heritage.

The addendum report helps fulfil the requirements of Section 5.6 of the *Environmental Planning and Assessment Act 1979*; namely that Sydney Metro examines and takes into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposed activity.

The legislative and policy framework for this additional assessment is as described in the exhibited SoHI.

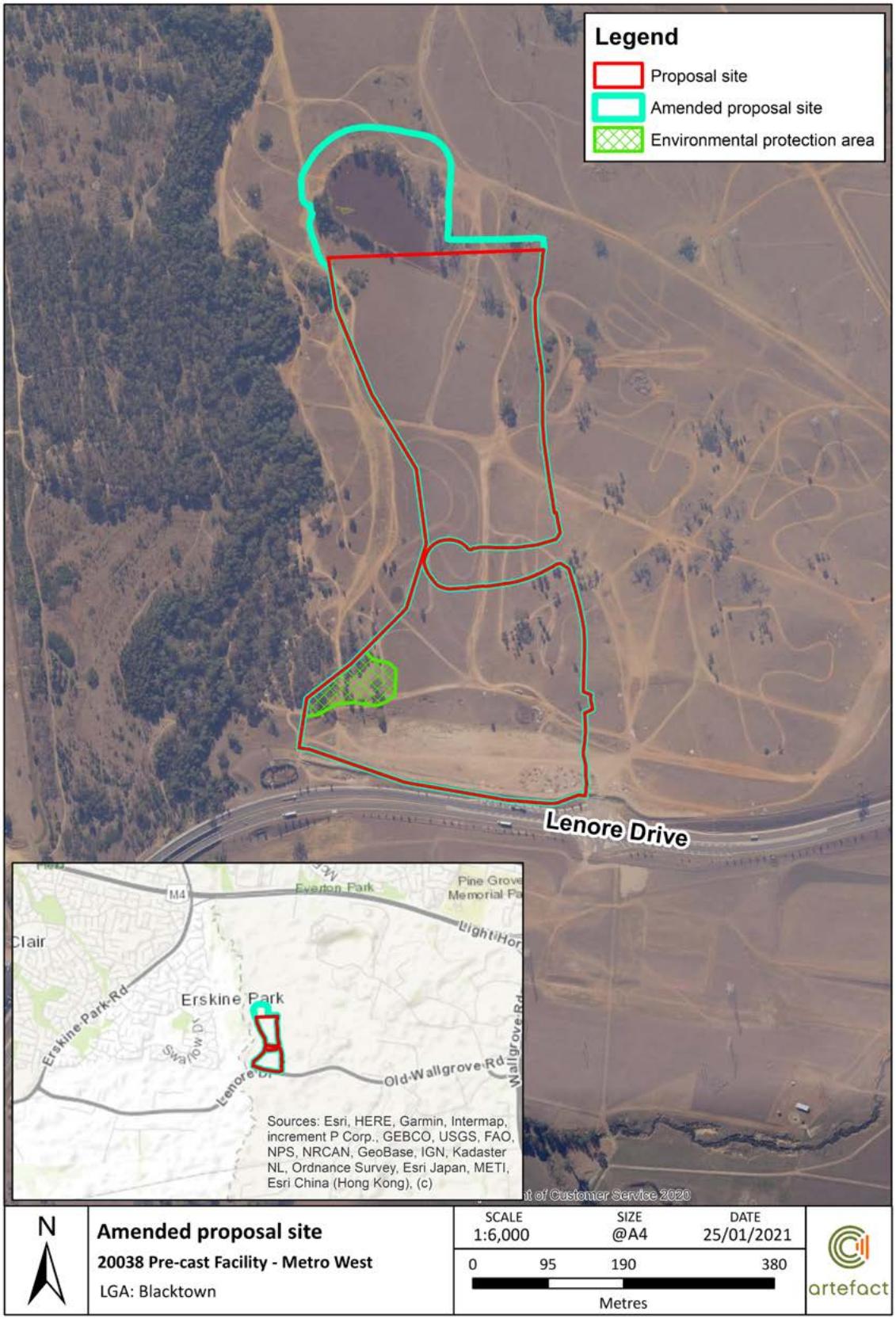


**Figure 2: Amended proposal site**

## 1.4 Authorship

This report was prepared by Jessica Horton (Heritage Consultant), Alyce Haast (Senior Heritage Consultant) and Jenny Winnett (Principal). Management input and review was provided by Josh Symons (Principal) and Sandra Wallace (Director).

# 2.0 ASSESSMENT METHODOLOGY

## 2.1 Identification of heritage listed items

A heritage register search was carried out on 8 April 2020. A search of the following State and Commonwealth statutory registers was undertaken, including:

- World Heritage List
- Commonwealth Heritage List
- National Heritage List
- State Heritage Register
- Blacktown Local Environment Plan 2015
- Section 170 Heritage and Conservation Registers for Sydney Water, Roads and Maritime, RailCorp, Department of Health, NSW Police Service
- NSW State Heritage Inventory database.

No listed heritage items are located within or in the vicinity of the amended proposal site.

A search of nominated heritage places for the World Heritage List, National Heritage List and Commonwealth Heritage List was undertaken on 8 December 2020. No nominated heritage places or items are located within or in the vicinity of the amended proposal site.

## 2.2 Site inspection

A site inspection of the amended proposal site was undertaken on 9 December 2020 to identify potential unlisted heritage items and identify evidence of archaeological remains. The inspections were undertaken on foot, using physical maps and GPS. Photographs were taken to record different aspects of the site including vegetation, levels of disturbance and any areas of archaeological sensitivity.

A summary of the site inspection is provided in Section 3.0.

## 2.3 Significance assessments

### 2.3.1 NSW heritage assessment criteria

Cultural significance is defined in Article 1.2 of the *Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013* (Burra Charter) (ICOMOS (Australia), 2013) as meaning "aesthetic, historic, scientific, social or spiritual value for past, present or future generations". Cultural significance may be derived from a place's fabric, association with a person or event, or for its research potential. The significance of a place is not fixed for all time, and what is of significance to us now may change as similar sites are located, more historical research is undertaken, and community tastes change.

If an item meets one of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have heritage significance. The significance of an item or potential archaeological site can then be assessed as being of local or state significance. If archaeological remains do not reach the local or state significance threshold, then it is not classified as a relic under the *Heritage Act 1977*.

The overall aim of assessing archaeological significance is to identify whether the archaeological remains, deposit, site or feature is of cultural value. The assessment will result in a succinct statement of heritage significance that summarises the values of the place, site, resource, deposit or feature.

The heritage significance assessment criteria were taken into consideration during the preparation of the non-Aboriginal heritage impact assessment for the proposal.

Where identified, each listed or unlisted potential heritage item, or potential archaeological remain is assessed against the seven criteria outlined in Table 1.

**Table 1: NSW heritage assessment criteria**

| Criteria | Description |
|---|---|
| **A – Historical significance** | An item is important in the course or pattern of the local area or states cultural or natural history. |
| **B – Associative significance** | An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area's or State's cultural or natural history. |
| **C – Aesthetic significance** | An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area or state. |
| **D – Social significance** | An item has strong or special association with a particular community or cultural group in the local area or state for social, cultural or spiritual reasons. |
| **E – Research potential** | An item has potential to yield information that will contribute to an understanding of the local area's or State's cultural or natural history. |
| **F – Rarity** | An item possesses uncommon, rare or endangered aspects of the local area's or State's cultural or natural history. |
| **G - Representativeness** | An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places of cultural or natural environments (or the cultural or natural history of the local area or state). |

## 2.4 Heritage impact assessment

This heritage impact assessment has been prepared using the *Statement of Heritage Impact* (NSW Heritage Office 2002) guideline, contained within the *NSW Heritage Manual.*

Impacts on heritage significance are identified as either:

- Physical impacts, resulting in the demolition or alteration of fabric of heritage significance or significant archaeological remains
- Visual impacts, resulting in changes to the setting or curtilage of heritage items or places, historic streetscapes and landscapes, visual amenity or views
- Impacts from vibration, subsidence, architectural noise treatment and demolition of adjoining structures.

Refer to Section 3.5 of the exhibited SoHI for further detail on assessing the magnitude of heritage impacts.

## 2.5 Non-Aboriginal archaeological assessment

An overview approach to the identification of potential archaeological remains has been adopted in this Addendum SoHI. Historical archaeological potential is defined as the potential of a site to contain significant archaeological remains, including works or relics as identified in the *Heritage Act 1977*. The assessment of historical archaeological potential is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) may have impacted on archaeological evidence for these former land uses. Knowledge of previous archaeological investigations, understanding of the types of archaeological remains likely to be associated with various land uses, and the results of site inspection are also taken into consideration when evaluating the potential of an area to contain archaeological remains.

### 2.5.1 Assessment of archaeological potential

Non-Aboriginal archaeological potential is defined as the potential of a site to contain historical archaeological 'relics', as classified under the *Heritage Act 1977*.

The potential for the survival of archaeological relics in a particular place is significantly affected by activities which may have caused ground disturbance. These processes include the physical development of the site (for example, phases of building construction) and the activities that occurred there. The likelihood for the survival of these relics (i.e. their archaeological potential) is distinct from the archaeological/heritage significance of these remains, should any exist. For example, there may be 'low potential' for certain relics to survive, but if they do, they may be assessed as being of State significance.

Identification of the potential historical archaeological remains of the amended proposal site is based on the review and understanding of its land use and development (site formation processes) through historical research and evaluating whether subsequent actions (either natural or human) may have impacted on evidence of former land use phases.

The grades of archaeological potential are outlined below in Table 2.

**Table 2: Grades of archaeological potential[1]**

| Grading | Justification |
|---|---|
| **Nil** | No evidence of historical development or use, or where previous impacts such as deep basement structures would have removed all archaeological potential |
| **Low** | Research indicates little or low intensity historical development, or where there have been substantial previous impacts, disturbance and truncation in locations where some archaeological remains such as deep subsurface features may survive |
| **Moderate** | Analysis demonstrates known historical development and some previous impacts, but it is likely that archaeological remains survive with some localised truncation and disturbance |
| **High** | Evidence of multiple phases of historical development and structures with minimal or localised twentieth century development impacts, and it is likely the archaeological remains would be largely intact. |

[1] Heritage Division, 2009. *Assessing Significance for Historical Archaeological Sites and Relics.*

### 2.5.2 Research potential and archaeological significance

Archaeological assessments of significance presented here are preliminary in nature and based on the potential archaeological remains present within the amended proposal site. Where potential archaeological remains have been identified the archaeological significance of the remains has been assessed against the NSW Heritage Assessment Criteria. The assessment is informed by the NSW Heritage Division (now Heritage NSW) *Assessing Significance for Historical Archaeological Sites and Relics* (NSW Heritage Division 2009).

Heritage significance in NSW is assessed using the Heritage Council of NSW's seven specific criteria based on the principles of the Burra Charter.

In 1984, Bickford and Sullivan examined the concept and assessment of archaeological research potential; that is, the extent to which archaeological remains can address research questions. They developed three questions which can be used to assess the research potential of an archaeological site:

- Can the site contribute knowledge that no other resource can?
- Can the site contribute knowledge that no other site can?
- Is this knowledge relevant to:
    - General questions about human history?
    - Other substantive questions relating to Australian history?
    - Other major research questions?

See Section 3.6.2 of the exhibited SoHI for further information on assessing research potential and archaeological significance.

### 2.5.3 Archaeological 'works' versus 'relics'

The *Heritage Act 1977* provides protection for archaeological remains through the operation of the 'relics' provisions. The primary aim of an archaeological significance assessment is to identify whether the archaeological remains, deposit, site or feature is of cultural value and therefore, considered to be a 'relic'.[2] Historical archaeological sites typically contain a range of different elements as vestiges and remnants of the past. Such sites will include 'relics' of significance in the form of deposits, artefacts, objects and usually also other material evidence from demolished buildings, works or former structures which provide evidence of prior occupations but may not be 'relics'.[3]

The *Heritage Act 1977* places 'works' in a separate category to archaeological 'relics'. 'Works' are typically remnants of historical structures that are considered to be items of environmental heritage but are not associated with artefact bearing material. Impacts to a 'work' do not require approval from the NSW Heritage Council or its delegate.

[2] Office of Environment and Heritage (OEH), Heritage Division, 2009. Assessing Significance for Archaeological Sites and 'Relics', p. 4
[3] Office of Environment and Heritage (OEH), Heritage Division, 2009. *Assessing Significance for Archaeological Sites and 'Relics'*, p. 7.

# 3.0 AMENDED HISTORICAL CONTEXT

A detailed historical context for the proposal site is included in the exhibited SoHI. Additional historical context relevant to the northern part of the amended proposal site is outlined below.

Historical development in the vicinity of the northern part of amended proposal site was limited to a number of rural properties, with the amended proposal site used for open paddocks and crop fields (Figure 4 to Figure 13). As depicted in the below figures, no significant structures are noted within the northern part of the amended proposal site from the 1950s, though two modern structures can be seen in the 2004 and 2007 aerial imagery, and some fence lines may be present. The large dam in the northern part of the amended proposal site is present in the c1960 aerial imagery.

A shed and yard complex is visible directly north-east and partially within the amended proposal site within these aerials. This shed structure appears to have been demolished by 2007 (Figure 12). The north-eastern corner of the amended proposal site is located within paddocks associated with the shed and yard complex (Figure 14). Visible remains of the shed and yard complex were identified on the site inspection undertaken by Artefact Heritage on 18 June 2020.

The Chatsworth Estate can be seen to the north, and partially within, the amended proposal site in historical aerial imagery dating from 1947 (Figure 4 to Figure 5, and Figure 16 to Figure 22). The Estate comprised the homestead and a number of outbuildings. Aerial imagery would indicate that a number of these outbuildings and a fence line were located within the amended proposal site, these structures appear to have been largely demolished by 2007. Visible remains of the Chatsworth Estate were identified on the site inspection undertaken by Artefact Heritage on 9 December 2020 as discussed in Section 4.1.

Previous heritage assessments of the shed and yard complex and the Chatsworth Estate are discussed below in Section 3.1.

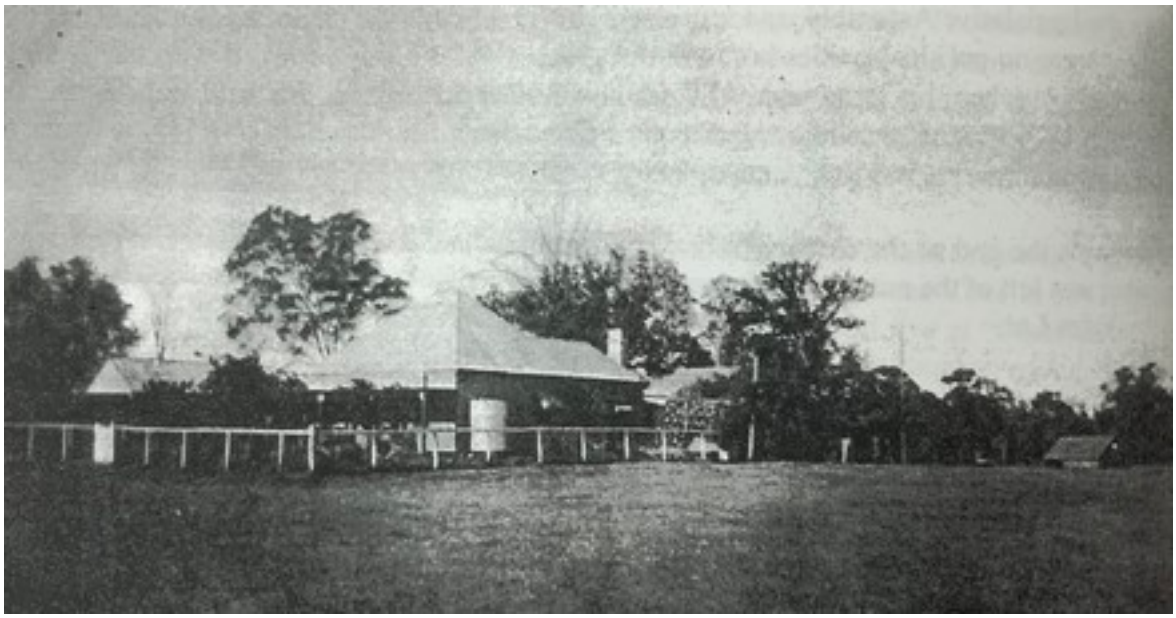

**Figure 3: An undated view of the Chatsworth homestead. Source: Nicolaidis 2000 p. 46**

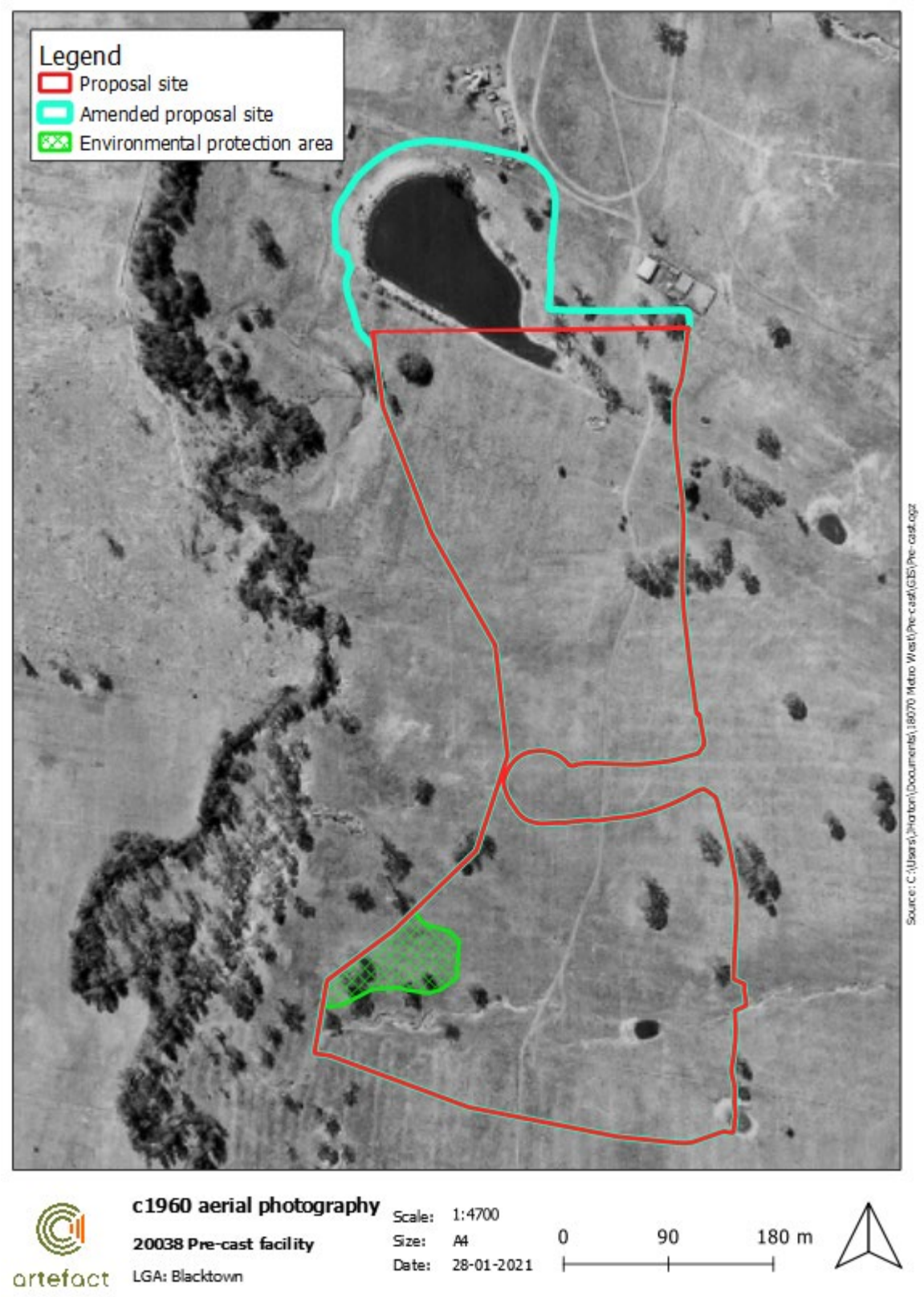


**Figure 4: c1960s aerial imagery depicting the amended proposal site and surrounding landscape, Source: NSW Department of Finance, Services and Innovation**

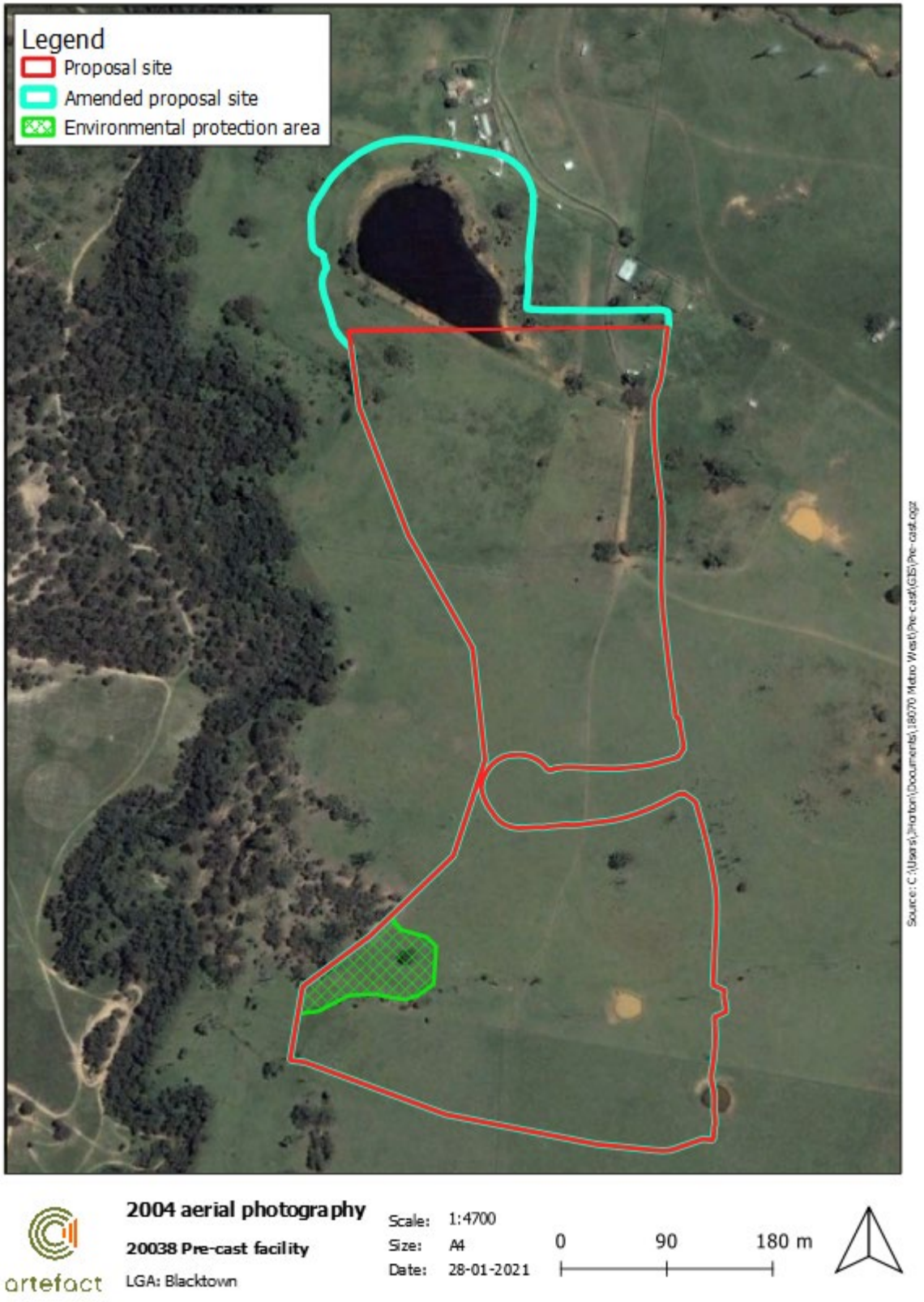


**Figure 5: 2004 aerial imagery. Note structure to the north-east of the amended proposal site and structures to the north of the amended proposal site boundary (outlined in red). Source: Google Earth**

## 3.1 Relevant heritage assessments

The following section provides a concise summary of relevant heritage assessments as they relate to the amended proposal site. Detailed information is provided for studies which cover the previously unassessed portion of the amended proposal site. A more detailed summary of relevant heritage assessments is provided in Section 4.5 of the exhibited SoHI.

**Navin Officer Heritage Consultants, 2006. *Historic Site EPRCH5: Cultural Heritage Assessment.* Report to FDC Building Services Pty Ltd.**

In 2005, Navin Officer Heritage Consultants undertook a cultural heritage assessment for the Erskine Park Employment Area, Ropes Creek, Western Sydney. The assessment identified the remains of a wooden slab hut with sandstock brick chimney, approximately 400 metres south west of the amended proposal site.

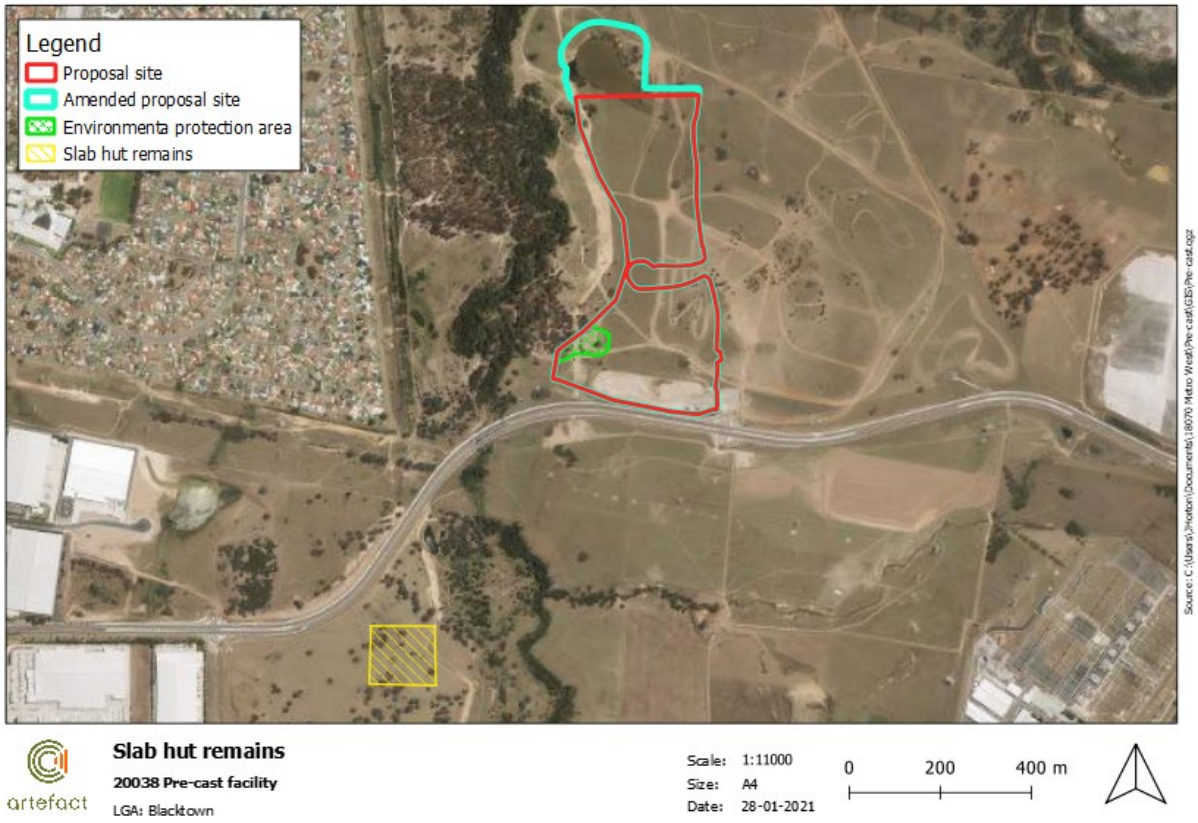


**Figure 6: Slab hut remains as identified by Navin Officer Heritage Consultants, 2006.**

**Artefact Heritage, 2016. *Archbold Road: SoHI.* Report to Parsons Brinkerhoff.**

Artefact Heritage prepared a SoHI for the upgrade and southern extension of Archbold Road between the Great Western Highway, Minchinbury and to the Southern Link Road, Eastern Creek. A portion of the assessment area falls within the amended proposal site. The assessment found that the area was associated with the early nineteenth century estates of William Cox, John Thomas Campbell and Henry Kable. It has typically been associated with pastoralism and horticulture, including orchards of the Chatsworth Estate during the mid-nineteenth century. By the late twentieth century, the area had become highly urbanised and industrialised.

The SoHI identified an area within the amended proposal site with potential to contain archaeological remains of a shed and yard complex on land originally belonging to the former Chatsworth Estate.

However, historical resources and imagery indicate that the yards were developed post-1900, and the shed was constructed between 1950 and 1960. This would indicate that these remains would not have been associated with the development of Chatsworth Estate; rather twentieth century development. The paddocks and the well/cistern associated with these remains are partially located within the amended proposal site, in the north-east corner (Figure 14).

In addition, the SoHI noted that the location of Chatsworth House was likely to be located between Ropes Creek and the shed and yard complex, outside the amended proposal site.

The development of the shed and yard complex is detailed within Figure 8 to Figure 14. The yard areas are visible within the c1950s aerial imagery (Figure 8), however, the shed does not appear until the c1960s (Figure 9). The complex appears to have been utilised throughout the late twentieth and into the twenty-first century, with the shed demolished c2007 (Figure 12).

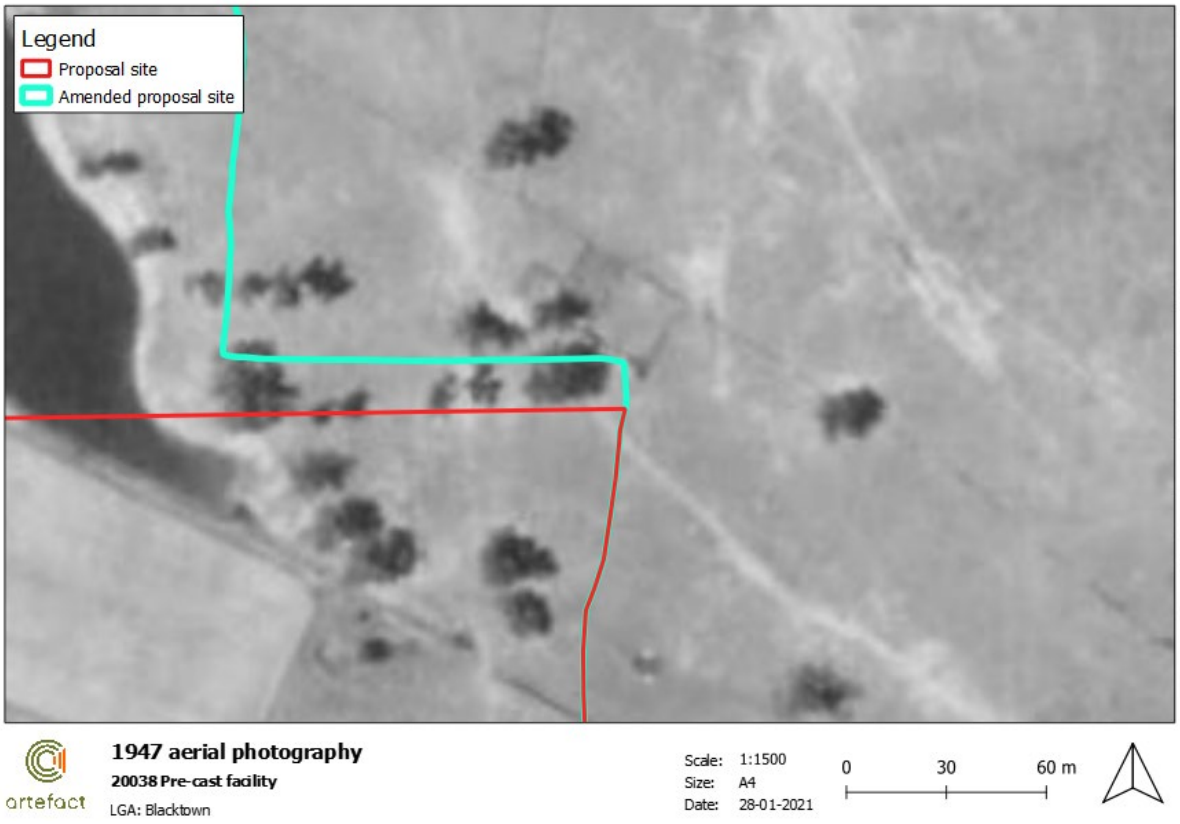


**Figure 7: Detail of shed and yard complex to the north-east of the amended proposal site on 1947 aerial imagery**

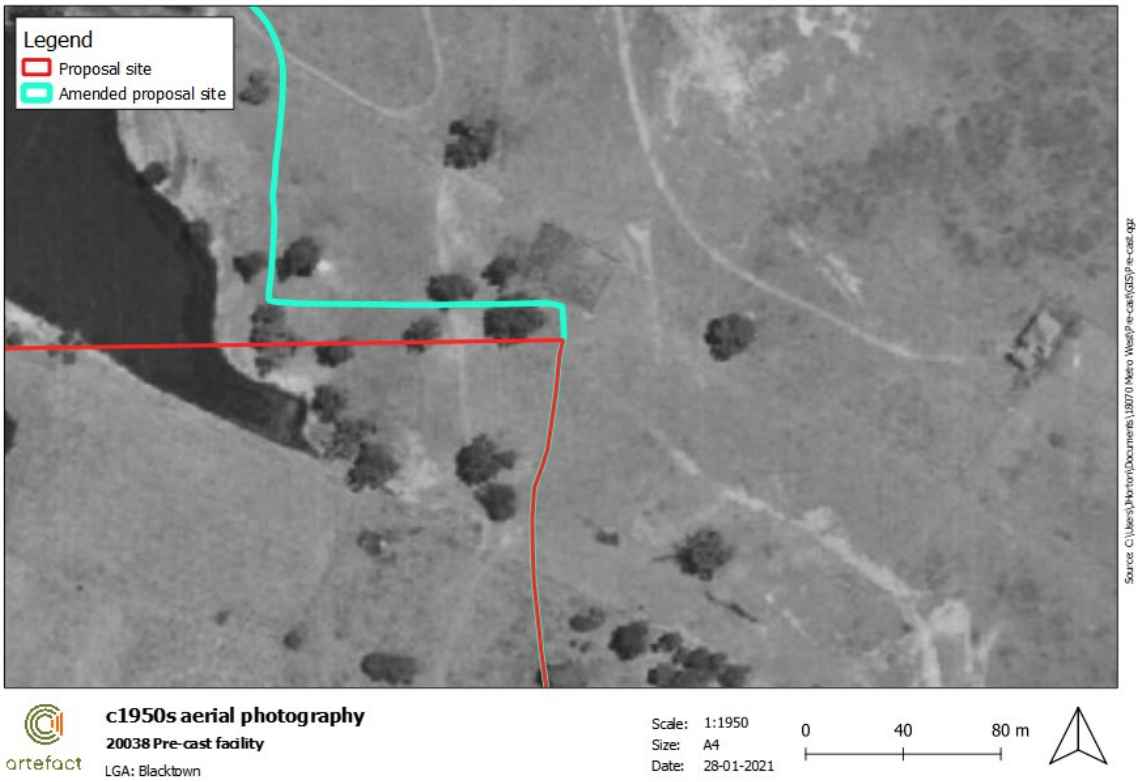


**Figure 8: Detail of shed and yard complex to the north-east of the amended proposal site on c1950s aerial imagery**


**Figure 9: Detail of shed and yard complex to the north-east of the amended proposal site on c1960s aerial imagery**

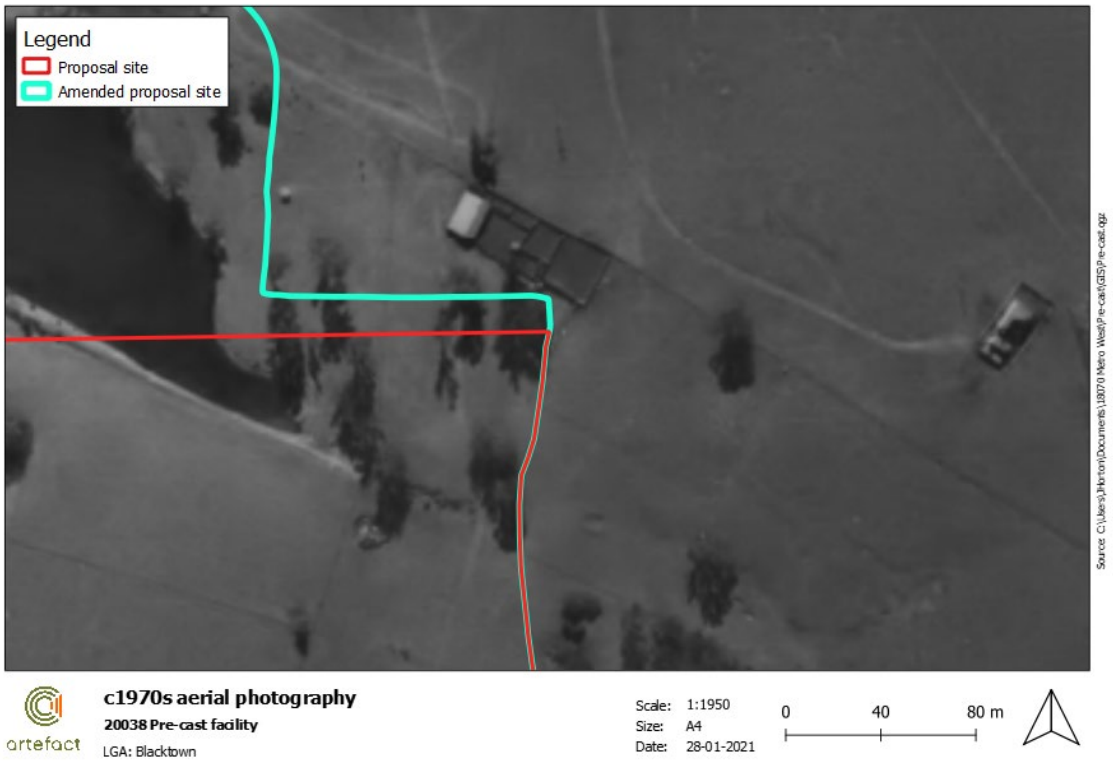


**Figure 10: Detail of shed and yard complex to the north-east of the amended proposal site on c1970s aerial imagery**


**Figure 11: Detail of shed and yard complex to the north-east of the amended proposal site, 2004 aerial imagery**


**Figure 12: Detail of shed and yard complex to the north-east of the amended proposal site, note demolitions, 2007 aerial imagery. Source: Google Earth**

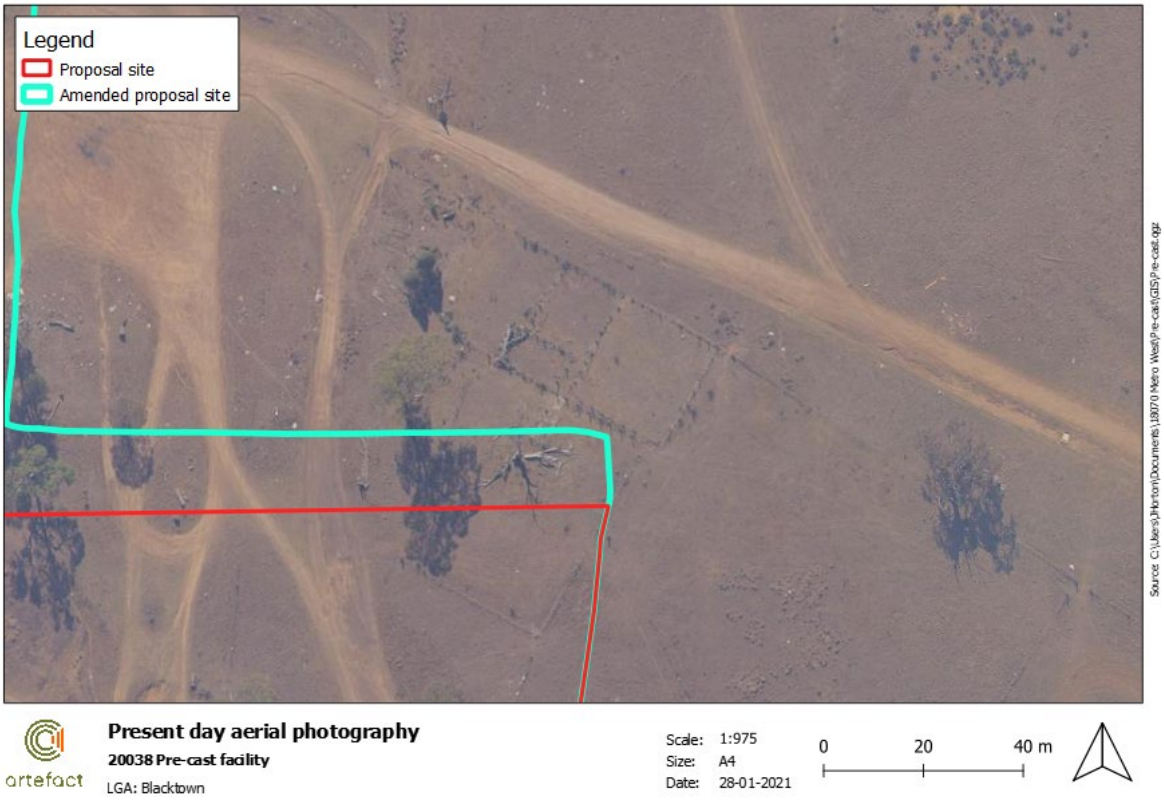


**Figure 13: Detail of shed and yard complex to the north-east of the amended proposal site, present-day aerial imagery. Source: Google Earth**

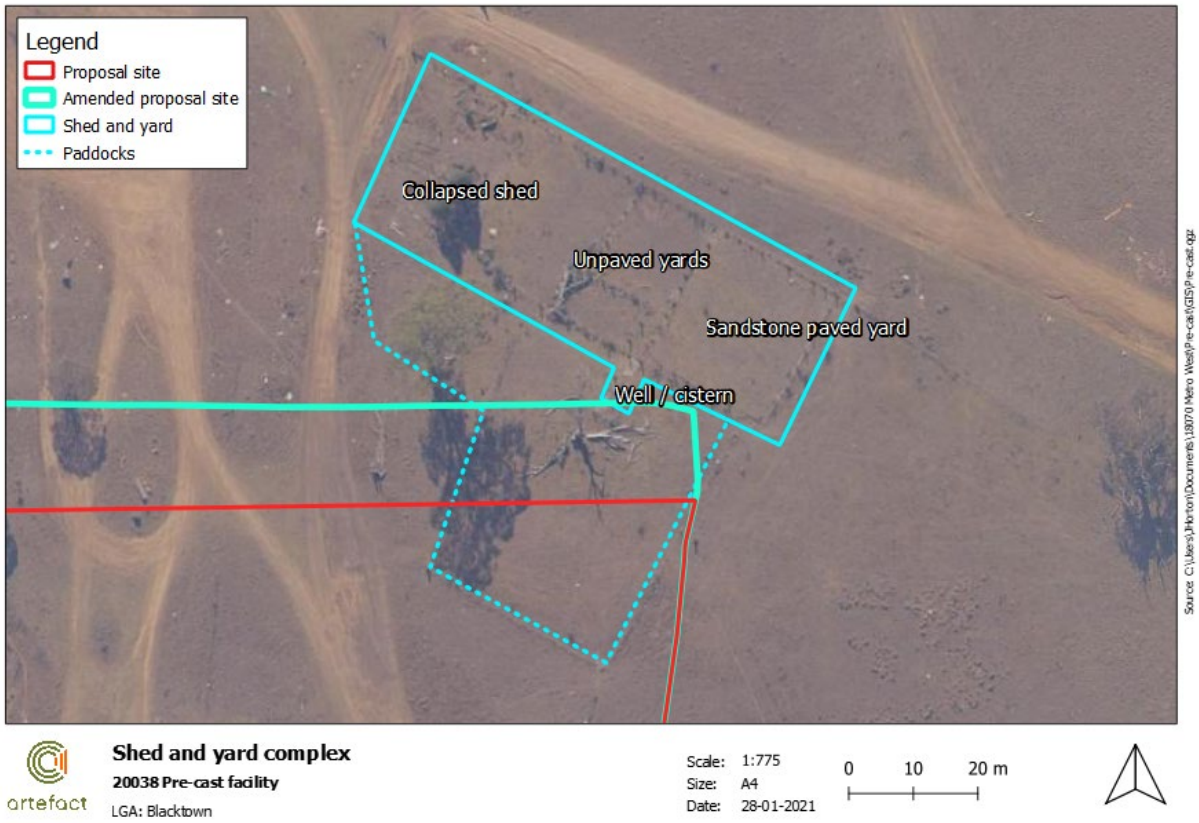


**Figure 14: Present day aerial imagery showing remains of former shed and yard complex, Note amended proposal site within associated paddock area**

**Ecological, 2016. *Lot 10 DP 1157491, Eastern Creek, NSW: Aboriginal and Historical Heritage Study.* Report to Department of Planning and Environment.**

Ecological were commissioned to prepare a Historical and Aboriginal Heritage Study to inform a Development Control Plan for Lot 10 DP1157491 at Eastern Creek, NSW which includes the amended proposal site. The report found that the area contained high potential for the survival of archaeological remains relating to the occupation and development of the Chatsworth homestead site over time (Figure 15). This resource was assessed as having local significance for association with the Chatsworth nursery and the Shepherd family.

The Chatsworth homestead is likely to have been the earliest building on the Chatsworth Estate, located outside the amended proposal site. A number of other buildings were associated with the homestead including stables, outbuildings, sheds, fenced yards and a garden. As seen in Figure 16 to Figure 22, a number of these structures were located within the amended proposal site, however they appear to have largely been demolished by 2007, and completely demolished by 2013.

Today, a few structural beams and some corrugated iron relating to the machine shed is still standing, and several concrete slabs indicate the location of later buildings as seen on the site visit conducted by Artefact Heritage on 9 December 2020 and discussed in Section 4.1, however, these appear to be located outside of the amended proposal site. There were likely to have been a number of other structures associated with the house that are not visible in aerial imagery and below ground features such as cess pits, rubbish pits and wells that have survived the demolition process.

The other historical archaeological areas identified by Ecological, including the shed and yard complex discussed above, were not considered to reach the threshold for local significance. These items are common on rural properties and were all constructed around or after 1900.

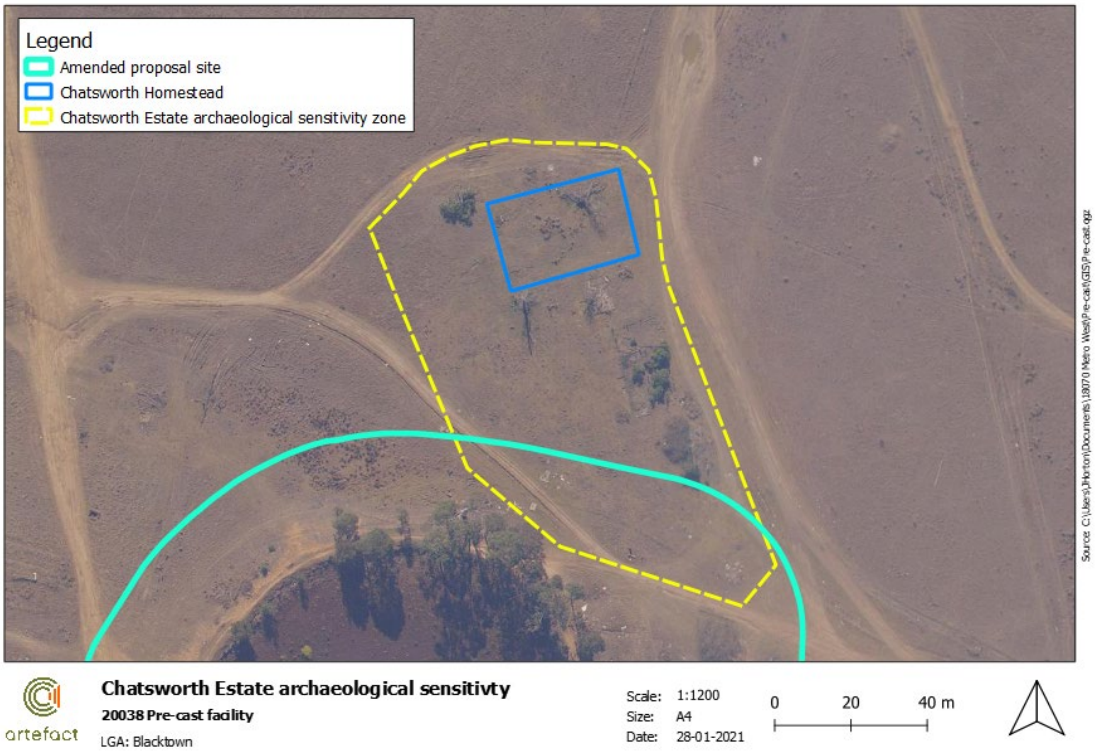


**Figure 15: Chatsworth Estate archaeological sensitivity map identified by Ecological**


**Figure 16: Detail of Chatsworth Estate to the north of the amended proposal site on 1947 aerial imagery**


**Figure 17: Detail of Chatsworth Estate to the north of the amended proposal site on c1960s aerial imagery**


**Figure 18: Detail of Chatsworth Estate to the north of the amended proposal site on c1970s aerial imagery**


**Figure 19: Detail of Chatsworth Estate to the north of the amended proposal site on c1980s aerial imagery**


**Figure 20: Detail of Chatsworth Estate to the north of the amended proposal site on 2004 aerial imagery**


**Figure 21: Detail of Chatsworth Estate to the north of the amended proposal site on 2007 aerial imagery**


**Figure 22: Detail of Chatsworth Estate to the north of the amended proposal site on 2013 aerial imagery**

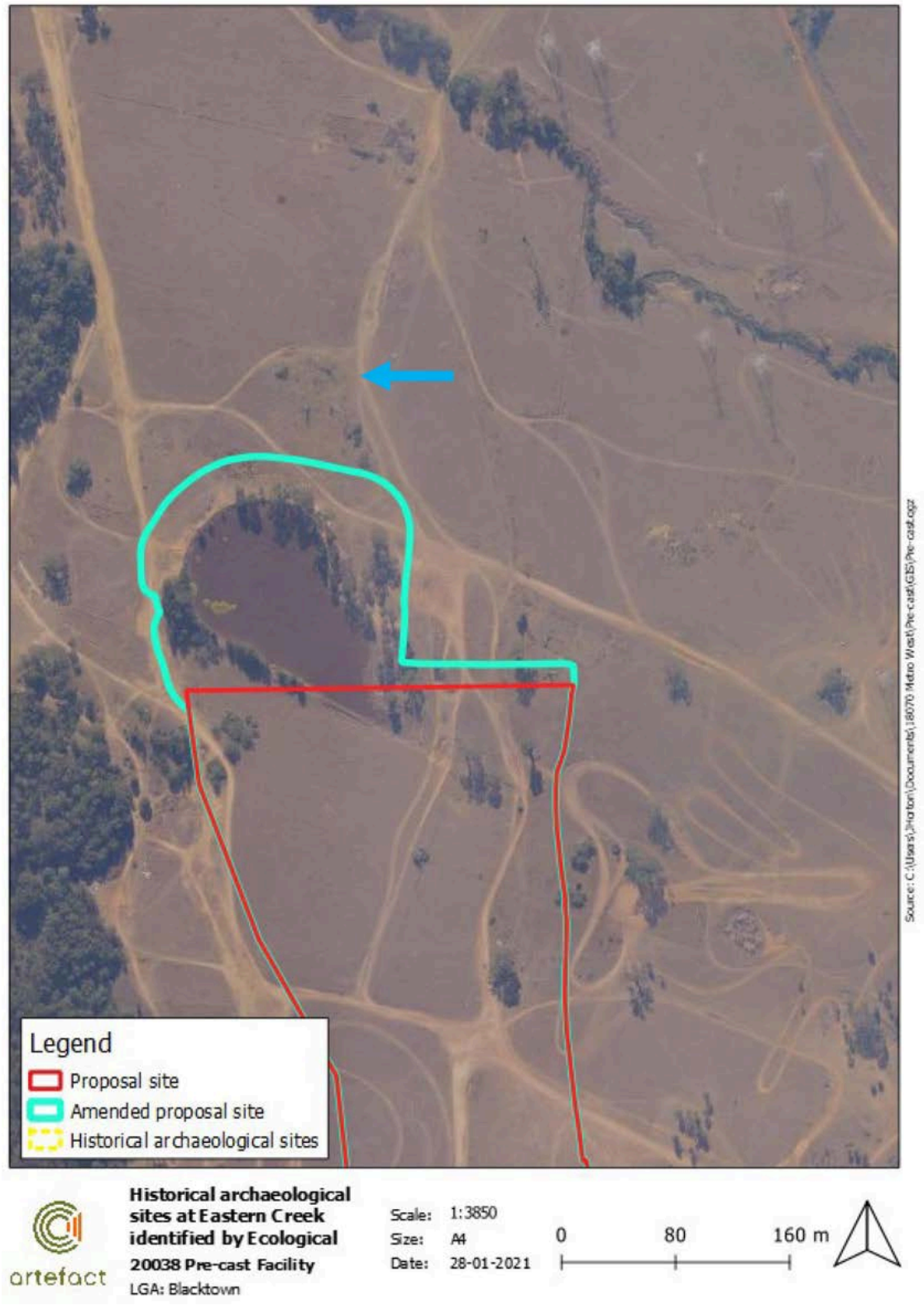


**Figure 23: Historical archaeological sites at Eastern Creek identified by Ecological. The Chatsworth homestead is located directly north of the reservoir, at the centre of the image (blue arrow)[4]**

[4] Ecological 2016, *Lot 10 DP1157491, Eastern Creek, NSW – Historical and Aboriginal Heritage Study.* p. 55.

# 4.0 EXISTING ENVIRONMENT OF THE AMENDED PROPOSAL SITE

## 4.1 Site inspection

A site inspection of the northern part of the amended proposal site was undertaken on 9 December 2020 by Jessica Horton (Heritage Consultant, Artefact Heritage) and Alyce Haast (Senior Heritage Consultant, Artefact Heritage).

There is no change to the existing environment of the proposal site as described in the exhibited SoHI. The amended proposal site includes an additional area of land to the north of the proposal site. This portion of the amended proposal site is characterised by open grassed paddock interspersed with vegetation, and a large dam. A number of dirt tracks extend throughout the amended proposal site; however, vegetation and grass has also grown over a number of these tracks.

Visible archaeological remains associated with the shed and yard complex discussed in Section 3.1 were encountered within the north-east corner of the amended proposal site including: a sandstone paved yard surface feature, sandstone edging, several former fence lines and a concrete structure (Figure 28 to Figure 31). Surface remains of the cistern/well in the form of a circular concrete and metal surface were encountered, these remains were partially covered by vegetation (Figure 30).

The sandstone paved yard feature included hand cut sandstone blocks which have been roughly paved across the yard structure. Based on the rough nature of these sandstone blocks it is considered likely that these features may have been re-used as part of construction of the yard feature. An additional fenced yard was located to the north-west of the sandstone paved feature with no evidence of sandstone or other formalisation of the surface identified. The two yard features were separate from the remainder of the paddock area by consistent and relatively closely spaced rectangular wooden fence posts. Minimal remains associated with the shed structure were noted with small pieces of corrugated iron noted in the north-western portion of the structure.

Additional remains to the south of the yard structures include a concrete pad feature which measures approximately 10 metres x 3 metres. The concrete feature is comprised of three sections, including a central rounded portion which dips slightly into the centre of the feature. The central portion included portions of brick lining which appeared to extend to some depth into the ground surface.

Both the yard features and shed feature are located outside of amended proposal site. Portions of the shed and yard complex within the amended proposal site were limited to a paddock fence line which was comprised of a mixture of star pickets and circular wooden fence posts. As discussed in Section 3.1, the amended proposal site enters the former Chatsworth Estate. Historical aerial imagery indicates that a number of outbuildings would have stood within the amended proposal site. Archaeological remains of the Chatsworth estate (Figure 32 to Figure 33) were encountered on the site visit undertaken on 9 December 2020; however, these remains are located outside of the amended proposal site (north) and will not be impacted by the amended proposal. Surface remains were not encountered within the amended proposal site, however extensive vegetation may have shielded these potential remains, and further remains may be present underground.

Figure 24: Dam, dirt tracks and vegetation within the northern part of the amended proposal site. Artefact Heritage, 2020.

Figure 25: Dam and vegetation within the northern part of the amended proposal site. Artefact Heritage, 2020.

Figure 26: Dam within northern part of the amended proposal site. Artefact Heritage, 2020.

Figure 27: Dam with raised embankment within the northern part of the amended proposal site. Artefact Heritage, 2020.

Figure 28: Sandstone paved yard surface north-east of the proposal site. Artefact Heritage, 2020.

Figure 29: Former fence line north-east of the proposal site. Artefact Heritage, 2020.

**Figure 30: Remains of the cistern/well within the amended proposal site. Artefact Heritage, 2020.**

**Figure 31: Raised sandstone paddock boundary north-east of the proposal site. Artefact Heritage, 2020.**

**Figure 32: Remains of the Chatsworth Homestead, to the north of the amended proposal site. Artefact Heritage, 2020.**

**Figure 33: Remains of the Chatsworth Homestead, to the north of the amended proposal site. Artefact Heritage, 2020.**

# 5.0 ARCHAEOLOGICAL ASSESSMENT

The archaeological potential of each land use phase has been assessed utilising the methods and criteria identified in Section 2.5.1 and Table 2.

## 5.1 Archaeological assessment

Based on historic plans and aerials, and after analysis of potential archaeological features within the landscape, it has been determined that the amended proposal site is partially located within the Mount Philo/Chatsworth Estate. This area was identified by Ecological in 2016 as being an 'archaeologically sensitive zone' (see Figure 17). The following assessment of archaeological potential has been divided into the following historical phases and is illustrated in Figure 34:

- Phase 1 – Ownership by John Thomas Campbell and Charles Roberts (c1819 – 1856)
    - There are no records of any significant developments taking place within the amended proposal site during this phase
    - There is no evidence of any structures being located within the amended proposal site during this phase
- Phase 2 – Thomas Shepherd's Chatsworth Estate and nursery (1856 – 1909)
    - Archaeological remains of the former Chatsworth homestead are likely to be preserved approximately 60m north-east (outside) the amended proposal site
    - Historic aerials and site inspection identified that outbuildings and yards had been established within the amended proposal site by 1947, although construction dates are unclear
    - Historical descriptions of the amended proposal site during this phase note that much of the amended proposal site retained heavy bushland up to the 1890s
- Phase 3 – Ownership by Thomas Baker (1909 – mid-1950s) and general grazing activity (mid-1950s to present).
    - Thomas Baker undertook farming and grazing on the property up until 1955
    - Extant remains associated with a shed and yard complex identified during a site inspection undertaken by Artefact Heritage included the remnants of three yards, a collapsed shed, two circular well / cistern structures, a concrete pad and reused sandstone block floor.

**Table 3: Assessment of archaeological potential for the amended proposal site**

| Historical phase | Known activity | Potential archaeological remains | Archaeological potential |
|---|---|---|---|
| 1 | General land clearance, low intensity pastoral / agricultural uses | • Postholes demonstrating the location of former fencelines<br>• Tree boles | Nil |

| Historical phase | Known activity | Potential archaeological remains | Archaeological potential |
|---|---|---|---|
| 2 | Chatsworth homestead[5] | • Evidence of Chatsworth homestead (brick and stone footings, postholes and flooring) | Nil |
| 2 | Chatsworth outbuildings | • Decommissioned wells, tanks or cisterns containing artefact bearing deposits<br>• Rubbish pits/bottle dumps containing artefacts bearing deposits<br>• Evidence of outbuildings (brick and stone footings, postholes and flooring associated with sheds and outbuildings)<br>• Evidence of landscaping (such as stone or brick retaining walls, edging, hard surfaces indicating former pathways, stone flagging)<br>• Former yard surfaces and areas of hardstand<br>• Postholes associated with ephemeral structures such as coops, stalls, stables, stock yard fencing | Moderate |
| 2 | Chatsworth Nursery | • Evidence of landscape modification (retaining walls, irrigation trenches, cultivation terraces, introduced soils)<br>• Undocumented outbuildings (brick and stone footings, postholes and flooring associated with sheds and outbuildings)<br>• Archaeobotanical evidence of former crops/ornamentals<br>• Water management structures (drains, wells, tanks)<br>• Postholes indicating former property boundaries/landscape division | Low |
| 3 | Farm buildings and yards | • Outbuildings (brick, concrete and stone footings, postholes and flooring associated with sheds and outbuildings)<br>• Areas of hard stand, concrete slabs<br>• Water management structures (drains, wells, tanks, dams)<br>• Postholes indicating former property boundaries/landscape division. | High |

[5] Note: The Chatsworth Homestead is located outside the amended proposal site.

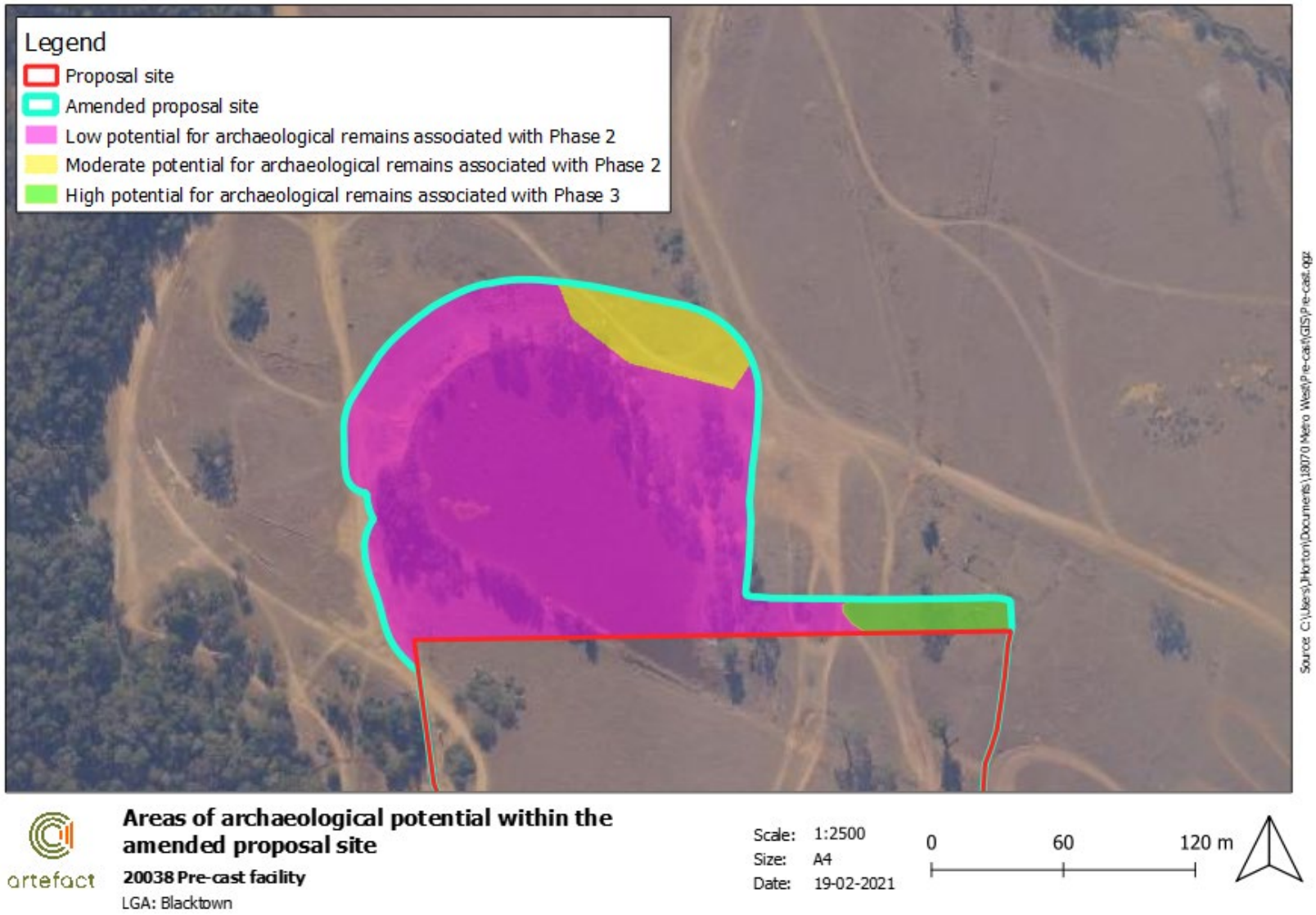


**Figure 34: Areas of historical archaeological potential relating within the northern part of the amended proposal site**

## 5.2 Assessment of archaeological significance

### 5.2.1 NSW Heritage Significance Criteria

The methodology for this assessment of archaeological significance has been outlined in Section 2.0.

The significance assessment for the archaeological potential of the potential significant archaeological remains has been supplemented by, and amended where necessary, from the *Lot 10 DP 1157491, Eastern Creek, NSW: Aboriginal and Historical Heritage Study* prepared by Ecological in 2016 (Table 4).

**Table 4: Heritage significance of the amended proposal site potential archaeological remains**

| Criteria | Description |
|---|---|
| **A – Historical Significance** | The amended proposal site is located within the original Mount Philo Estate (later known as the Chatsworth Estate), one of the earliest land grants in the area. The Shepherd family occupied and developed the site from the 1850s and the land was an important and well known nursery for over 50 years. The Chatsworth homestead was occupied by only two families for 100 years and remained the main house on the property up until its demolition c2006.<br><br>The amended proposal site is within an area originally containing outbuildings associated with the operation of the estate. These buildings were associated with the day to day functioning of the nursery and farm. Archaeological evidence of these structures may provide insight into the layout and function of these undocumented farm buildings.<br><br>This portion of the amended proposal site also has the potential to contain an artefactual resource within refuse deposits dumped and/or accumulated within undocumented structures (wells, tanks, cisterns) and rubbish pits/bottle dumps. An intact artefact deposit has the potential to provide information on the preferences and tastes of former occupants and contribute to our understanding of the day to day lives of the Shepherd and Baker families and their servants/workers.<br><br>**Intact archaeological remains associated with Phase 2 of the development of the Chatsworth Estate has the potential to reach the local significance threshold under this criterion.** |
| **B – Associative Significance** | The potential archaeological remains within the amended proposal site may be associated with the Chatsworth Nursery, a prominent early horticultural enterprise. The Shepherd family, David Shepherd in particular, made a significant contribution to the development of horticulture and the nursery industry in NSW.<br><br>The amended proposal site has the potential to contain an artefactual resource within refuse deposits dumped and/or accumulated within undocumented structures (wells, tanks, cisterns) and rubbish pits/bottle dumps. An intact artefact deposit has the potential provide information on the preferences and tastes of former occupants and contribute to our understanding of the day to day lives of the Shepherd and Baker families and their servants/workers.<br><br>Archaeological remains relating to the occupation and activities of the Shepherd family on the site would be of local associative significance.<br><br>It is unlikely that the shed and yard complex archaeological remains would contain remains directly associated with these land owners.<br><br>**Intact archaeological remains associated with Phase 2 of the development of the Chatsworth Estate and Chatsworth Nursery has the potential to reach the local significance threshold under this criterion.** |

| Criteria | Description |
|---|---|
| **C – Aesthetic Significance** | Although it is recognised that exposed in situ archaeological remains may have distinctive/attractive qualities, only rarely are these considered 'important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW'.<br><br>**The potential archaeological remains for Phase 2 and 3 do not meet the local significance threshold for this criterion.** |
| **D – Social Significance** | The archaeological remains may be of interest to those that are concerned with local history and horticulture, however the site is unlikely to demonstrate a strong association with community or cultural groups. Community consultation was not undertaken for this assessment. It is unlikely the remains would have social significance as their whereabouts are not well known to the public.<br><br>**The potential archaeological remains do not meet the local significance threshold for this criterion.** |
| **E – Research Potential** | Potential archaeological remains associated with outbuildings associated with the Chatsworth Estate and nursery have the potential to yield information relating to mid-19th century vernacular construction techniques and agricultural practices.<br><br>Evidence of domestic activities and the personal preferences of the occupants of the site may also be present in the form of deposits within rubbish pits and decommissioned structures such as wells and cisterns. Such have the potential to contain large numbers of artefacts, such artefacts can provide information on discard practises during the life of the structure and backfill following disuse. Should intact artefact-bearing deposits be identified within the amended proposal site, their analysis may provide data which can contribute to our understanding of the life-ways, preferences, socio-economic standing, gender and ethnicity of the occupants and employees of the site. Such information is not available from documentary sources.<br><br>The former fenced paddocks within the amended proposal site, associated with the shed and yard complex, would have been constructed post-1900 as grazing activities were limited at the site prior to this time. Although there is potential for the archaeological remains to provide information on former pastoral practices within the region, it is unlikely to provide information not available from any other source and is unlikely to reach the local significance threshold under this criterion.<br><br>**Intact archaeological remains associated with Phase 2 of the development of the Chatsworth Estate and nursery has the potential to reach the local significance threshold under this criterion.** |
| **F – Rarity** | Archaeological sites associated with vernacular homesteads, stables, stock yards and sheds on the outskirts of Sydney or in rural NSW are not rare. The potential archaeological remains is not considered rare as there are many similar archaeological sites in rural NSW.<br><br>**The potential archaeological remains do not meet the local significance threshold for this criterion.** |
| **G - Representativeness** | The potential archaeological remains are unlikely to demonstrate any particular characteristics of NSW's cultural or natural places of cultural or natural environments or for the local area.<br><br>**The potential archaeological remains do not meet the local significance threshold for this criterion.** |

### 5.2.2 Preliminary Statement of Significance

The amended proposal site has a historical association with the Shepherd family who lived on and developed the site from the 1850s. The land was an important and well known nursery for over 50 years and the homestead was the residence of only two families for a period of 100 years.

The amended proposal site has been assessed as having low to moderate potential to contain locally significant archaeological remains associated with Phase 2 - the Chatsworth Estate and Chatsworth Nursery (see Figure 35). Potential remains may include evidence of undocumented agricultural outbuildings, landscaping and water management. Should remains of this type survive intact and remain in situ, they may reach the local significance threshold for its associative and historical significance. These remains, however, are unlikely to demonstrate social or aesthetic significance. The potential archaeological remains are unlikely to be considered rare, however intact archaeological remains may contain research potential associated with the lifeways of the Chatsworth family and early 19th century construction techniques. Should an intact and legible archaeological remains associated with Chatsworth Estate and nursery or the Shepherd family be identified within the amended proposal site, the remains may reach the local significance threshold under NSW Heritage Criteria A, B and E for their association with individuals and groups of local historical importance.

Potential archaeological remains associated with Phase 3 (i.e. 20th century rural structures) are likely to be present within the amended proposal site. However, these remains are not expected to reach the threshold for local significance, as they do not fulfil the heritage significance criteria as outlined in Table 4.

## 5.3 Summary of archaeological potential and significance

The amended proposal site has moderate potential to contain archaeological remains associated with the development of Thomas Shepherd's Chatsworth Estate and nursery (1856 – 1909/historical Phase 2) in the form of structural evidence associated with former outbuildings, working yard surfaces and landscaping.

In general, the study area has limited potential to contain archaeological remains associated directly with residential occupation of the Chatsworth Estate with analysis of available sources indicating that the main homestead complex was located approximately 60 metres north-east of the amended proposal site.

The exception to this is the potential for the amended proposal site to contain rubbish pits and/or bottle dumps, or decommissioned wells or tanks/cisterns containing household refuse. An *in situ* primary refuse deposit has the potential to provide information regarding the lives of the former inhabitants of the estate. Refuse deposits often contain significant amounts of artefacts that, when analysed, can provide evidence of socio-economic status, consumption habits, preferences and occupations of former inhabitants.

Should intact artefact-bearing deposits associated with Phase 2 be identified within the amended proposal site they may be directly associated with the Shepherd family and/or the workers on the estate. Artefacts from such contexts would have archaeological research potential at a local level and be considered 'relics' as defined by the relics provisions of the *Heritage Act 1977*.

Evidence of later 20th century agricultural use of the study area may be present as concrete and brick footings and slabs (historical Phase 3). Remains of this type would be typical of within a rural agricultural context for the period and are unlikely to reach the local significance threshold or be considered 'relics' under the *Heritage Act 1977*.

A summary of archaeological potential and significance of potential remains is outlined in Table 5 and illustrated in Figure 35.

**Table 5: Summary of archaeological potential and significance**

| Phase | Potential remains | Significance | Potential | Considered Relics under the Heritage Act 1977 |
|---|---|---|---|---|
| **1** | General land clearance, low intensity pastoral / agricultural uses | N/A | Nil | N/A |
| **2** | Chatsworth homestead | Local | Nil | N/A |
| | Chatsworth outbuildings[6] | Local | Moderate | Yes, if associated with artefact bearing deposits |
| | Chatsworth Nursery | Local | Low | Yes, if associated with artefact bearing deposits |
| **3** | Farm buildings and yards | Nil | High | No |

[6] Note: The Chatsworth Homestead is located outside the amended proposal site.


**Figure 35: Areas of historical archaeological potential with the potential to meet the local significance threshold within the northern part of the amended proposal site**

# 6.0 HERITAGE IMPACT ASSESSMENT

## 6.1 Heritage impact assessment

The proposed works would comprise the construction and operation of two precast facilities to support tunnelling for Sydney Metro West. There are no heritage listed items in or within the vicinity of the amended proposal site, therefore there would be neutral physical and visual impacts to listed items. Impacts to listed items associated with vibration or settlement would also be neutral.

## 6.2 Archaeological impact assessment

The amended proposal site overlaps with the outbuildings of the former Chatsworth Estate (Phase 2), paddocks and well/cistern associated with a former shed and yard complex in the north-eastern corner of the amended proposal site (Phase 3), as well as a small rubbish dump. The Chatsworth Estate is associated with the nineteenth century rural development (Phase 2) of the area and is considered to be of local significance. Potential archaeological remains associated the shed and yard complex (Phase 3) are not expected to reach the threshold for local significance.

The remainder of the amended proposal site has been assessed as having nil to low potential for archaeological remains. Potential archaeological remains which may be identified across the remainder of the amended proposal site are not expected to reach the threshold for local significance. Non-Aboriginal archaeological impacts have moderate potential to occur within the northernmost portion of the amended proposal site with the construction of two basins. There is low potential for non-Aboriginal archaeological impacts to occur within the remainder of the amended proposal site as a result of the amended proposal.

## 6.3 Statement of heritage impact

There are no listed or unlisted items of heritage significance identified within or within the vicinity of the amended proposal site and consequently no physical or visual impacts to heritage items are anticipated.

The amended proposal site has been assessed as having moderate potential to contain intact archaeological remains associated with the development of the Chatsworth Estate and nursery (Phase 2), and high potential to contain archaeological evidence of former agricultural buildings associated with Phase 3.

Should intact archaeological remains of Phase 2 be identified, these would reach the local significance threshold. Should intact artefact bearing deposits associated with Phase 2 be identified, these would be considered to be locally significant archaeological 'relics' and protected under the relics provision of the *Heritage Act 1977*. The current assessment has identified that all other remains within the amended proposal site are unlikely to meet the threshold for local significance.

A statement of heritage impact has been prepared in accordance with the model provided in the NSW Heritage Council guidelines which delineates a statement of heritage impact into three key component questions[7] in Table 6.[8]

[7] NSW Heritage Division, *Statements of Heritage Impact.* Accessed online https://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf

[8] The guidelines also provide examples of further assessment questions which may be appropriate in relation to modification to existing identified Heritage items. As no heritage listed items or unlisted items of local significance were identified within the proposal site, further consideration of these questions is not required.

**Table 6: Statement of heritage impact for the proposal**

| Development | Discussion |
|---|---|
| What aspects of the proposal respect or enhance the heritage significance of the amended proposal site? | The amended proposal site is situated in a location which avoids locally significant structural remains associated with the former Chatsworth homestead to the north.<br><br>No heritage items have been identified as subject to visual impacts associated with the amended proposal. |
| What aspects of the proposal could have a detrimental impact on the heritage significance of the amended proposal site? | The proposed excavation works associated with the proposed drainage basins and batter in the northern part of the amended proposal site have moderate potential to have a physical impact on locally significant archaeological remains, as outlined in Section 5.0; and potential 'relics' in the form of artefact bearing deposits, associated with the development of the Chatsworth Estate and nursery (Phase 2).<br><br>No listed heritage items have been identified within the amended proposal site. |
| Have more sympathetic options been considered and discounted? | The proposed excavation works associated with the proposed drainage basins and batter in the northern part of the amended proposal site have moderate potential to have a physical impact on locally significant archaeological remains within the northern part of the amended proposal site, as outlined in Section 5.0<br><br>However, these impacts are limited to remains associated with the Chatsworth nursery and outbuildings associated with the Chatsworth Estate. Remains associated with the locally significant Chatsworth homestead are located directly north of the amended proposal site and would be avoided. |

# 7.0 CONCLUSIONS AND RECOMMENDATIONS

## 7.1 Conclusions

It was found that:

- There are no listed items of heritage significance identified within or near the amended proposal site. As such, the proposal would not impact any listed heritage item
- If identified, intact archaeological remains of Phase 2 are expected to reach the threshold for local significance, and would be subject to physical impacts by the amended proposal
- The potential for archaeological remains associated with Phase 3 identified within the north-east corner of the amended proposal site are expected to be subject to physical impacts by the amended proposal, however these remains are not expected to reach the threshold for local significance.

The remainder of the amended proposal site has been assessed as having nil to low potential for twentieth century (Phase 3) archaeological remains.

## 7.2 Recommendations

Construction impacts on heritage should be minimised and managed. The following measures, in addition to those identified within the exhibited SoHI, would be implemented to reduce and avoid impacts to potential archaeological remains within the amended proposal site.

**Table 7: Mitigation measures**

| Mitigation measure | Description |
|---|---|
| **Archaeological monitoring and s140 Excavation Permit** | Excavation works would aim to avoid the area of moderate potential for locally significant archaeological relics associated with the Chatsworth Estate where possible.<br><br>Should excavation works in this area be unavoidable, a program of archaeological monitoring would be implemented If necessary, a s140 Excavation Permit granted under section 141 of the *Heritage Act 1977* would be obtained from Heritage NSW prior to the commencement of excavation works |
| **Archaeological Methodology and Research Design** | Any application for an Excavation Permit under the *Heritage Act 1977* would be accompanied by an Archaeological Methodology and Research Design (AMRD). The AMRD would outline the archaeological potential and significance of the area to be impacted and assess the impact of the proposed excavation works on those resources. The AMRD would provide appropriate methodologies for investigation, protection and/or avoidance of archaeological remains. |

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artefact

Artefact Heritage

ABN 73 144 973 526
Level 4, Building B
35 Saunders Street
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au
www.artefact.net.au

# Appendix B  Addendum Archaeological Survey Report

# Sydney Metro West Eastern Creek Precast Facilities

Addendum Archaeological Survey Report

Report to Sydney Metro

Blacktown LGA

February 2021

artefact

Artefact Heritage
ABN 73 144 973 526
Suite 56, Jones Bay Wharf
26-32 Pirrama Road
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au

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# CONTENTS

# FIGURES

# TABLES

# 1.0 INTRODUCTION

## 1.1 Project background

Sydney Metro is proposing to construct and operate two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The proposal is in Eastern Creek within the Blacktown City Council local government area. The proposal would be located on Lenore Drive, Eastern Creek (the proposal site). The precast facilities, which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other.

Sydney Metro, a NSW Government agency, is the proponent and a determining authority for this proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

A Review of Environmental Factors (REF) was prepared to describe the proposal, document potential impacts of the proposal on the environment and detail the management and mitigation measures to be implemented. An Aboriginal Archaeological Survey Report (ASR) was carried out to support the exhibited REF (exhibited ASR). The exhibited REF (and exhibited ASR) was publicly exhibited from 16 November 2020 to 4 December 2020 to allow stakeholders, including members of the public, to provide input to the project assessment and determination process.

The precast facilities do not form part of the Sydney Metro West Critical State Significant Infrastructure planning application (SSI-10038), which would be assessed and determined separately.

## 1.2 Proposed amendments to the proposal

The proposal design as described in Chapter 5 of the exhibited REF included the provision of water management infrastructure such as rainwater tanks to capture rainwater from sheds, appropriate onsite stormwater and flood detention facilities, and a water recycling facility. Since the exhibition of the REF, further hydraulic assessment and drainage modelling have been carried out to inform the detailed design process for the management of surface water and stormwater runoff across the amended proposal site. This assessment has identified the need for two basins required to be located outside of the proposal site due to their size and the direction of fall across the proposal site.

The proposed basins would both be located to the north of the northern precast site and would require amendment to the proposal site boundary (the amended proposal site). The locations of the basins, and the amended proposal site boundary are shown Figure 1 and Figure 2. An Addendum to the exhibited REF has been prepared to document the amendments to the proposal and any changes in the potential impacts. A full description of the amended proposal is provided in Section 2 of the Addendum Report.

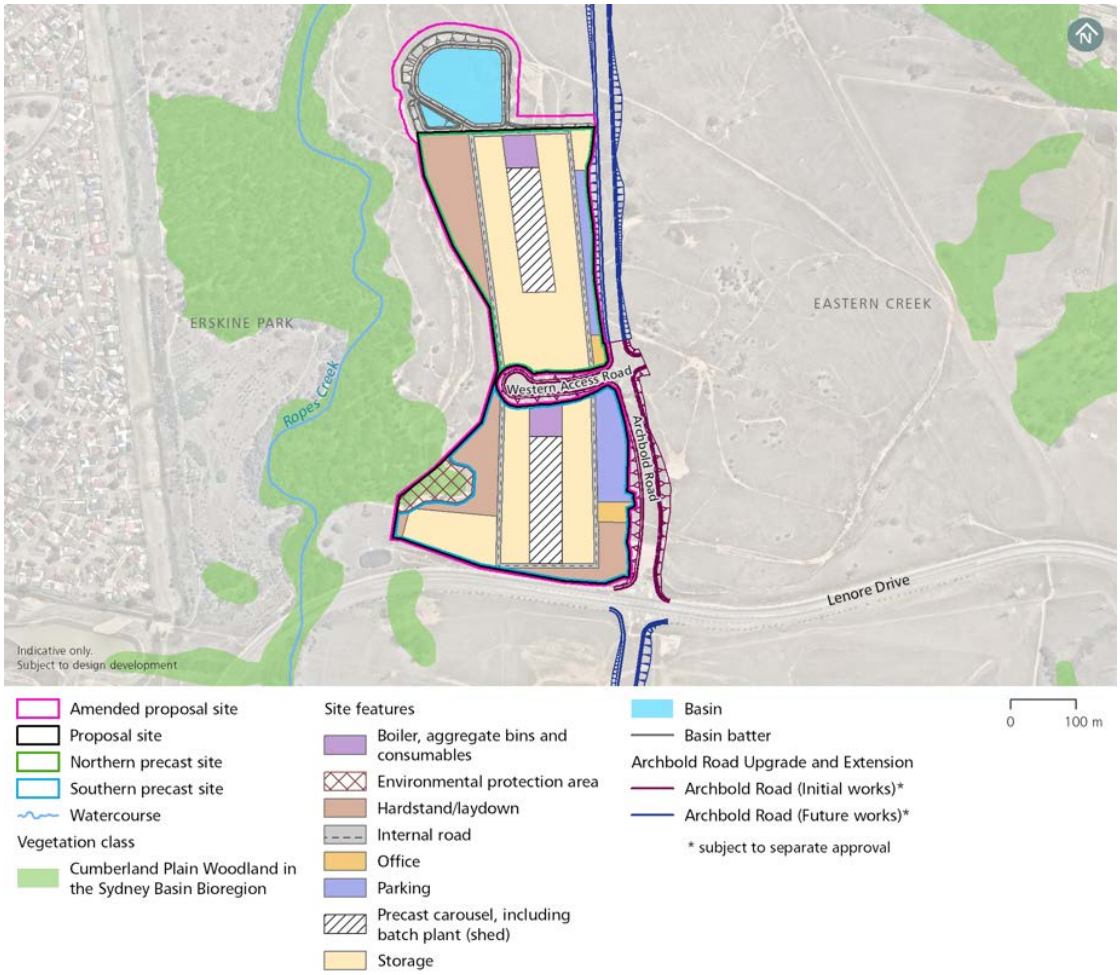


**Figure 1: The amended proposal site layout**

## 1.3 Purpose and scope of this addendum

This Addendum ASR is one of a number of technical papers that form part of the Addendum Report. The purpose of this Addendum ASR is to identify and assess the changes to or additional impacts as a result of the proposed amendments to the exhibited proposal in relation to Aboriginal heritage.

The legislative and policy framework for this additional assessment is as described in Section 1 of the Addendum Report.

Background information including legislation, environmental background and archaeological background where consistent with the exhibited ASR are not repeated in this Addendum ASR.

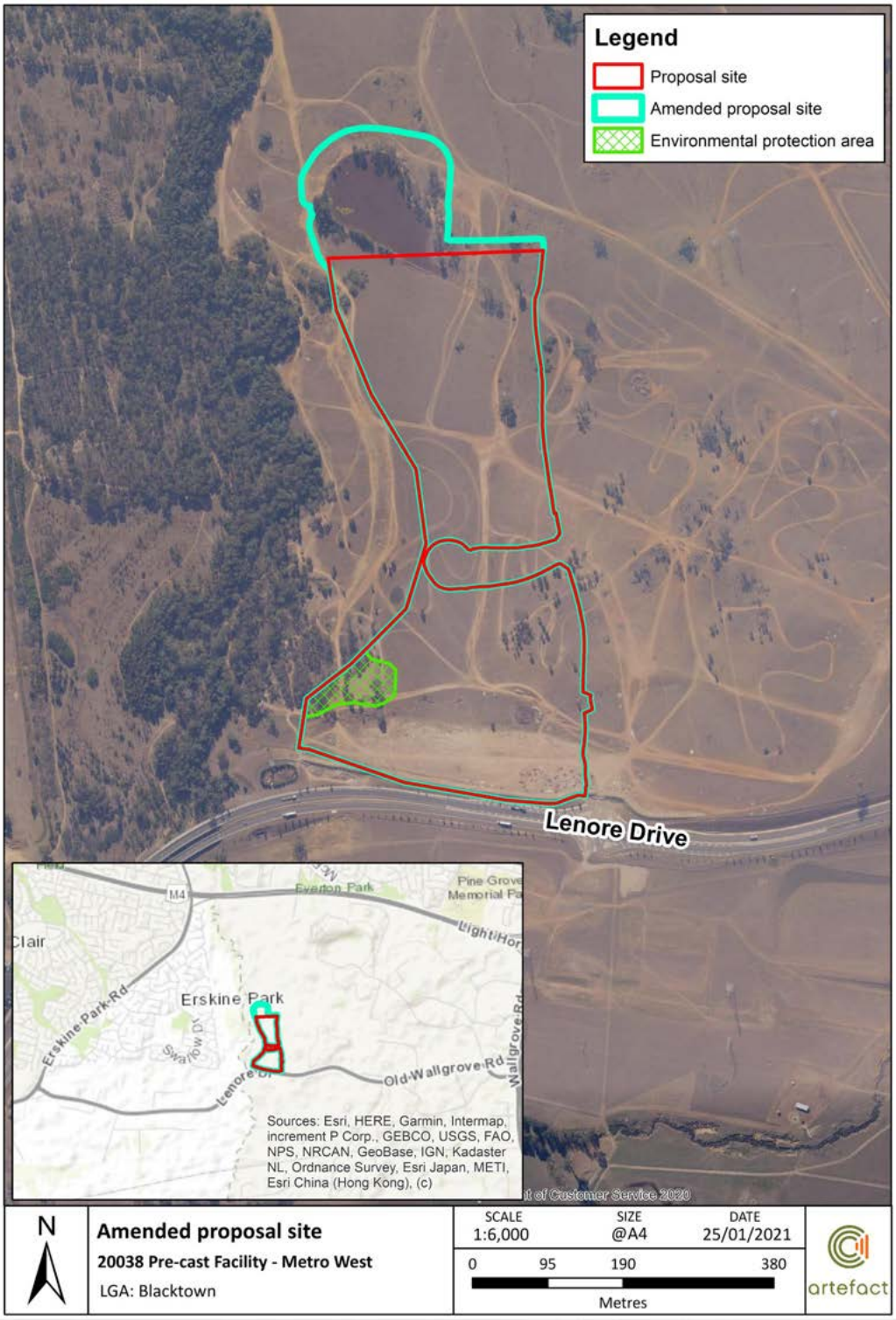


**Figure 2: Proposal site and amended proposal site**

## 1.4 Authorship

This report was prepared by Alyce Haast (Senior Heritage Consultant). Management input and review was provided by Josh Symons (Technical Director) and by Sandra Wallace (Managing Director).

# 2.0 ASSESSMENT METHODOLOGY

## 2.1 Archaeological survey

### 2.1.1 Aboriginal site definition

An Aboriginal site is generally defined as an Aboriginal object or place. An Aboriginal object refers to any deposit, object or material evidence (not being a handicraft) relating to Aboriginal habitation of the area that comprises New South Wales (Office of Environment, Climate Change and Water, 2010a: 37). Aboriginal objects may include stone tools, scarred trees or rock art. Some sites, or Aboriginal places can also be intangible and although they might not be visible, these places have cultural significance to Aboriginal people.

The Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (Office of Environment and Heritage, 2011) states in regard to the definition of a site and its boundary that one or more of the following criteria must be used when recording material traces of Aboriginal land use:

- The spatial extent of the visible objects, or direct evidence of their location
- Obvious physical boundaries where present, for example mound site and middens (if visibility is good), or a ceremonial ground
- Identification by the Aboriginal community on the basis of cultural information.

For the purposes of this Addendum ASR, an Aboriginal site, or potential Aboriginal site, was defined by recording the spatial extent of visible traces or the direct evidence of their location within the amended proposal site.

### 2.1.2 Archaeological survey methodology

#### *2.1.2.1 Timing and personnel*

Archaeological survey of the northern part of the amended proposal site not previously subject to survey was undertaken on the 9 December 2020. The survey was supervised by Alyce Haast (Senior Heritage Consultant, Artefact Heritage) with Jessica Horton (Heritage Consultant, Artefact Heritage) and Steve Randall (a representative of Deerubbin Local Aboriginal Land Council (LALC)) also in attendance.

#### *2.1.2.2 Aims*

The aims of the archaeological survey were to:

- Cover a representative sample of the amended proposal site that would potentially be impacted by the amended proposal
- Reinspect any previously registered sites
- Record any previously unidentified Aboriginal objects or sites observed during the survey
- Identify areas of Potential Archaeological Deposit (PAD) that may be present in areas that have had no or minimal disturbance
- Liaise with stakeholders present regarding the archaeological potential of the amended proposal site
- Collect information to ascertain whether further archaeological investigation is required.

#### 2.1.2.3 Methodology and coverage

The northern part of the amended proposal site generally consists of a large dam and surrounding areas of open grassland. Given the extremely limited visibility, sample survey of the northern part of the amended proposal site was undertaken on foot by a team of three, with survey focused on areas of exposure, sensitive landforms as identified through predictive modelling and the site extent of any previously registered sites.

A handheld non-differential Global Positioning System was used to track the path of the survey team and record the coordinates of survey transects as well as the location of Aboriginal sites.

A photographic record was kept during the survey. Photographs were taken to record aspects of survey units including surface exposures, vegetation, areas of surface disturbance, and any identified Aboriginal sites and areas of archaeological potential. Scales were used for photographs where appropriate as specified in the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (Department of Environment Climate Change and Water, 2010a).

Survey was delineated into one survey unit.

## 2.2 Significance assessment methodology

An assessment of the cultural heritage significance of an item or place is required in order to form the basis of its management. The *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011) provides guidelines for heritage assessment with reference to the Burra Charter (Australia ICOMOS, 2013) and the Heritage Office (2001) guidelines. The *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011) requires consideration of the following:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

Assessment of archaeological significance for each Aboriginal site within the northern part of the amended proposal site completed as part of the Addendum ASR. Assessment for previously identified sites were based on significance assessments within the AHIMS site card, observations from the exhibited REF survey and archaeological survey of the amended proposal site. Significance assessments for newly identified sites were based on site observations from the current survey in consideration of the above criteria.

## 2.3 Impact assessment methodology

The definition of harm to an object or place under the *National Parks and Wildlife Act 1974* (NPW Act) includes any act or omission that 'destroys, defaces or damages the object or place or in relation to an object – moves the object from land on which it had been situated' (Section 5 of the *National Parks and Wildlife Act 1974*).

Direct harm may occur as a result of activities which disturb the ground surface including site preparation activities, earthworks and ground excavation, and the installation of services and infrastructure.

Indirect harm for Aboriginal heritage refers to impacts that may affect sites or features located immediately beyond or within the amended proposal site. Indirect harm may include impacts from vibration, increased visitation or increased erosion, including ancillary project activities (construction and/or operation) that are not located within the amended proposal site.

Registered Aboriginal sites which are within the vicinity of the amended proposal site are comprised of artefact sites or areas of PAD. Any buried Aboriginal objects would not be subject to impacts as a result of vibration. There are no Aboriginal places in the vicinity of the amended proposal site which may be subject to indirect impacts.

The Addendum ASR considered the potential impact of the amended proposal on identified sites and areas of PAD. This is further discussed in Section 8.0.

# 3.0 ADDENDUM ENVIRONMENTAL AND ARCHAEOLOGICAL BACKGROUND

## 3.1 Environmental background

The amended proposal site includes an additional area of land to the north of the northern precast site. The existing environment of this additional area is comprised of a large dam located on a first order tributary of Ropes Creek and surrounding grassland. The amended proposal site is consistent with the environment as described in the exhibited REF.

## 3.2 Registered AHIMS sites

Based on the AHIMS search completed for the exhibited REF there are no additional AHIMS sites within the amended proposal site to those mapped and described in the exhibited REF.

The amended proposal site extends over a larger proportion of one recorded Aboriginal site, Blacktown Southwest 7 (AHIMS ID 45-5-0559), which is discussed further in Section 5.1.1.

## 3.3 Previous archaeological assessments

A summary of previous relevant archaeological assessments is summarised in Section 8.5 of the exhibited REF.

Following exhibition of the REF it is understood that archaeological test excavation in accordance with the *Code of Practice for Archaeological Investigation in NSW* (Department of Environment, Climate Change and Water, 2010a) has been undertaken across the proposal site/portions of the proposal site. This includes archaeological test excavation within the site extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) as identified in the exhibited REF.

No information on the extent of the test excavation program, methodology for test excavation, or results of test excavation was available at the time this Addendum ASR was prepared.

# 4.0 ARCHAEOLOGICAL SURVEY

## 4.1 Survey coverage

A summary of survey coverage, in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (Department of Environment, Climate Change and Water, 2010a) is outlined in Table 1 and Table 2.

**Table 1: Survey coverage summary – survey units**

| Survey unit | Survey unit area ($m^2$) | Landform | Visibility (%) | Exposure (%) | Effective coverage ($m^2$) | Effective coverage (%) |
|---|---|---|---|---|---|---|
| 1 | 28,854 | Drainage line, slope | 10 | 5 | 144.2 | 0.5 |

**Table 2: Survey coverage summary – landforms**

| Landform | Landform area ($m^2$) | Area effectively surveyed ($m^2$) | Percentage of landform effectively surveyed (%) | Number of sites |
|---|---|---|---|---|
| Drainage line | 11,486 | 57.43 | 0.5 | 0 |
| Slope | 17,368 | 86.84 | 0.5 | 3 |

## 4.2 Description of survey

The northern part of the amended proposal site encompasses a large dam (Figure 3) as well as open grassland immediately surrounding the dam (Figure 4 to Figure 6). The northern part of the amended proposal site consisted of a gently sloping landform adjacent to the Ropes Creek floodplain.

Observed landform modification within the northern part of the amended proposal site was largely related to the dam, which includes a high earthen wall constructed across a first order tributary of Ropes Creek (Figure 7). Landform modification for construction of the dam was mainly observed around its southern and western margins, where the large earthen wall is situated. The northern and eastern margins of the dam, which abut slightly elevated terrain, appeared as generally unmodified natural contexts.

Surface visibility across the northern part of the amended proposal site was generally limited by dense grass cover. Small areas of surface visibility were inspected along the top of the dam wall, as well as within existing erosion scours in the north eastern portion of the northern part of the amended proposal site.

No old growth trees were identified within the northern part of the amended proposal site.

A portion of one previously recorded AHIMS site is located within the northern part of the amended proposal site, Blacktown Southwest 7 (AHIMS ID 45-5-0559).

Three newly identified Aboriginal sites were identified within the amended proposal site, RCAS 13, RCIF 3 and RCIF 4 which are further discussed in Section 5.2.

**Figure 3: Large dam feature within northern part of the amended proposal site**

**Figure 4: Open grassland within north eastern portion of northern part of the amended proposal site**

**Figure 5: Ground exposure within northern portion of northern part of the amended proposal site**

**Figure 6: Low lying grassland within the north western portion of the northern part of the amended proposal site**

**Figure 7: Steep dam walls in western portion of the northern part of the amended proposal site**

# 5.0 RESULTS

## 5.1 Registered Aboriginal sites

### 5.1.1 Blacktown Southwest 7 (AHIMS ID 45-5-0559)

**Site type:** Artefact scatter
**Centroid:** AGD AMG84 Zone 56 299710 mE 6257100 mN
**Artefact reburial centroid:** GDA MGA94 Zone 56 297837 mE 6257330 mN

Blacktown Southwest 7 (AHIMS ID 45-5-0559) was originally recorded by Kohen in 1986 as an artefact scatter eroding out of a slope and top of a raised terrace landform. The site has been partially destroyed by Sydney Water pipeline works for the St Marys Wastewater System Augmentation Project (AHIP C0000501). Salvage excavation for that project resulted in the retrieval of 1,346 artefacts from a 25 square metre salvage area. Following salvage excavation, the artefacts were reburied within the wider site extent and within the amended proposal site.

A portion of the recorded extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) was inspected as part of archaeological survey for the exhibited REF in April 2020. Evidence of earthworks along the Sydney Water pipeline undertaken under AHIP C0000501 were observed. The April 2020 archaeological survey for the exhibited REF identified five previously unrecorded artefacts within the former boundary of AHIP C0000501. High grasses limited surface visibility across the remainder of the site extent.

During the June 2020 archaeological survey for the exhibited REF, the site extent of AHIMS ID 45-5-0559 was reassessed. Further assessment of the area identified that the raised landform associated with the original site recorded extended further to the east. Examination of areas of surface visibility suggested that visible soils within this portion of the proposal site were relatively intact. The site extent was modified to encompass the entirety of the localised raised landform context.

The recorded extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) within the northern part of the amended proposal site was subject to archaeological survey for this Addendum ASR. Portions of the site within the northern part of the amended proposal site were heavily vegetated and included regrowth vegetation located at the boundary of the large dam feature to the north of the site extent (Figure 8 to Figure 9). No additional Aboriginal objects were identified within the portion of AHIMS ID 45-5-0559 within the northern part of the amended proposal site.

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**Figure 8: High grasses within portion of Blacktown southwest 7 within the northern part of the amended proposal site**

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**Figure 9: Area of Blacktown southwest 7 directly adjacent existing dam**

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**Figure 10: Results of archaeological survey of the northern part of the amended proposal site**

## 5.2 Newly identified Aboriginal sites

### 5.2.1 RCAS 13 (AHIMS ID 45-5-5441)

**Site type:** Artefact Scatter, PAD
**Centroid:** MGA 56 297974mE 6257359mS
**Site length:** 110 metres
**Site width:** 50 metres

RCAS 13 (AHIMS ID 45-5-5441) comprises an artefact scatter and area of PAD. The artefact scatter associated with this site was identified within a wide exposure directly adjacent to the large dam within the amended proposal site. The surface exposure is located within a very gently sloped landform which does not appear to have been modified during construction of the dam. The wider landform surrounding the former drainage line was identified as an area of PAD due to the lack of identifiable disturbance associated with construction of the dam, the gently raised nature of the landform, and the location of the surface artefacts within a similar landform context to Blacktown Southwest 7 (AHIMS ID 45-5-0559).

While no evidence of extensive disturbance was noted within the site extent, the exposure appears to have been utilised by vehicles suggesting that the area is likely to have been subject to some level of post depositional movement.

**Table 3: Summary of artefacts identified at RCAS 13**

| Material | Colour | Artefact type | Length (mm) | Width (mm) | Thickness (mm) |
|---|---|---|---|---|---|
| Silcrete | Red | Complete flake | 34 | 29 | 18 |
| Basalt | Grey | Complete flake/ potential grinding stone fragment | 42 | 45 | 4 |
| Indurated mudstone/Tuff (IMT) | White | Complete flake | 46 | 66 | 20 |
| Silcrete | Red | Single platform core | 32 | 33 | 27 |
| Silcrete | Red | Distal flake fragment | 23 | 24 | 05 |
| Silcrete | Red | Distal flake fragment | 29 | 18 | 7 |
| Silcrete | Red | Proximal flake fragment | 29 | 43 | 22 |
| Silcrete | Red | Proximal flake fragment | 39 | 29 | 5 |
| Silcrete | Red | Complete flake, Backed blade | 41 | 24 | 5 |
| Silcrete | Red | Proximal flake fragment | 25 | 25 | 3 |

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**Figure 11: Ground exposure associated with surface artefact scatter of RCAS 13**

**Figure 12: Regrowth eucalypts within eastern portion of RCAS 13**

**Figure 13: Silcrete SPC within RCAS 13**

**Figure 14: Silcrete backed blade within RCAS 13**

**Figure 15: IMT complete flake within RCAS 13**

**Figure 16: Basalt flake within RCAS 13**

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**Figure 17: Identified surface artefacts and area of PAD associated with RCAS 13**

### 5.2.2 RCIF 3 (AHIMS ID 45-5-5442)

**Site type:** Isolated find
**Centroid:** MGA 56 297900 mE 6257437mS
**Site length:** 0.5 metres
**Site width:** 0.5 metres

RCIF 3 (AHIMS ID 45-5-5442) comprises an isolated silcrete artefact located on an artificial dam wall. The dam wall was located approximately two metres above the surrounding ground surface. Visibility across the wider dam area was low with existing grasses and leaf litter obscuring the immediate surrounds. The artefact is a silcrete medial flake fragment. Characteristics of the identified artefact are provided in Table 4.

**Table 4: Summary of artefact identified at RCIF 3**

| Material | Colour | Artefact type | Length (mm) | Width (mm) | Thickness (mm) |
|---|---|---|---|---|---|
| Silcrete | Red | Medial flake fragment | 20 | 12 | 5 |

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**Figure 18: Location of RCIF 3 at top of dam wall**

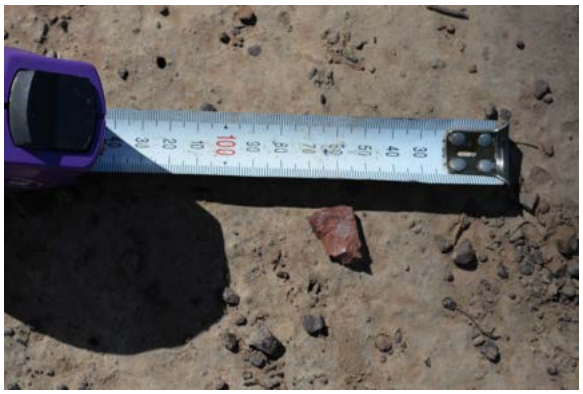

**Figure 19: Silcrete artefact located within RCIF3**

### 5.2.3 RCIF 4 (AHIMS ID 45-5-5443)

**Site type:** Isolated find
**Centroid:** MGA 56 297855 mE 6257438mS
**Site length:** 0.5 metres
**Site width:** 0.5 metres

RCIF 4 (AHIMS ID 45-5-5443) comprises an isolated IMT artefact located within a talus slope located on the north western side of a large dam. The surface of the slope was largely comprised of ironstone gravels. Surface visibility was high within the slope landform associated with the redeposition of gravels associated with colluvial movement. The artefact is an IMT medial flake fragment. Characteristics of the identified artefact are provided in Table 5.

**Table 5: Summary of artefact identified at RCIF 4**

| Material | Colour | Artefact type | Length (mm) | Width (mm) | Thickness (mm) |
|---|---|---|---|---|---|
| IMT | White | Medial flake fragment | 18 | 10 | 5 |

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**Figure 20: Site context of RCIF 4 located within steep slope of dam**

**Figure 21: IMT artefact within RCIF 4**

# 6.0 ANALYSIS AND DISCUSSION

## 6.1 Analysis of archaeological potential

The archaeological potential of an area is determined by its landform, its location and the level of disturbance. Certain landforms, such as gentle slopes are more conducive to the survival of archaeological material while others such as steep slopes are not. Additionally, different landform types are likely to have been utilised differently resulting in a different archaeological signature. The proximity of a landform to natural resources, in particular, permanent water sources is also a determining factor in assessing archaeological potential. Correlations between site location and proximity to a water source have been demonstrated in previous archaeological investigations where the number of sites and their densities is highest in close proximity to a water source.

In areas where there is a high level of disturbance however, the archaeological potential is lowered. It is unlikely that surface finds in these contexts are in their original context, and it is unlikely that subsurface archaeological deposits are intact.

## 6.2 Identified Aboriginal sites and areas of PAD

Surface artefact sites within the amended proposal site include two isolated finds on a dam wall:

- RCIF 3 (AHIMS ID 45-5-5442)
- RCIF 4 (AHIMS ID 45-5-5443).

The location of these isolated finds are shown in Figure 10 above.

Both sites are located in significantly disturbed contexts, with no associated archaeological potential.

A total of 10 artefacts were identified on the ground surface at Aboriginal site RCAS 13. These artefacts were identified on the ground surface adjacent to a large dam. Due to the presence of numerous surface artefacts and the lack of surface visibility across the remaining area and general intactness of that area, the remainder of RCAS 13 was identified as an area of PAD.

A portion of the registered extent of Blacktown Southwest 7 (AHIMS ID 45-5-0559) is located within the amended proposal site. This site area has not been extended, as the northern boundary of the site is bounded by the artificial dam wall, which is a heavily disturbed context.

# 7.0 SIGNIFICANCE ASSESSMENT

## 7.1 Archaeological significance assessment

A summary of the archaeological significance for Aboriginal sites within the northern part of the amended proposal site is provided in Table 6.

Assessment of previously identified sites was based on significance assessments on AHIMS site cards, observations during survey for the exhibited REF and observations during the current assessment.

**Table 6: Summary of impacts associated with the amended proposal**

| Site name/ AHIMS ID | Research potential | Representative value | Rarity | Education potential | Overall archaeological significance |
|---|---|---|---|---|---|
| Blacktown Southwest 7, (AHIMS ID 45-5-0559) | Moderate-high | High | High | High | High |
| RCAS 13 (AHIMS ID 45-5-5441) | Moderate | Moderate | Moderate | Moderate | Moderate |
| RCIF 3 (AHIMS ID 45-5-5442) | Low | Low | Low | Low | Low |
| RCIF 4 (AHIMS ID 45-5-5443) | Low | Low | Low | Low | Low |

### 7.1.1 Blacktown Southwest 7 (AHIMS ID 45-5-0559)

Blacktown Southwest 7 (AHIMS ID 45-5-0559) is a dense sub-surface artefact scatter on a raised landform adjacent to the Ropes Creek floodplain. Assessment during the salvage excavation undertaken as part of the St Marys Wastewater System Augmentation project identified Blacktown Southwest 7 as being of high significance, as a large number of rare artefacts were recovered during archaeological salvage excavation.

The salvage report (ENSure JV 2015) assessed the site as demonstrating a moderate-high level of integrity and research potential. The salvage report (ENSure JV 2015) assessed the site to have high representative and rarity values associated with the variety of artefacts identified across the salvage excavation including some relatively uncommon artefacts. The site is considered to have high education values associated with the variety of artefacts present. The overall archaeological significance of Blacktown Southwest 7 is considered to be high.

### 7.1.2 RCAS 13 (AHIMS ID 45-5-5441)

RCAS 13 (AHIMS ID 45-5-5441) is an artefact scatter and area of PAD. While the significance of the area of PAD is at present unknown, the identified surface artefacts identified a substantial variation in artefact types with a variety of raw materials types and artefact morphologies represented within the assemblage. Based on the variety of artefacts identified within the surface exposure the site is considered to demonstrate moderate representativeness and when combined with the area of PAD, moderate research potential. The surface artefacts are comprised of a low density artefact scatter located in a relatively intact context which are considered to be moderately rare within the amended

proposal site and wider Cumberland Plain. In isolation from the area of PAD the artefact scatter is considered to demonstrate moderate rarity values and moderate education values. The significance of this site would be updated following the completion of archaeological test excavation across the area of PAD.

### 7.1.3 RCIF 3 (AHIMS ID 45-5-5442)

RCIF 3 (AHIMS ID 45-5-5442) is an isolated silcrete artefact located on a dam wall. Isolated silcrete artefacts are considered to be common both within the amended proposal site and the wider Cumberland Plain. As the isolated find was identified within a disturbed context it is considered to demonstrate low research potential and is not considered to be representative of a specific example of past land use by Aboriginal people. As an isolated find of a common artefact type in the region, the site is considered to demonstrate low representative and education values. The overall archaeological significance of RCIF 3 is considered to be low.

### 7.1.4 RCIF 4 (AHIMS ID 45-5-5443)

RCIF 4 (AHIMS ID 45-5-5443) is an isolated IMT artefact located within an artificial slope landform associated with construction of a large dam feature. Isolated IMT artefacts are considered to be common both within the amended proposal site and the wider Cumberland Plain. As the isolated find was identified within a disturbed context it is considered to contain low research potential and is not considered to be representative of a specific example of past land use by Aboriginal people. As an isolated find of a common artefact type in the region, the site is considered to demonstrate low representative and education values. The overall archaeological significance of RCIF 4 is considered to be low.

## 7.2 Cultural significance

No specific areas of cultural significance were identified during site survey with a representative of Deerubbin LALC. No comments on the archaeological significance of the identified sites were received during the site inspection. During the site survey Deerubbin LALC noted that further investigation through test excavation should be undertaken prior to development.

Further assessment of the cultural significance of amended proposal site will be undertaken during preparation of the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the proposal.

# 8.0 IMPACT ASSESSMENT

## 8.1 Identified impacts

A summary of sites located within the northern part of the amended proposal site and the assessed impact to the sites is provided in Table 7.

**Table 7: Impacts associated with the amended proposal**

| Name / AHIMS ID | Type of harm | Degree of harm | Consequence of harm |
|---|---|---|---|
| Blacktown Southwest 7, (AHIMS ID 45-5-0559) | Direct | Partial | Partial loss of value |
| RCAS 13 (AHIMS ID 45-5-5441) | Direct | Total | Total loss of value |
| RCIF 3 (AHIMS ID 45-5-5442) | Direct | Total | Total loss of value |
| RCIF 4 (AHIMS ID 45-5-5443) | Direct | Total | Total loss of value |

# 9.0 MANAGEMENT AND MITIGATION MEASURES

## 9.1 Guiding principles

The overall guiding principle for cultural heritage management is that Aboriginal sites should be conserved. If conservation is not practicable, measures should be taken to mitigate impacts. The nature of the mitigation measures recommended is based on the assessed significance of the sites and the impact assessment.

## 9.2 Conservation

Those portions of site Blacktown Southwest 7 (AHIMS ID 45-5-0559) outside the amended proposal site would not be subject to impact. The location of these sites should be marked on construction drawings or Environmental Control Maps so that the portions of each site outside the construction footprint are not impacted. Further heritage assessment would be required prior to any works outside the amended proposal site.

## 9.3 Comprehensive consultation

Further heritage investigation must include comprehensive consultation with Aboriginal stakeholders in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (Department of Environment, Climate Change and Water, 2010b). This includes ongoing consultation regarding Aboriginal cultural values as well as throughout the archaeological test excavation process, during preparation of an ACHAR and when submitting an AHIP application to the Heritage NSW for the amended proposal.

## 9.4 Test excavation

A program of archaeological test excavation would be undertaken within Blacktown Southwest 7 (AHIMS ID 45-5-0559) for the amended proposal. Analysis of the results of test excavation undertaken to date within Blacktown Southwest 7 (AHIMS ID 45-5-0559) would be undertaken to determine if enough information has been obtained, or if further test excavation within the amended proposal site is required.

Archaeological test excavation within RCAS 13 (AHIMS ID 45-5-5441) would be undertaken to investigate the significance of the identified area of PAD associated with RCAS 13. Further investigation of this area of PAD would be required to confirm the nature of proposed impact to the identified site, as well as identify appropriate mitigation measures for proposed impacts.

Test excavation under the *Code of Practice for Archaeological Investigation of Aboriginal objects in New South Wales* (Department of Environment, Climate Change and Water, 2010a) would be required in order to determine whether subsurface Aboriginal objects are present within the site extent of RCAS 13. The purpose of the excavations would be to confirm the extent of subsurface artefacts, their association with other sites in the area and their significance. Further information regarding the nature, extent and significance of this site will subsequently assist in the identification of appropriate mitigation measures for proposed impacts to the site. Archaeological test excavation is not conducted to mitigate against impacts.

Prior to the commencement of test excavation, a test excavation methodology would be prepared and circulated to registered Aboriginal parties for a 28 day review and comment period. Test excavation would be limited to relevant areas of the impact footprint of the amended proposal.

## 9.5 Artefact reburial location

The site card for Blacktown Southwest 7 (AHIMS ID 45-5-0559) indicates that there is one artefact reburial location within the amended proposal site associated with AHIP C0000501 (Figure 22). Further clarification of the location of the reburial location in relation to the proposed works would be required to determine appropriate management and mitigation measures.

Potential management of the existing artefact reburial sites would be discussed with registered stakeholders for the project as part of consultation completed for the ACHAR.

## 9.6 Aboriginal Heritage Impact Permit application

As Aboriginal objects that are not currently subject to an AHIP are present within the amended proposal site, an AHIP would need to be obtained to allow impacts to the following sites:

- Blacktown Southwest 7 (AHIMS ID 45-5-0559)
- RCAS13 (AHIMS ID 45-5-5441)
- RCIF 3 (AHIMS ID 45-5-5442)
- RCIF 4 (AHIMS ID 45-5-5443).

The application for an AHIP for the above sites would require the completion of an ACHAR in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011) and completion of archaeological test excavation and associated reporting. The preparation of an ACHAR would involve comprehensive Aboriginal stakeholder consultation in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (Department of Environment, Climate Change and Water, 2010b), an assessment of Aboriginal cultural heritage values and an assessment of the potential harm to those values from the amended proposal.

Results from this assessment and the results of the test excavation would be used as a basis of the ACHAR. Mitigation measures developed during the ACHAR would address potential impacts caused by the amended proposal and form the basis of proposed mitigation to be assessed as part of the AHIP application. Conditions of the AHIP (once issued), would be in addition to management measures proposed for the current Addendum ASR and the exhibited REF for the proposal.

# 10.0 RECOMMENDATIONS

The following recommendations regarding Aboriginal heritage are based on consideration of:

- Statutory requirements under the *National Parks and Wildlife Act 1974*
- The requirements of the relevant guidelines: *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Department of Environment, Climate Change and Water, 2010a) and the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (Department of Environment, Climate Change and Water, 2010b)
- The results of the background research, site surveys and sensitivity assessment
- The likely impacts of the proposed development within the amended proposal site.

It was found that:

- Four Aboriginal sites are located within the amended proposal site
    - Blacktown Southwest 7 (AHIMS ID 45-5-0559) including an artefact reburial location associated with former salvage excavation
    - RCAS 13 (AHIMS ID 45-5-5441)
    - RCIF 3 (AHIMS ID 45-5-5442)
    - RCIF 4 (AHIMS ID 45-5-5443).
- The current assessment has identified an area of potential archaeological deposit (PAD) associated with the wider site extent of Aboriginal sites RCAS 13 (AHIMS ID 45-5-5441) and Blacktown Southwest 7 (AHIMS ID 45-5-0559)
- Blacktown Southwest 7 (AHIMS ID 45-5-0559) would be subject to partial harm within the amended proposal site
- All remaining sites within the amended proposal site would be subject to total harm resulting in total loss of value.

The following recommendations are made in relation to the amended proposal site and are in addition to the recommendations of the exhibited ASR:

- Archaeological test excavation would be undertaken to determine the significance of Aboriginal sites within the amended proposal site in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010a). Sites subject to test excavation would include:
    - Blacktown Southwest 7 (AHIMS ID 45-5-0559) where the results of test excavation undertaken to date within Blacktown Southwest 7 (AHIMS ID 45-5-0559) indicate that further information is required to adequately characterise the nature of the site within the amended proposal site.

    - RCAS 13 (AHIMS ID 45-5-5441) to aid in the assessment of the extent and significance of the site.
- Management of the existing artefact reburial site (AHIMS ID 45-5-0559) which would be subject to impact by the amended proposal would be discussed with registered stakeholders as part of consultation completed for the ACHAR.

# 11.0 REFERENCES

Australian ICOMOS 2013, The Burra Charter, The Australia ICOMOS Charter for places of cultural significance.

Department of Environment, Climate Change and Water 2010a. Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW

Department of Environment, Climate Change and Water 2010b, Aboriginal cultural heritage consultation requirements for proponents

Heritage Office 2001, Assessing heritage significance, available at: https://www.heritage.nsw.gov.au/assets/Uploads/a-z-publications/a-c/Assessing-Heritage-Significance.pdf

ENSure JV 2015, St Marys Wastewater System Augmentation Salvage Excavation Report, report prepared for Sydney Water

Office of Environment and Heritage 2011 Guide to Investigating, assessing and reporting on Aboriginal cultural heritage in NSW: Part 6 National Parks and Wildlife Act 1974

artefact

Artefact Heritage

ABN 73 144 973 526
Suite 56, Jones Bay Wharf
26-32 Pirrama Road
Pyrmont NSW 2009 Australia

+61 2 9518 8411
office@artefact.net.au
www.artefact.net.au

# Appendix C Addendum Biodiversity Assessment Report

# Sydney Metro Precast Facility

## Biodiversity Assessment Addendum Report

**Final | v02**

**February 2021**

**Sydney Metro Authority**

Sydney Metro Precast Facility

| | |
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Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.jacobs.com



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| | | | | | |
| | | | | | |

# Contents

# Glossary of terms

| Term | Definition |
|---|---|
| Additional site area | The additional area added onto the Proposal to form the Amended proposal site. |
| Amended ecological study area | The amended proposal site with an approximate 50 metre buffer. |
| Amended proposal (the) | Construction of and operation of two separate adjacent precast facilities, the northern and southern precast facilities, including boiler, aggregate bins and consumables, hardstand/laydown areas, offices, parking, pre-cast carousel including batch plant, sheds, and sediment basins for on-site water management. |
| Amended proposal site (the) | Site located at Lenore Drive opposite Old Wallgrove Road, Eastern Creek, including area for basins. |
| Ecological study area | The proposal site with an approximate 50 metre buffer. |
| Northern precast | Proposed pre-cast facility at the north of the site with an approximate area of 8.00 ha. |
| Proposal (the) | Construction of two separate precast facilities, Northern and Southern precast, including boiler, aggregate bins and consumables, hardstand/laydown areas, offices, parking, pre-cast carousel including batch plant, and warehouses. |
| Proposal site (the) | Site located at Lenore Drive opposite Old Wallgrove Road, Eastern Creek. |
| Southern precast | Proposed pre-cast facility at the south of the site with an approximate area of 8.00 ha. |
| Study area | Area encompassing the site and immediate surrounds. |

# Executive Summary

Sydney Metro propose to establish two precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. Since the exhibition of the Review of Environmental Factors (REF), further hydraulic assessment and drainage modelling have been carried out to inform the detailed design process for the proposal. This assessment has identified the need for two basins to be located outside of the proposal site during construction and operation of the proposal (the amended proposal).

This report details the methods and results of a biodiversity survey and assessment of the distribution and abundance of threatened species, populations and ecological communities, and the extent and magnitude of ecological impacts associated with the amended proposal.

An additional ecological survey was undertaken within the northern part of the amended proposal site on 9 December 2020. The assessment followed applicable components of the methodology used in the exhibited REF Biodiversity Assessment Report (BAR) (exhibited BAR) (Jacobs 2020).

Three Plant Community Types (PCT) were identified in the amended proposal site based on floristic composition, geology, and landscape position with regard to relevant regional vegetation classifications:

- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)
- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

These PCTs are in poor condition. The remainder of the vegetated areas are classed as exotic grassland.

Two threatened ecological communities (TECs) listed under the *Biodiversity Conservation Act 2016* (BC Act) were identified in the amended proposal site:

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered, BC Act)
- Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered, BC Act).

River-Flat Eucalypt Forest vegetation was also assessed against the conservation advice for the EPBC Act listed River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria. Vegetation within the northern part of the amended proposal site did not meet the minimum condition thresholds and therefore is not eligible to be included in the EPBC Act TEC.

One threatened plant species was recorded in the amended proposal site during the field survey: *Grevillea juniperina* subsp. *juniperina*. Forty-nine plants were identified growing around the large dam in the additional site area. Most of these plants are small juveniles that have likely been seeded by the larger mature plants around the dam. All forty-nine plants would be directly impacted by the amended proposal. These plants form part of the large Ropes Creek population. No other threatened plant species are considered likely to occur in the amended ecological study area.

The following fauna species are either known to occur in adjacent habitat and/or are considered at least moderately likely to occur in the amended proposal site based on the presence of suitable habitat:

- Green and Golden Bell Frog (*Litoria aurea*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Cave-roosting insectivorous bats: Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and Southern Myotis (*Myotis macropus*)
- Hollow-roosting insectivorous bats: Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
- Woodland birds: Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) and Varied Sittella (*Daphoenositta chrysoptera*)
- Nectarivorous birds: Little Lorikeet (*Glossopsitta pusilla*) and Swift Parrot (*Lathamus discolor*)
- Large predatory birds: Little Eagle (*Hieraaetus morphnoides*), Square-tailed Kite (*Lophoictinia isura*), Powerful Owl (*Ninox strenua*) and Masked Owl (*Tyto novaehollandiae*).

The key impacts of the amended proposal include the removal of an additional 1.06 hectares of native vegetation and threatened species habitat, which increases the total impact of the amended proposal to 2.98 hectares. A subset of the total area within the amended proposal site includes the following threatened ecological communities:

- 0.38 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered, BC Act)
- 0.003 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered, BC Act).

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur, and the extent of this impact would be proportionate to the extent of vegetation that is cleared. Additional impacts to fauna may occur during clearing and dewatering of the existing dam.

Additional indirect operational impacts from the amended proposal would include the potential release of sediment-laden wastewater into Ropes Creek in the event the sediment basins overflow. Invasion and spread of weeds (particularly *Salvinia molesta* into Ropes Creek), invasion and spread of pests, and invasion and spread of pathogens and disease are also a risk due to the potential for vehicles and machinery to introduce and spread contaminated soil during clearing. Significant impacts to aquatic ecosystems are unlikely to occur as a result of the amended proposal.

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts from the amended proposal, some residual impacts would occur. This assessment has identified the translocation of *Grevillea juniperina* subsp. *juniperina* individuals as a potential measure to mitigate some of this impact.

The overall outcome of the BC Act tests of significance and EPBC Act assessments of significance indicate that there is a high level of certainty that the impacts to threatened biodiversity are unlikely to be significant.

# 1. Introduction

## 1.1 Background

Sydney Metro is proposing to construct and operate of two adjacent precast facilities (the proposal) to support the construction of the proposed Sydney Metro West. The proposal is in Eastern Creek within the Blacktown City Council local government area. The proposal would be located on Lenore Drive, Eastern Creek (the proposal site). The precast facilities which are the subject of this proposal would manufacture precast concrete segments for the purpose of lining the Sydney Metro West tunnels. The precast facilities would be able to be operated independently of each other. A full description of the proposal is provided in Section 5 of the exhibited REF.

Sydney Metro, a NSW Government agency, is the proponent and a determining authority for this proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

A Review of Environmental Factors (REF) was prepared to describe the proposal, document potential impacts of the proposal on the environment and detail the mitigation measures to be implemented. A Biodiversity Assessment Report was carried out to support the REF (Jacobs 2020). The REF (and supporting biodiversity assessment (REF BAR)) was publicly exhibited from 16 November 2020 to 4 December 2020 to allow stakeholders, including members of the public, to provide input to the project assessment and determination process.

The precast facilities do not form part of the Sydney Metro West Critical State Significant Infrastructure planning application (SSI-10038), which would be assessed and determined separately.

## 1.2 The amended proposal

The proposal design as described in Chapter 5 of the exhibited REF included the provision of water management infrastructure such as rainwater tanks to capture rainwater from sheds, appropriate onsite stormwater and flood detention facilities, and a water recycling facility. Since the exhibition of the REF, further hydraulic assessment and drainage modelling have been carried out to inform the detailed design for the management of surface water and stormwater runoff across the amended proposal site. This assessment used inputs including the direction of fall and associated runoff flows across the proposal site to identify the appropriate size and location of water management infrastructure that would be required during construction and operation of the proposal. As a result, such infrastructure would be required to be located outside of the proposal site. Therefore, two basins are proposed:

- A detention basin to manage stormwater flows across the proposal site
- A bioretention basin to manage water quality of surface water and stormwater runoff.

The proposed basins would both be located to the north of the northern precast site and would require amendment to the proposal site boundary (the amended proposal site). The locations of the basins, and the amended proposal site boundary are shown on **Figure 1.1**. A full description of the amended proposal is provided in Section 2 of the Addendum REF.

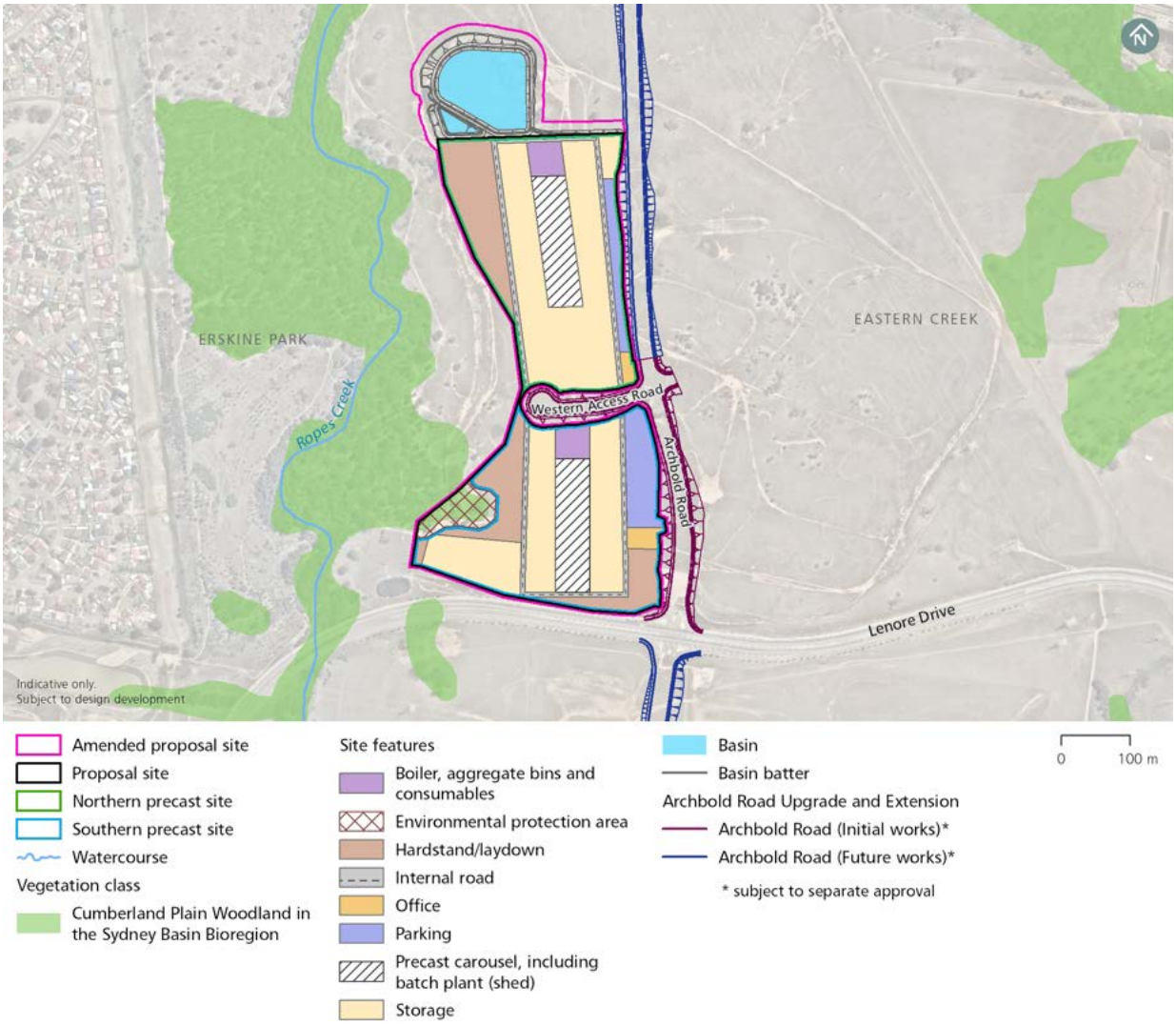


Figure 1.1 The amended proposal layout

## 1.3 Purpose and scope of this report

This Addendum BAR is one of a number of technical papers that form part of the Addendum REF. The purpose of this technical paper is to identify and assess the changes to, or additional impacts as a result of, the proposed amendments to the exhibited proposal in relation to biodiversity.

The legislative and policy framework for this additional assessment is as described in Section 2 of the exhibited BAR (Jacobs 2020).

# 2. Assessment methodology

An ecological survey was undertaken within the northern part of the amended proposal site not subject to previous survey (see **Figure 3.2**) on 9 December 2020 by an ecologist. The assessment followed applicable components of the methodology used in the exhibited BAR, including:

- Vegetation survey and verification of mapping
- Targeted threatened plant meanders
- Targeted threatened animal searches
- Aquatic habitat assessment.

The purpose of this assessment was to document the biodiversity values and identify potential impacts within the additional site area of the amended proposal site. The remainder of the amended proposal site (the exhibited proposal site) was not resurveyed as part of this assessment. Database searches have not been redone and it is assumed that the information documented in the exhibited BAR is still relevant.

# 3. Existing environment of the amended proposal site

The northern part of the amended proposal site is largely consistent with the description of the existing environment in Section 8.11.2 of the exhibited BAR, however it consists mostly of the large northern dam. Any changes to the existing environment in relation to the amended proposal are discussed below.

## 3.1 Plant community types

Three plant community types were identified within the additional site area of the amended proposal site (see **Figure 3.2**):

- Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)
- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

An additional 0.38 hectares of poor condition Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) occurs around the edges of the dam within the additional site area.

An additional 0.003 hectares of Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) occurs within the additional site area.

The amended proposal site now includes the entire artificial large dam in the north of site, instead of just the southern portion as in the exhibited REF BAR. This additional site area includes 0.68 hectares of *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

## 3.2 Threatened ecological communities

The additional site area contains an additional 0.38 hectares of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered under the BC Act). No new TECs were identified in the additional site area. A total of two TECs listed under the BC Act have been identified in the amended ecological study area (see **Photo 3-2)**:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as critically endangered) – consistent with Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered) – consistent with Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).

## 3.3 Threatened species

***Grevillea juniperina* subsp. *juniperina***

Forty-nine individuals of *Grevillea juniperina* subsp. *juniperina* (vulnerable under the BC Act) were recorded in four clusters within the additional site area during the survey (see Error! Reference source not found.**)**. Most of these plants are small juveniles (see **Photo 3-2**) that have likely been seeded by the larger mature plants around the dam. All plants were identified along the banks of the dam in the amended proposal site (see **Figure 3.2**).

**Photo 3-1: Grevillea juniperina subsp. juniperina mature plant (Location: around the northern dam bank of the amended proposal site).**

**Photo 3-2: Grevillea juniperina subsp. juniperina juvenile plants (enclosed in red squares) (Location: around the northern dam bank of the amended proposal site).**

**Green and Golden Bell Frog**

As identified in the exhibitedBAR, the large dam and grassy edges contains suitable foraging and dispersal habitat for the Green and Golden Bell Frog. Suitable habitat has been identified as the extent of *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071). In line with the findings of the BAR, the dam is not considered to be suitable breeding habitat for this species.

**Cumberland Plain Land Snail**

Rubbish piles, representing suitable habitat for the Cumberland Plain land Snail, were identified within the amended proposal site, however, no live snails or shells were found. The rubbish piles are located within low condition woodland, which is unlikely to provide suitable habitat for this species, as described in Section 4.5.2 of the exhibited BAR.

## 3.4 Aquatic habitat

The aquatic environment in the northern part of the amended proposal site includes one large artificial dam located on a mapped unnamed first-order stream. The habitat of the artificial dam in the amended proposal site is degraded and not suitable for the threatened fish species. Comparing the aquatic habitat of the dam against the basic 'Class' system (Fairfull and Witheridge et al. 2003), it would be considered Class 4 "unlikely fish habitat". Class 4 constitutes a named or unnamed waterway with intermittent flow following rain events only,

little or no defined drainage channel, little or no flow or free-standing water or pools after rain events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present). The dam does not have characteristics suitable for any of the threatened fish species known or predicted to occur in the locality as shown in Table B-2 in Appendix B of the exhibited BAR.

## 3.5 Matters of National Environmental Significance

In line with Section 4.7.1 of the exhibited BAR, three threatened animal species listed under the EPBC Act are considered moderately likely to use the habitats in the amended proposal site for foraging: the Green and Golden Bell Frog (listed as endangered), the Swift Parrot (listed as critically endangered) and the Grey-headed Flying-fox (listed as vulnerable). No threatened plants listed under the EPBC Act are considered to have a moderate or higher likelihood of occurring.

Of the migratory species identified from database searches, only the Fork-tailed Swift and White-throated Needletail are considered moderately likely to fly over the amended proposal site but would not use it as habitat.

The northern part of the amended proposal site would not increase impacts to any TECs listed under the EPBC Act, however some of the vegetation requires assessment against the listing advice of a newly listed TEC. The assessment below shows that River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria is not present in the northern part of the amended proposal site and would not be impacted.

### 3.5.1 River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria

On 15 December 2020, a new TEC was listed under the EPBC Act. River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria was listed as critically endangered under the EPBC Act, based on a loss of integrity through increased fragmentation and isolation resulting from historic clearing, weed invasion, invasive fauna, changes to floodplain hydrology and inappropriate management regimes, including grazing and fire (Department of Agriculture, Water and the Environment 2020).

The exhibited REF was placed on public exhibition on 4 December 2020, prior to the new TEC listing on 15 December 2020, therefore only vegetation in the northern part of the amended proposal site is subject to assessment under this new TEC listing.

The conservation advice for the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (Department of Agriculture, Water and the Environment 2020) states that the ecological community corresponds closely with the NSW-listed River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. However, the primary difference is that the national listing focuses legal protection on patches of the ecological community that are the most functional, relatively natural and in comparatively good condition. These patches are identified through minimum condition thresholds (see **Figure 3.1**).

There are two patches of Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) in the the northern part of the amended proposal site that meet the description of the EPBC Act TEC and are subject to assessment under the minimum condition thresholds. As shown in **Figure 3.1**, the minimum patch size for eligibility is 0.5 hectares. The two patches of PCT 835 within the northern area of the amended proposal site are 0.47 hectares and 0.18 hectares, and are greater than 30 meters apart so cannot be considered a single patch. The patches are also greater than 30 meters (approximately 60 meters) from the Ropes Creek riparian corridor, which would be the closest example of the EPBC Act TEC to the amended proposal site.

It can be argued that 0.47 hectares could be rounded to 0.5 hectares and therefore meet the “small patch” size in **Figure 3.1**. A small patch must meet the biotic thresholds listed in Table 3.1. A vegetation integrity plot, in

accordance with the Biodiversity Assessment Method (BAM), was undertaken in PCT 835 in the northern part of the amended proposal site as part of the exhibited BAR. Using the data collected in this plot, the minimum biotic thresholds have been assessed in Table **3.1**. As the plot recorded less 50 % native understorey it does not meet the biotic threshold.

Table 3.1: Minimum biotic thresholds of a small patch (Department of Agriculture, Water and the Environment 2020)

| **Biotic thresholds for a small patch** | **Plot 3 (PCT 835)** |
|---|---|
| ≥ 50% of its total perennial understorey vegetation cover is comprised of native species | Of the 66.6 % understorey recorded, only 10 % consisted of native species cover. |
| AND<br>Ground cover richness ≥ 6 native species per sample plot | The plot recorded 12 native ground cover species. |
| AND<br>At least 10 large trees (greater than 45 cm DBH) per ha. | The plot only assesses an area of 0.1 ha. 1 tree over 50 cm was recorded. Extrapolated out to 1 ha, this equals 10 large trees. |

The overall conclusion is that the extent of PCT 835 in the northern part of the amended proposal site does not meet the minimum condition thresholds listed in the conservation advice and therefore is not eligible for inclusion under the EPBC Act listed River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria.

| Patch size thresholds → / Biotic thresholds ↓ | Large patch Patch size ≥ 2 ha | Small contiguous[7] patch Patch size ≥ 0.5 ha within a larger area of native vegetation ≥ 5 ha | Small patch Patch size ≥ 0.5 ha |
|---|---|---|---|
| **High condition** ≥ 80% of its total perennial understorey vegetation cover[1] is comprised of native species AND Ground cover richness[2] ≥ 10 native species per sample plot AND ≥ 20 large trees[3] per ha | CLASS A1 Large or contiguous patch in high condition | | CLASS B1 Small patch in high condition |
| **Good condition with arboreal mammals** ≥ 50% of its total perennial understorey vegetation cover[1] is comprised of native species AND Ground cover richness[2] ≥ 6 native species per sample plot AND At least 10 large trees[3] per ha AND Evidence of 4 or more species of arboreal mammals[4] detected[5] in the patch | CLASS A2 Large or contiguous patch in good condition with arboreal mammals | | CLASS B2 Small patch in good condition with arboreal mammals |
| **Good condition** ≥ 50% of its total perennial understorey vegetation cover[1] is comprised of native species AND Ground cover richness[2] ≥ 6 native species per sample plot AND At least 10 large trees[3] per ha | CLASS B3 Large or contiguous patch in good condition | | CLASS C1 Small patch in good condition |
| **Moderate condition** ≥ 30% of its total perennial understorey vegetation cover[1] is comprised of native species AND Ground cover richness ≥ 4 native species per sample plot[2] | CLASS C2 Large or contiguous patch in moderate condition | | |

[1] Perennial understorey vegetation cover includes vascular plant species of all layers below the canopy with a life-cycle of more than two growing seasons. It includes herbs (graminoids and forbs), grasses, shrubs and juvenile plants of canopy species, but does not include annual plants, cryptogams, plant litter or exposed soil.

[2] Ground cover richness includes combined species richness of native grasses, forbs, ferns and sedges per 0.04 ha (20 x 20 m sample plot).

[3] Large eucalypt trees are greater than 45 cm [diameter at breast height (dbh)]. This is used as a surrogate for tree hollows and habitat values.

[4] Excluding micro-bats (Microchiroptera).

[5] Survey guidelines (DSEWPC 2011).

[7] Contiguous means the patch is connected to, or in close proximity to (i.e. within 30 m of), another area of native vegetation (i.e. an area where the total perennial vegetation cover is dominated (50 percent or more) by native plant species).

Figure 3.1: Condition classes and thresholds for the EPBC Act listed River-flat eucalypt forest TEC, taken from the Conservation Advice (Department of Agriculture, Water and the Environment 2020)

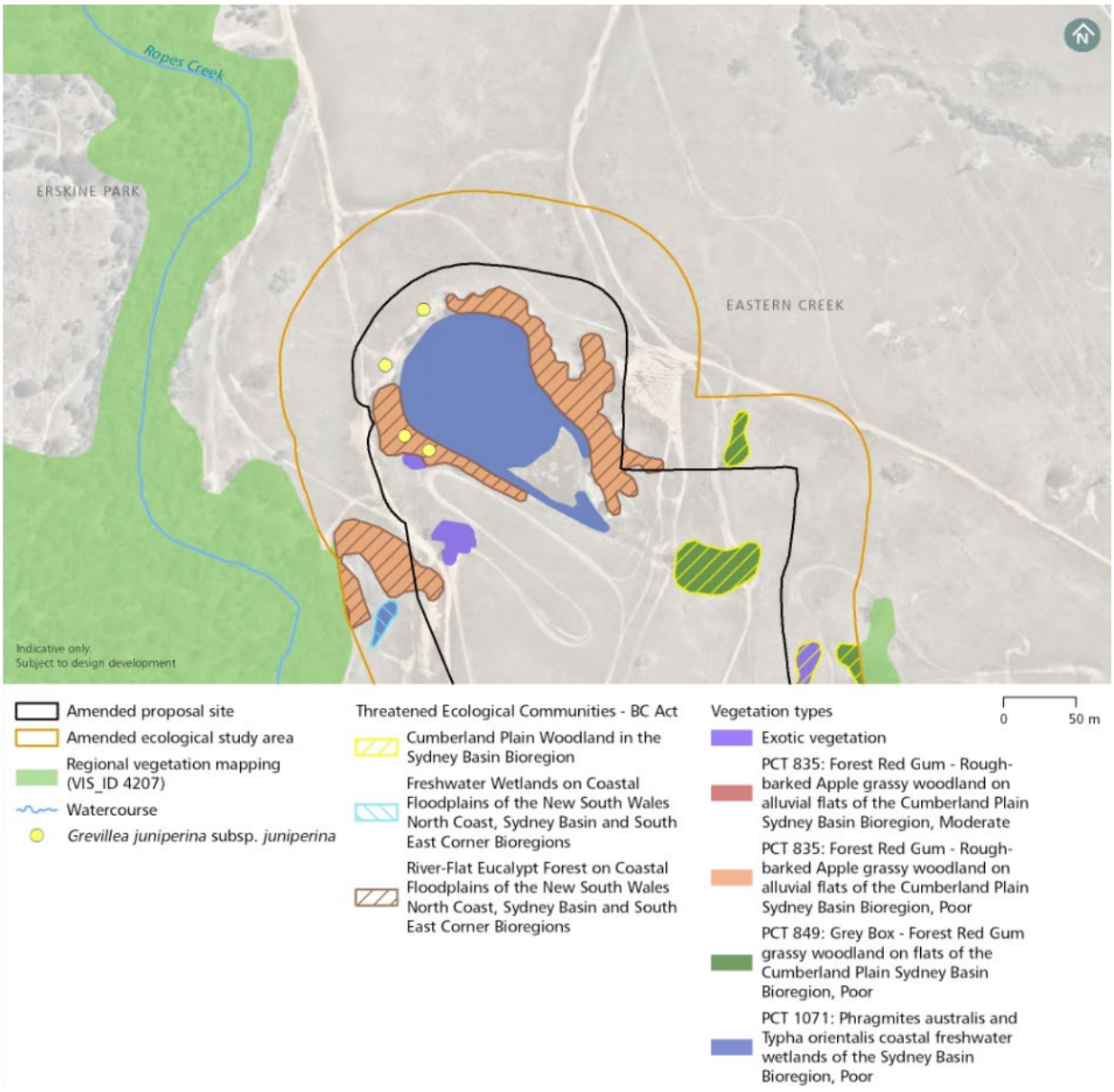


Figure 3.2 Biodiversity values in the additional site area of the amended proposal site

# 4. Construction impacts

The likely additional direct and indirect impacts of the construction of the amended proposal on biodiversity are summarised in this chapter. Direct impacts have been calculated using the boundary of the amended proposal site as the extent of construction in accordance with the exhibited BAR.

## 4.1 Removal of native vegetation

Three PCTs would be subject to additional direct impacts from the amended proposal, including 1.06 hectares of clearing, comprising two TECs (**Table 4.1)**. This additional area increases the total proposal impacts to 2.98 hectares of clearing.

Table 4.1: Impacts to PCTs and TECs

| Plant Community Type (PCT) | TEC status | Potential impact | | |
|---|---|---|---|---|
| | | Exhibited BAR impacts (ha) | Additional impacts (ha) | Total amended proposal site (ha) * |
| Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) | River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered, BC Act) | 0.07 | 0.38 | 0.45 |
| Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) | Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered, BC Act) | 1.74 | 0.003 | 1.74 |
| *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) | - | 0.11 | 0.68 | 0.79 |
| | Sub-total | 1.92 | 1.06 | 2.98 |
| Exotic vegetation | NA | 0.07 | 0 | 0.07 |
| Planted native vegetation | NA | 0.002 | 0 | 0.002 |
| | Total: | 1.98** | 1.06 | 3.05** |

**Excludes environmental protection zone.*

***These areas do not add up to the total due to rounding to two decimal places.*

## 4.2 Removal of threatened species and habitat

The amended proposal would result in an additional direct impact to 49 *Grevillea juniperina* subsp. *juniperina* plants (vulnerable under the BC Act) growing around the large dam in the north of the site. These plants are comprised mostly of small juveniles that have likely been seeded by the small number of mature plants. The impacted plants are outliers of a large Ropes Creek population (see Section 4.5.1 of the exhibited REF).

There would be no other additional direct impacts to threatened species from the amended proposal.

The native vegetation to be removed provides potential habitat for some of the threatened species identified in Section 4.5.2 of the exhibited BAR. **Table 4.2** provides a summary of potential direct impacts to threatened species habitat from the amended proposal.

Table 4.2: Potential impacts to threatened species habitat

| Species | BC Act status | EPBC act status | Potential impact | |
|---|---|---|---|---|
| | | | **Additional impacts to exhibited BAR** | **Total amended proposal site** |
| Green and Golden Bell Frog (*Litoria aurea*) | Endangered | Endangered | Removal of an additional 0.68 ha of potential non-breeding habitat | Removal of a total of 0.79 ha of potential non-breeding habitat. This would represent a small proportion of similar quality habitat present in the broader locality. |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | Vulnerable | Vulnerable | Removal of an additional 0.38 ha of suitable foraging habitat. | Removal of a total of 2.19 ha of suitable foraging habitat. No breeding habitat (camps) would be impacted. |
| **Insectivorous bats (cave-roosting)** | | | | |
| Little Bent-winged Bat (*Miniopterus australis*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of suitable foraging habitat. | Removal of a total of 2.98 ha. The amount of habitat removal is relatively small in comparison to the amount of higher quality habitat available in the broader locality. |
| Large Bent-winged Bat (*Miniopterus orianae oceanensis*) | Vulnerable | Not listed | | |
| Southern Myotis (*Myotis macropus*) | Vulnerable | Not listed | | |
| **Insectivorous bats (hollow-roosting)** | | | | |
| Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of suitable foraging habitat. | Removal of a total of 2.98 ha foraging habitat and four hollow-bearing trees. The amount of habitat removal is relatively small in comparison to the amount |
| Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) | Vulnerable | Not listed | | |

| Species | BC Act status | EPBC act status | Potential impact | |
|---|---|---|---|---|
| | | | Additional impacts to exhibited BAR | Total amended proposal site |
| Greater Broad-nosed Bat (*Scoteanax rueppellii*) | Vulnerable | Not listed | | of higher quality habitat available in the broader locality. |
| Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) | Vulnerable | Not listed | | |
| **Woodland birds** | | | | |
| Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of suitable foraging habitat. | Removal of a total of 2.19 ha of suitable foraging habitat. The amount of habitat removal is relatively small when the amount of available habitat in the broader locality is considered. |
| Varied Sittella (*Daphoenositta chrysoptera*) | Vulnerable | Not listed | | |
| **Nectarivorous birds** | | | | |
| Little Lorikeet (*Glossopsitta pusilla*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of foraging habitat. | Removal of a total of 2.19 ha of foraging habitat and four hollow-bearing trees. The amount of habitat removal is relatively small when the amount of available habitat in the broader locality is considered. |
| Swift Parrot (*Lathamus discolor*) | Endangered | Critically endangered | | |
| **Large predatory birds** | | | | |
| Little Eagle (*Hieraaetus morphnoides*) | Vulnerable | Not listed | Removal of an additional 0.38 ha of foraging habitat. | Removal of a total of 2.19 ha of foraging habitat. However, no high-quality habitat is present within the amended ecological study area and this species may only visit the amended ecological study area on occasion to hunt. The amount of habitat removal is small when the amount of available habitat in the broader locality is considered. |
| Square-tailed Kite (*Lophoictinia isura*) | Vulnerable | Not listed | | |
| Powerful Owl (*Ninox strenua*) | Vulnerable | Not listed | | |
| Masked Owl (*Tyto novaehollandiae*) | Vulnerable | Not listed | | |

#### 4.2.1 Assessments of significance

Assessments of significance have been undertaken for threatened species under the BC Act and Matters of National Environmental Significance under the EPBC Act based on the amended proposal. Further details of the assessments of significance under the EPBC Act and BC Act are provided in **Appendix A** of this technical paper.

In summary, the amended proposal is unlikely to result in a significant impact to any Matter of National Significance or BC Act species considered to have a moderate or high likelihood of occurring in the amended ecological study area.

## 4.3 Aquatic impacts

Impacts on aquatic habitat would be increased compared to the proposal detailed in the exhibited BAR. However, the aquatic habitat is generally in poor condition due to previous development and agricultural activity within the catchment which has resulted in changes to hydrological conditions, increased input of nutrients, sedimentation and weed invasion. The aquatic habitat in the amended proposal site meets the description for Class 4 (unlikely fish habitat). As such, there would be no impacts to sensitive or key fish habitats from the amended proposal.

## 4.4 Injury and mortality

The northern dam would need to be dewatered for the construction of the basins in the amended proposal. There is a possibility that native fish, turtle, and frog species have colonised these dams. These species would need to be captured and relocated into a similar aquatic environment to which they were found by suitably qualified aquatic ecologists under a Fisheries Permit issued by the NSW Department of Primary Industries (DPI).

## 4.5 Indirect impacts

The amended proposal site is unlikely to significantly change the assessment of indirect construction impacts that are documented in the exhibited BAR.

Construction of the basins has the potential to result in the spread of exotic species during dewatering and vegetation clearing. The large dam is infested with *Salvinia molesta*, a listed Weed of National Significance (WoNS) that spreads by inappropriate disposal of plant fragments. This WoNS has the potential to spread into Ropes Creek during dewatering and vegetation clearing. All plant material removed from the large dam during construction needs to be disposed of at a licensed waste disposal facility. Additionally, the predatory fish species Eastern Gambusia (*Gambusia holbrooki*) was present in the large dam during surveys undertaken for the exhibited BAR. Measures should be taken to ensure *Gambusia holbrooki* are not spread into Ropes Creek during dewatering activities.

# 5. Operational impacts

The key impacts of the proposal would occur during the construction phase. As such, the potential operational impacts documented in the exhibited BAR remain unchanged within the amended proposal site.

The only potential increase in likelihood of operational impacts of the basins would be through the inadvertent release of wastewater into Ropes Creek in the event the basins overflow. However, this would only likely occur during extreme weather events and the dam design includes a weir for flows greater than one percent annual exceedance probability (AEP). This is therefore unlikely to cause any water quality impacts as the first flush pollutants would be highly diluted before being naturally discharged over the weir.

# 6. Revised management and mitigation measures

Management and mitigation measures identified to address potential additional impacts of the amended proposal are outlined in **Table 6.1**. This is in addition to mitigation measures as detailed in Table 8-46 of the exhibited REF relating to Biodiversity.

Table 6.1: Additional management and mitigation measures

| No. | Impact | Management and mitigation measure |
|---|---|---|
| B15 | Removal of 49 individual Grevillea *juniperina* subsp. *juniperina* plants. | The translocation of 49 individuals of *Grevillea juniperina subsp. juniperina* around Ropes Creek would be investigated and implemented if feasible and reasonable. |
| B16 | Dewatering of northern dam potentially causing injury and mortality of native fish, frogs, and turtles. | A suitably qualified aquatic ecologist would be present during the dewatering of the northern dam. If native fish, turtle and/or frog species are found, they would be relocated into a similar aquatic environment by a trained aquatic ecologist under a Fisheries Permit issued by Department of Primary Industries (DPI). Sydney Metro would apply for a Fisheries Permit, if required. |
| B17 | Potential impacts from the spread of exotic species. | Water removed from the northern dam during dewatering would be filtered for *Salvinia molesta* and *Gambusia holbrooki* before releasing into surrounding environments to minimise the potential for spreading of these exotic species. |

# 7. Conclusion

The amended proposal would increase impacts on biodiversity values from what was reported in the exhibited BAR. However, no new impacts have been identified in the proposed amendment.

With the additional site area, the total impacts of the proposal now include the removal of 2.98 hectares of native vegetation belonging to three Plant Community Types (PCTs) and three Threatened Ecological Communities (TECs). This vegetation also represents habitat for some threatened species. The assessment outcomes for these species detailed in the exhibited BAR remains valid.

The amended proposal will now impact 49 *Grevillea juniperina subsp. juniperina* plants growing in four clusters around the large dam. These plants are mostly small juveniles. The 49 plants form part of a large population that occurs along Ropes Creek. This species is known to colonise disturbed habitats and the plants growing around the dam are likely a result of the transportation of alluvial sediment from Ropes Creek when the dam was built. The population size along Ropes Creek is likely very large and the loss of these plants is unlikely to result in a significant impact to this species.

The updated BC Act tests of significance and EPBC Act assessments of significance (see **Appendix A**) indicate that there is a high level of certainty that the impacts to threatened biodiversity are unlikely to be significant.

The new impacts do not change the overall findings of the exhibited REF. No offsets are required under the BC Act or the EPBC Act.

# 8. References

DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT 2020. Conservation Advice for the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria. Accessed: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/154-conservation-advice.pdf.

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SAUNDERS, D. L. & TZAROS, C. L. 2011. National Recovery Plan for the Swift Parrot Lathamus discolor. Melbourne: Birds Australia.

WSP | PARSONS BRINCKERHOFF 2017. Biodiversity Assessment Report - Archbold Road Upgrade, Old Wallgrove Road to the Great Western Highway.

# Appendix A. Tests of significance

Tests of significance were conducted in the exhibited BAR (Jacobs 2020) for threatened species and ecological communities that were recorded in the ecological study area during field surveys or were identified as having a moderate or high potential to occur in the ecological study area based on the presence of suitable habitat (see Appendix B of the exhibited BAR). Assessments have been updated for this addendum report where impacts to threatened species or ecological communities have increased.

The following tests of significance have been undertaken in accordance with the *Threatened Species Test of Significance Guidelines* (Office of Environment and Heritage 2018), which outlines a set of guidelines to help applicants/proponents of a development or activity with interpreting and applying the factors of the assessment process.

For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

## Biodiversity Conservation Act 2016 assessment

**Threatened ecological communities**

The threatened ecological communities that are present in the amended proposal site and are subject to this assessment include:

- Cumberland Plain Woodland in the Sydney basin Bioregion
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

In addressing this question, the local occurrence of these threatened ecological communities is taken to be the community that occurs within the amended ecological study area and all contiguous vegetation. Risk of extinction is used here as the likelihood that the local occurrence of the ecological community would become

extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the threatened ecological community from the proposal. Composition refers to the assemblage of species and the physical structure of the community.

Cumberland Plain Woodland in the Sydney basin Bioregion is listed as a critically endangered ecological community and is considered to be facing an extremely high risk of extinction in New South Wales in the immediate future. The River-Flat Eucalypt Forest TEC is considered likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

The threatened ecological communities subject to this assessment are already at risk of extinction and the amended proposal would exacerbate this risk. However, the amended proposal is considered unlikely to result in the extinction of the local occurrence of any TECs. The amended proposal is predicted to remove around 1.74 hectares of the Cumberland Plain Woodland TEC and a smaller extent of the River-Flat Eucalypt Forest TEC (0.45 hectares) – see **Table A-1**below. The greatest impact to Cumberland Plain Woodland TEC is to poor quality regenerating woodland and derived grasslands. Higher quality remnants would be retained. When the impacts are considered in the local context (i.e. the amended ecological study area, a 50-metre buffer around the amended proposal site), this includes 58 percent of the Cumberland Plain Woodland TEC and 48 percent of the River-Flat Eucalypt Forest TEC present in the amended ecological study area. This proportion is only accounting for a narrow band around the amended proposal site. A more valuable calculation would be the proportional impact of the occurrence of these TECs in the locality (the area within a 10-kilometre radius surrounding the amended proposal site). When this is considered, the proportional impact to Cumberland Plain Woodland TEC (0.08 percent) and River-Flat Eucalypt Forest TEC (0.03 percent) are very low.

Table A-1 Updates impacts to TECs from the amended proposal site

| Plant community type (PCT) | % cleared in CMA | Condition class | BC Act | Direct impact[1] (ha) | Area in ecological study area[2] (ha) | Area in locality (ha)[3] |
|---|---|---|---|---|---|---|
| Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) | 93 | Moderate | CE | <0.001 | 0.89 | 2,088 |
| | | Poor | CE | 1.13 | 1.73 | |
| | | Derived grassland | CE | 0.61 | 0.81 | |
| | | | **Sub-total** | **1.74** | **3.43** | |
| Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (835) | 93 | Poor | E | 0.45 | 0.93 | 1,560 |

[1] Area to be cleared based on ground-truthed vegetation mapping within the amended proposal site boundary.
[2] Based on a 50-metre buffer around the amended proposal site.
[3] Based on regional mapping within a 10km radius of the ecological study area.

The amended proposal is considered unlikely to substantially and adversely modify the composition of the two TECs so that their local occurrences are placed at risk of extinction. The local occurrences of these TECs have already been substantially and adversely modified by past land use practices. All TECs subject to this assessment are currently suffering from altered composition caused by a very large reduction in ecological function, as indicated by:

- altered community structure (i.e. missing structural layers)
- altered species composition (i.e. lack of native species)
- disruption of ecological processes (i.e. altered drainage)
- invasion and establishment of exotic species resulting in weed dominance
- degradation of habitat
- fragmentation.

The highest quality vegetation within the amended ecological study area would mostly be avoided through design, including through the establishment of an environmental protection area in the south west of the amended proposal site. Impacts would be primarily to poor quality regenerating woodland and derived grasslands. The amended proposal is not considered likely to further modify the composition of any of the TECs within the amended ecological study area such that the local occurrence of either TEC is placed at risk of extinction. The composition of the threatened ecological communities within the amended ecological study area is predicted to remain intact after the implementation of the amended proposal. However, the remaining patches would be smaller.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The amended proposal is predicted to remove around 1.74 hectares of the Cumberland Plain Woodland TEC and a smaller extent of the River-Flat Eucalypt Forest TEC (0.45 hectares). More than 99 percent of this impact would be to poor quality woodland and derived grasslands.

Fragmentation is unlikely to occur from the amended proposal as the work would largely involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the amended proposal would not result in the breaking apart of large blocks of high-quality examples of threatened ecological communities. No further habitat fragmentation on a landscape scale would occur because of the amended proposal. Isolation of habitats is likely to increase by a small extent as the distance between patches on either side of the amended proposal site would be increased.

Due to the conservation significance of these TECs (particularly the critically endangered Cumberland Plain Woodland in the Sydney basin Bioregion), the remaining patches of these TECs within NSW are likely to be important for their survival. However, the patches within the amended proposal site are small and are largely degraded and higher-quality remnants adjacent to the amended ecological study area would be retained. Furthermore, there would be no impact to priority conservation land core habitats or regional corridors (mapped to the west of the amended proposal site and avoided through design). As such, the TEC patches within the amended ecological study area can be considered less important than larger high-quality examples of these TECs in the locality that retain high levels of ecological integrity and function.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 39 listed KTPs. Of the 39 listed KTPs under the BC Act, nine are applicable to the TEC subject to this assessment (see **Table A-2**). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

Table A-2 Key threatening processes that may result from the amended proposal that may affect threatened ecological communities

| Clear threatening process | Relevance to the amended proposal |
|---|---|
| Clearing of native vegetation | Yes. The amended proposal would result in clearing of native vegetation. |
| Infection of frogs by amphibian chytrid causing the disease chytridiomycosis | Yes. The amended proposal may result in the introduction or spread of amphibian chytrid. However, hygiene measures would be followed to prevent spread of this fungus. |
| Infection of native plants by *Phytophthora cinnamomi* | Yes. The amended proposal may result in the introduction or spread of *Phytophthora cinnamomi*. However, hygiene measures would be followed to prevent spread of *Phytophthora cinnamomi*. |
| Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae | Yes. The amended proposal may result in the introduction or spread of Exotic Rust Fungi. However, hygiene measures would be followed to prevent spread of Exotic Rust Fungi. |
| Invasion and establishment of exotic vines and scramblers | Yes. The amended proposal may result in the invasion and establishment of exotic vines and scramblers. However, weed control measures would be followed to prevent invasion and establishment of exotic vines and scramblers. |
| Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata* | Yes. The amended proposal may result in the invasion and establishment of African Olive *Olea europaea* L. subsp. *cuspidata*. However, weed control measures would be followed to prevent invasion and establishment of African Olive *Olea europaea* L. subsp. *Cuspidata.* |
| Invasion, establishment and spread of *Lantana camara* | Yes. The amended proposal may result in the invasion and establishment of *Lantana camara*. However, weed control measures would be followed to prevent invasion and establishment of *Lantana camara.* |

| Clear threatening process | Relevance to the amended proposal |
|---|---|
| Invasion of native plant communities by exotic perennial grasses | Yes. This key threatening process is already affecting the amended proposal site. The amended proposal may result in further invasion and establishment of exotic perennial grasses in native vegetation that would be retained. However, weed control measures would be followed to prevent this potential impact. |
| Removal of dead wood and dead trees | Yes. Some dead wood and dead trees would be removed as part of the amended proposal. |

**Conclusion**

In summary, the amended proposal is considered unlikely to have an adverse effect on the extent of the two TECs such that the local occurrence of each is likely to be placed at further risk of extinction. The impacts to these PCTs is primarily (>99 percent) to poor-quality woodland and derived grasslands. The impact is small when considered in the context the extent of the TECs within the broader locality. The highest quality vegetation in the amended ecological study area would largely be avoided through design. The amended proposal is considered unlikely to substantially and adversely modify the composition of any of the TECs as the current composition of the TECs is highly modified.

There is unlikely to be any further increase in fragmentation from the amended proposal. The TECs within the amended ecological study area are not recognised as important to the long-term survival of the TECs in the locality as the patches are small and in poor to moderate condition. Furthermore, only a slither (0.6 square meters that is realistically avoidable) of moderate quality woodland identified as important under the Cumberland Plain Recovery Plan (i.e. priority conservation land) would be impacted. The amended proposal would contribute to some KTPs that cannot be mitigated against including clearing of native vegetation and removal of dead wood and dead trees.

Considering the context of the TECs and intensity of the potential impacts to these TECs from the amended proposal, an overall conclusion has been made that the amended proposal is unlikely to result in a significant impact to these TECs.

***Grevillea juniperina subsp. juniperina* (Juniper-leaf Grevillea)**

Forty-nine *Grevillea juniperina* subsp. *juniperina* plants were identified from four clusters around the large man-made dam in the north of the amended ecological study area during surveys. These plants may have grown from the transportation of seeds in alluvium soil around Ropes Creek when the dam was built, based on the regrowth of riparian vegetation along the bank. Potential habitat for this species is typically woodland areas on Wianamatta Shale and Tertiary alluvium. Around 30 plants were also identified just outside of the amended ecological study area in the south west near Ropes Creek. This species appears to be somewhat common along the Ropes Creek corridor based on the prevalence of recorded sightings in the locality (i.e. Atlas records).

The amended proposal would result in the removal of a small area of potential low condition habitat and 49 individual plants, consisting mostly of small juveniles.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

According to the Environmental Impact Assessment Guidelines for *Grevillea juniperina* subsp. *juniperina* (NSW National Park and Wildlife Service 2002), all populations should be assumed to be viable. Therefore, the 49 plants along the bank of the large artificial dam in the north of the amended ecological study area are part of a local viable population around Ropes Creek. Considering the presence of juveniles, these plants are also reproducing.

Based on publicly available data, there are 1,092 recorded sightings of *Grevillea juniperina* subsp. *juniperina* in the locality. Considering single records investigated near the amended ecological study area contained numerous plants, the number of individuals in the locality is likely to be much higher. Over 30 plants were also identified to the west of the amended ecological study area on the edge of Ropes Creek. Based on this information, the population size in the locality is likely quite high.

The amended proposal would impact (remove) 49 individual plants around the large dam, however, given most of the population would remain in higher condition habitats around Ropes Creek, this is not considered to constitute an adverse effect on the life cycle of this population of *Grevillea juniperina* subsp. *juniperina*. The plants that would be impacted are primarily juveniles that have likely germinated from a selection of adult plants. The amended proposal would also remove a small area of potential habitat; however, the primary alluvial habitat would remain around Ropes Creek. Given that this species seems to commonly regenerate and persist in disturbed areas, the amended proposal is unlikely to place the local population of *Grevillea juniperina* subsp. *juniperina* at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   - **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   - **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   - **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   - **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   - **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The amended proposal would directly impact (remove) a small area of potential habitat, consisting of low condition woodland on the edges of the Ropes Creek riparian zone and regrowth woodland around the large dam. There may also be some small indirect impacts on the moderate quality woodland to be retained through edge effects, however considering this species is able to grow in open and disturbed sites these edge effects are unlikely to make the habitat unsuitable.

Fragmentation is unlikely to occur from the amended proposal as the work would largely involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the amended proposal would not result in the breaking apart of large blocks of high-quality habitats. No further habitat fragmentation on a landscape scale would occur because of the amended proposal.

Importantly, the amended proposal would mostly avoid the highest quality alluvium habitat for *Grevillea juniperina* subsp. *juniperina* through design. The work would be undertaken at the edge of the habitat and avoids impacts to the core habitats of the viable population on the edge of Ropes Creek.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to *Grevillea juniperina* subsp. *juniperina*, the amended proposal would directly contribute to one key threatening process (KTPs) listed under the BC Act; Clearing of native vegetation. The amended proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds, particularly exotic grasses that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing, and habitat removal associated with the amended proposal is considered unlikely to be significant in terms of available habitat for the *Grevillea juniperina* subsp. *juniperina* adjacent to the amended ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The amended proposal would directly impact (remove) 49 individual plants. However, these plants represent an outlying occurrence of the larger Ropes Creek viable population and the majority of the population would remain in the locality. The amended proposal would directly impact (remove) a small area of potential habitat, consisting of low condition woodland on the edges of the Ropes Creek riparian zone and regrowth woodland around the large dam. The 0.06 hectares of potential habitat removal is a very small proportion of the area of available alluvial habitat around Ropes Creek. Therefore, an overall conclusion has been made that the amended proposal is unlikely to result in a significant impact to *Grevillea juniperina* subsp. *juniperina*.

**Green and Golden Bell Frog (*Litoria aurea*)**

The Green and Golden Bell Frog was not identified in the amended ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment. Targeted surveys for the Green and Golden Bell Frog were undertaken in proximity to the amended ecological study area as part of the Archbold Road Upgrade and Extension REF (WSP | Parsons Brinckerhoff 2017), which was unsuccessful at locating this species.

Although records of this species in the locality are rare, the Green and Golden Bell Frog has a moderate likelihood of occurring in habitats in the amended ecological study area based on the presence of suitable habitat. The amended proposal would directly impact (remove) up to 0.79 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Green and Golden Bell Frog is found in a wide variety of water bodies, commonly in disturbed habitats, but not in fast flowing streams. Breeding habitat in NSW includes water bodies that are still, shallow, ephemeral, unpolluted (but the frog can be found in polluted habitats), unshaded, with aquatic plants and free of Mosquito Fish (*Gambusia holbrooki*) and other predatory fish, with terrestrial habitats that consisted of grassy areas and vegetation no higher than woodlands, and a range of diurnal shelter sites (Pyke & White 1996).

The amended proposal would remove up to 0.79 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat. The Green and Golden Bell Frog has not been identified in the amended ecological study area though may occur based on the presence of suitable habitat and connectivity that the Ropes Creek riparian corridor provides between the amended ecological study area and the most recent record (2012) in the locality. The amended proposal would not directly impact on a known breeding site or key population. The loss of habitat would be to foraging and sheltering habitat only. This impact is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**

**ii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

**iii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**

**i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**

**ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**

**iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The amended proposal would remove up to 0.79 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat.

Fragmentation is unlikely to occur from the amended proposal as the work would largely involve removing farm dams along two first order drainage lines that do not provide any east-west connectivity. The habitat removed would likely represent sheltering and foraging habitats for any individuals moving along the Ropes Creek corridor. The Ropes Creek corridor and north-south connectivity would remain after the completion of the amended proposal.

The habitat that would be removed meets the description of suitable habitat for the Green and Golden Bell Frog (Pyke & White 1996), however this species has not been recorded in the amended ecological study area. The habitat is likely to represent sheltering and foraging habitat for individuals dispersing across the landscape and is a small proportion of a very large number of similar quality farm dams in the locality. The main connectivity corridor near the amended ecological study area would be represented by Ropes Creek, which would not be impacted by the amended proposal. Therefore, the habitats that would be removed are unlikely to be highly important to the long-term survival of the Green and Golden Bell Frog in the locality.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

**e.** whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to the Green and Golden Bell Frog, the amended proposal is consistent with three key threatening processes listed under the BC Act:

- Clearing of native vegetation
- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands
- Chytridiomycosis due to amphibian Chytrid Fungus.

The extent of native vegetation clearing and habitat removal associated with the amended proposal is considered unlikely to be significant in terms of available habitat for the Green and Golden Bell Frog in the surrounding landscape.

The amended proposal would only impact flow regimes on the two first order streams that cross the amended ecological study area, however these are very ephemeral and only drain run-off from the immediate surroundings into Ropes Creek, which is normally trapped by the two dams anyway. Therefore, the amended proposal is unlikely to significantly contribute to this Key Threatening Process.

The disease Chytridiomycosis already exists in the Cumberland Plain and as such it is unlikely that the amended proposal would further exacerbate this Key Threatening Process. Construction activities would follow frog hygiene practices to limit the spread of this disease.

**Conclusion**

This species has not been identified in the amended ecological study area and no individuals are expected to be directly impacted. The amended proposal would remove up to 0.79 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat. The amended proposal would not directly impact on a known breeding site. The habitats are likely to represent foraging and shelter for individuals dispersing across the landscape and are a small proportion of the availability of similar quality habitat in the locality. Surveys for this species would be undertaken as part of the pre-clearing process prior to the commencement of clearing and de-watering of ponds. Overall, the amended proposal is considered unlikely to result in a significant impact to the Green and Golden Bell Frog.

**Grey-headed Flying-fox (*Pteropus poliocephalus*)**

The Grey-headed Flying-fox is considered moderately likely to forage in the trees within the amended ecological study area, particularly *Eucalyptus moluccana* and *Eucalyptus tereticornis*. No roost camps are present in the amended ecological study area, however the bats from the Parramatta Park camp and/or the intermittent Ropes camp are likely to forage in the amended ecological study area.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats*:*

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.

There are no roost camps located in the amended ecological study area and at the time of this assessment the amended proposal would not directly impact on any known breeding / maternity site. As such, the impacts of the amended proposal to the Grey-headed Flying-fox would be limited to loss of feeding habitat caused by direct clearing or damage to native vegetation during the construction phase.

The amended proposal would remove around 2.19 hectares of potential foraging habitat (although it is not likely that the entirety of this habitat is used), however, removal of vegetation would be avoided where possible. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within the locality. Given the relatively widespread nature of similar poor-quality vegetation in the locality and abundance of higher-quality foraging habitat within the feeding range of the camps located near the amended ecological study area, the amended proposal is not expected to significantly affect the life cycle of the species.

The amended proposal is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The potential habitat of the Grey-headed Flying-fox within the amended ecological study area is limited to foraging habitat and includes all vegetation where fruiting and flowering trees and shrubs are present. The extent of potential foraging habitat for the Grey-headed Flying-fox would be reduced by around 2.19 hectares. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered.

Importantly, the amended proposal would not result in fragmentation of habitat for the Grey-headed Flying-fox. This species is highly mobile and would freely fly long distances (up to 50 km) over open areas including urbanised city centres to move between roost camps and foraging sites. The amended proposal would not affect the movement of the Grey-headed Flying-fox between habitat patches.

Importantly, the amended proposal would not affect the most important habitats for Grey-headed Flying-fox within the locality. The most important habitats for the local Grey-headed Flying-fox sub-populations are the roosting camps at Parramatta Park (Nationally Important) and Ropes Creek (intermittent). These camps would not be affected by the amended proposal. Foraging habitat within the amended ecological study area is likely to

form part of an overall foraging range of these sub-populations and would only form a small proportion of available habitat for this species. As such, the foraging habitat within the amended ecological study area is unlikely to be of critical importance for the survival of the Grey-headed Flying-fox within the locality.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to Grey-headed Flying-fox, the amended proposal would directly contribute to one key threatening process (KTPs) listed under the BC Act; Clearing of native vegetation. The amended proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the amended proposal is considered unlikely to be significant in terms of available habitat for the Grey-headed Flying-fox adjacent to the amended ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The Grey-headed Flying-fox would be impacted by a small reduction in extent of suitable foraging habitat from the amended proposal of around 2.98 hectares. No roosting camps or other important habitat would be impacted. As such, the amended proposal is considered unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. After consideration of the factors above, an overall conclusion has been made that the amended proposal is unlikely to result in a significant impact to the Grey-headed Flying-fox.

**Insectivorous bats (cave-roosting)**

The species subject to this assessment include:

- Little Bent-winged Bat (*Miniopterus australis*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Southern Myotis (*Myotis macropus*)

The Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis were not identified in the amended ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis are moderately likely to occur within the amended ecological study area based on the presence of native vegetation providing habitat for these species. These species have been recorded widely in the locality and are likely to use the amended ecological study area as foraging habitat. No roosting habitat would be impacted by the amended proposal.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a. **in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Little Bent-winged Bat is generally found in well-timbered areas where they roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and occasionally buildings. They often share roosting sites with the Large Bent-winged Bat. In NSW the largest maternity colony is in close association with a large maternity colony of Large Bent-winged Bat. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites / maternity colonies are known in Australia.

The Large Bent-winged Bat primarily roosts in caves, but will also use derelict mines, storm-water tunnels, buildings and other man-made structures. The Large Bent-winged Bat forms populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 kilometres range of maternity caves. The Large Bent-winged Bat hunts in forested areas.

The Southern Myotis generally roosts in groups of 10 – 15 close to water in caves, mine shafts, hollow-bearing trees, storm-water channels, buildings, under bridges and in dense foliage. The Southern Myotis forages over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW, females have one young each year usually in November or December.

All vegetation within the amended ecological study area is likely to provide foraging habitat for these three species. The Southern Myotis will preferentially forage in the riparian zones and open water surface of Ropes Creek and potentially the dams within the amended ecological study area. Riparian zones are also likely to be a focal point for foraging of the Little Bent-winged Bat and Large Bent winged Bat. Only a minor area of riparian habitat would be impacted by the amended proposal, and the design of the amended proposal has minimised impacts to riparian vegetation.

The amended proposal would impact up to 2.98 hectares of suitable foraging habitat for these species, primarily poor condition woodland. Much of this area is not considered high-quality habitat. The current potential for these species to occur, based on the presence of potential foraging habitat around the amended proposal site, is unlikely to be affected by the amended proposal.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

b. **in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
    i. **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
    ii. **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

c. **in relation to the habitat of a threatened species or ecological community:**
    i. **the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**

ii. **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
iii. **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The amended proposal would remove around 2.98 hectares of potential foraging habitat for the Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis. However, much of the vegetation that would be impacted is considered poor quality habitat. The amount of habitat removal is small when the amount of available higher-quality habitat in the locality is considered.

Much of the native vegetation within the amended ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence. Importantly, the amended proposal would not result in fragmentation of habitat for these species. These species are highly mobile and will freely fly long distances over open areas to move between habitats. The amended proposal would not affect the movement of the Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis between habitat patches.

The vegetation in the amended ecological study area would form a small component of a larger foraging range for these species. Riparian vegetation is likely to be a focal point of foraging activity, as are the edges of vegetation patches. The loss of native vegetation from the amended ecological study area would reduce the amount of foraging habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants in the locality, the vegetation within the amended ecological study area is not considered as important for the long-term survival of these species.

d. **whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

e. **whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis, the amended proposal is consistent with two Key Threatening Process (KTP) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The amended proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the amended proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the amended ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis would potentially be impacted by a small reduction in extent of foraging habitat from the amended proposal. It is unlikely that roosting habitat would be affected. The amended proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the amended proposal is unlikely to result in a significant impact to these threatened insectivorous bats.

**Insectivorous bats (hollow-roosting)**

- The species subject to this assessment include:
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

The Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat were not identified in the amended ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat are moderately likely to occur within the amended ecological study area based on the presence of suitable habitat (particularly vegetated riparian zones) and nearby records. These species have been recorded widely in the locality and are likely to use the amended ecological study area as foraging habitat on occasion. These species are widespread on the Cumberland Plain and are powerful flyers capable of fast long-distance travel for foraging.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a. **in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Eastern False Pipistrelle prefers to inhabit moist habitats with mature trees taller than 20 metres. This species generally roosts in eucalypt hollows, though has also been found under loose bark on trees or in buildings. The Eastern False Pipistrelle hibernates in winter and females are pregnant in late spring to early summer.

The Eastern Coastal Free-tailed Bat occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in human-made structures.

The Greater Broad-nosed Bat utilises a variety of habitats from woodland through to moist and dry open eucalypt forest and rainforest. This species usually roosts in tree hollows but has also been found in buildings. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of young.

The Yellow-bellied Sheathtail-bat roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. The Yellow-bellied Sheathtail-bat forages in most habitats

including forested areas and open paddocks. Breeding has been recorded from December to mid-March, when a single young is born. The seasonal movements of this species are unknown but there is speculation about a migration to southern Australia in late summer and autumn.

The amended ecological study area is likely to provide suitable habitat for these four species. In particular, the riparian zones are likely to be a focal point for foraging due to the higher productivity of these areas (i.e. more insect prey available around creek lines). Tree hollows were also present in some remnant mature trees around the dam in the north of the amended proposal site, providing potential roosting opportunities. Tree hollows were recorded as moderately abundant in the large remnant trees in the amended ecological study area.

These species, particularly the Yellow-bellied Sheathtail-bat are large and fast flyers and will exploit the edges of vegetation and open treeless areas for foraging. As such, foraging habitat for these species is widespread in the locality. It is unknown whether the amended ecological study area contains a roost site for any of these species. However, the eight hollow bearing trees that were recorded in the amended ecological study area may provide some suitable roosting habitat for these species. Breeding may potentially occur in these trees or these trees may form part of the range of breeding bats and may be used intermittently as shelters. Other trees and vegetation in the amended ecological study area may also be suitable for roosting under loose bark or in foliage.

The amended proposal would impact up to 2.98 hectares of suitable foraging habitat and four hollow-bearing trees would be removed. However, much of this area is not considered high quality habitat. The current potential for these species to occur based on the presence of potential foraging habitat in the amended ecological study area and wider locality is expected to remain after completion of the proposal.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   - **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   - **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   - **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   - **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   - **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The amended proposal would remove around 2.98 hectares of suitable foraging habitat and four hollow-bearing trees would be removed. However, much of this area is considered poor quality habitat. The amount of habitat removal is small when the amount of available habitat in the locality is considered. Tree hollows were present in some remnant mature trees around the dam providing potential roosting opportunities. Tree hollows were recorded as moderately abundant in the large remnant trees in the amended ecological study area.

Much of the native vegetation within the amended ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence. Importantly, the amended proposal would not result in fragmentation of habitat for these species. These species are highly mobile and will freely fly long distances over open areas to move between habitats. The

amended proposal would not affect the movement of the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat between habitat patches.

The vegetation in the amended ecological study area would form a small component of a larger foraging range for these species. Riparian vegetation is likely to be a focal point of foraging activity, as are the edges of vegetation patches. The loss of native vegetation and hollow-bearing trees from the amended ecological study area would reduce the amount of habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants and abundance of tree hollows in the locality, the vegetation within the amended ecological study area is not considered as important for the long-term survival of these species.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat, the amended proposal is consistent with two Key Threatening Process (KTP) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The amended proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing, and habitat removal associated with the amended proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the amended ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

The four insectivorous bat species subject to this assessment would potentially be impacted by a small reduction in extent of foraging habitat from the amended proposal. Up to four hollow-bearing trees that may be utilised as roosts would be impacted. The amended proposal is unlikely to reduce the population size or decrease the reproductive success of this species. After consideration of the factors above, an overall conclusion has been made that the amended proposal is unlikely to result in a significant impact to these threatened insectivorous bats.

**Woodland birds**

The two woodland bird species concerning this assessment are known to utilise highly modified and partially-cleared habitats and are likely to pass through the amended ecological study area periodically. The amended ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to foraging. The species subject to this assessment include:

- Dusky Woodswallow (*Artamus cyanopterus*)
- Varied Sittella (*Daphoenositta chrysoptera*)

The Dusky Woodswallow and Varied Sittella were not identified in the amended ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

**a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Dusky Woodswallow primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and groundcover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. It feeds on invertebrates, mainly insects, which are captured whilst hovering or sallying above the canopy or over water. It also frequently hovers, sallies and pounces under the canopy, primarily over leaf litter and dead timber. Nests are an open, cup-shape, made of twigs, grass, fibrous rootlets and occasionally casuarina needles, and generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post.

The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.

Suitable foraging habitat for the Dusky Woodswallow and Varied Sittella is present within the amended ecological study area where there are rough-barked tree species and mature smooth-barked gums with dead branches. Breeding habitat is considered unlikely to be present, due to the poor quality of vegetation in the amended proposal site. However, potential breeding habitat is more likely to occur in the larger less disturbed vegetation remnants in the locality.

The loss of vegetation within the amended ecological study area would directly affect the opportunity for these woodland birds to feed in the area. The amended proposal would impact up to hectares of potential suitable habitat for the Dusky Woodswallow and Varied Sittella. However, much of this potential suitable habitat is not considered critical habitat. The current potential for these species to occur, based on the presence of potential foraging habitat, is unlikely to be affected by the amended proposal.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The extent of habitat for the Dusky Woodswallow and Varied Sittella would be impacted by 2.19 hectares. However, much of this area is considered poor quality habitat. The amount of habitat removal is relatively small when the amount of available habitat in the locality is considered.

Much of the native vegetation within the amended ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence. Movement of individuals and exchange of genetic material from the vegetation in the amended ecological study area to and from vegetation along the Ropes Creek corridor can be expected. Importantly, the amended proposal would not result in fragmentation of habitat for these species. These species are known to utilise highly modified and partially cleared habitats and are likely to pass through the amended ecological study area on occasion. The amended ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to foraging. The amended proposal would not affect the movement of the Dusky Woodswallow and Varied Sittella between habitat patches.

The vegetation in the amended ecological study area would form a small component of a larger foraging range for these species. Riparian vegetation is likely to be a focal point of foraging activity, as are the edges of vegetation patches. The loss of native vegetation from the amended ecological study area would reduce the amount of foraging habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants in the locality, the vegetation within the amended ecological study area is not considered as important for the long-term survival of these species.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Dusky Woodswallow and Varied Sittella, the amended proposal is consistent with three Key Threatening Processes (KTP's) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees

The amended proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.

- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the amended proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the amended ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

These two woodland bird species would potentially be impacted by a small reduction in extent of foraging habitat from the amended proposal. The amended proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the amended proposal is unlikely to result in a significant impact to these species.

**Nectarivorous birds**

The species subject to this assessment include:

- Little Lorikeet (*Glossopsitta pusilla*)
- Swift Parrot (*Lathamus discolor*)

The Little Lorikeet and Swift Parrot were not identified in the amended ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The Little Lorikeet is highly likely to occur within the amended ecological study area and was recorded in 2019 occurring 300 metres from the amended ecological study area in Shale Plains Woodland.

Additionally, the Swift Parrot is moderately likely to occur within the amended ecological study area and records indicate a scattered distribution throughout the locality. The nearest record is from St Clair in 2014, 3.5 kilometres north west of the amended ecological study area. However, the Swift Parrot is a migrant species that does not breed in the locality and is considered to occur within the amended ecological study area on an infrequent basis during winter migration.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a. **in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Little Lorikeet occurs just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets are generally considered to be nomadic and forage mainly on flowers, nectar and fruit. The breeding biology of Little Lorikeets is partially known however studies indicate that nest hollows are located at heights of between 2 metres and 15 metres, mostly in living, smooth-barked eucalypts, and hollow openings are approximately 3 centimetres in diameter.

The Swift Parrot breeds only in Tasmania and breeding success is strongly correlated with the intensity and extent of flowering of Tasmanian Blue Gums. The majority of the species migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal

plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands.

No significant areas of potential foraging habitat for these species was identified during the field survey. *Eucalyptus tereticornis* is a winter flowering species and may provide a foraging resource for migrating Swift Parrots. A range of hollow sizes are present in large remnant trees in the amended ecological study area, which may provide roosting opportunities for both species and potentially nesting habitat for the Little Lorikeet. The amended proposal would impact up to 2.19 hectares of vegetation that would provide potential foraging habitat and four hollow-bearing trees would be removed. However, much of this area is not considered critical habitat for these species. Shelter and food resources in the amended ecological study area are likely to be important for the life cycle of these species, however there is a low potential that the amended proposal would adversely affect the life-cycle of the species to be impacted given the widespread occurrence of suitable foraging habitat and nearby records.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The amended proposal would remove around 2.19 hectares of potential foraging habitat and four hollow-bearing trees would be removed. However, much of this area is considered poor quality habitat. The amount of habitat removal is relatively small when the amount of available habitat in the locality is considered. A range of hollow sizes are present in large remnant trees in the amended ecological study area, which may provide roosting opportunities for both species and potentially nesting habitat for the Little Lorikeet.

Much of the native vegetation within the amended ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence. Movement of individuals and exchange of genetic material from the vegetation in the amended ecological study area to and from vegetation along the Ropes Creek corridor can be expected. Importantly, the amended proposal would not result in fragmentation of habitat for these species. These species are highly mobile and will freely fly long distances over open areas to move between habitats. The amended proposal would not affect the movement of the Little Lorikeet and Swift Parrot between habitat patches.

The vegetation in the amended ecological study area would form a small component of a larger foraging range for these species. The Swift Parrot has been recorded in the locality (notably three records on Eastern Creek in 2019) and sporadically occurs in the urbanised areas of western Sydney during winter. *Eucalyptus tereticornis* is a winter flowering species and the trees in the amended ecological study area may provide a foraging resource for

migrating Swift Parrots. Additionally, the Little Lorikeet has been recorded in 2019 occurring 300 metres from the amended ecological study area in Shale Plains Woodland, which also occurs in the amended ecological study area. A range of hollow sizes are present in large remnant trees in the amended ecological study area, which may provide roosting opportunities for both species and potentially nesting habitat for the Little Lorikeet. The Swift Parrot and Little Lorikeet may pass through the amended ecological study area during movements between larger foraging habitats (e.g. from Prospect Nature Reserve to Whalan Reserve and Wianamatta Regional Park and Nature Reserve), though the habitat that would be impacted is not considered to be important to the long-term survival of the species.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Little Lorikeet and Swift Parrot, the amended proposal is consistent with two Key Threatening Processes (KTP's) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The amended proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing and habitat removal associated with the amended proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the amended ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

These two nectarivorous birds would potentially be impacted by a small reduction in extent of foraging habitat from the amended proposal. The loss of four large hollow-bearing tress may also reduce roosting and nesting (Little Lorikeet) opportunities in the locality. However, considering the small proportion of habitat to be lost, the amended proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the amended proposal is unlikely to result in a significant impact to these species.

**Large predatory birds**

The four large predatory bird species concerning this assessment are known to utilise highly modified and partially cleared habitats and are likely to pass through the amended ecological study area periodically. The amended ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to foraging.

The species subject to this assessment include:

- Little Eagle (*Hieraaetus morphnoides*)
- Square-tailed Kite (*Lophoictinia isura*)
- Powerful Owl (*Ninox strenua*)
- Masked Owl (*Tyto novaehollandiae*)

The Little Eagle, Square-tailed Kite, Powerful Owl and Masked Owl were not identified in the amended ecological study area during field surveys for this assessment. No targeted surveys have been undertaken as part of this assessment.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a. **in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet.

The Square-tailed Kite hunts primarily over open forest, woodland and mallee communities as well as over adjacent heaths and other low scrubby habitats in wooded towns. It feeds on small birds, their eggs and nestlings as well as insects. Seems to prefer structurally diverse landscapes.

The Powerful Owl is a sedentary species with a home range of approximately 1,000 hectares it occurs within open eucalypt, *Casuarina* or *Callitris* pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally, feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands.

The Masked Owl occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. They are also known to occasionally roost and nest in caves.

These large predatory bird species may visit the amended ecological study area on occasion to hunt, however no high-quality habitat is present within the amended ecological study area for these species. No large stick nests for the Little Eagle and Square-tailed Kite were observed during the field surveys. The nearest record in 2015 of the Powerful Owl is located between Erskine Park and Eastern Creek (2km east of the amended ecological study area). This record is located in Shale Plains Woodland, vegetation which is also present in the amended ecological study area. Suitable marginal foraging habitat is present on the amended proposal site for the Powerful Owl. However, no large tree hollows suitable for breeding were observed during the field survey. Alternatively, the most suitable habitat for the Masked Owl exists along Ropes Creek. The Masked Owl exhibits no breeding habitat within the amended ecological study area.

The amended proposal would impact up to 2.19 hectares of potential foraging habitat for these species. However, much of this area is not considered critical habitat for these species. No nesting habitat for these species would be impacted by the amended proposal. Shelter and food resources in the amended ecological study area are likely to be important for the life cycle of these species, however there is a low potential that the amended proposal would adversely affect the life-cycle of the species to be impacted given the widespread occurrence of suitable foraging habitat and nearby records in the locality.

This amount of habitat removal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

**b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
   **ii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
   **iii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**c. in relation to the habitat of a threatened species or ecological community:**
   **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
   **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
   **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The extent of potential foraging habitat for the Little Eagle, Square-tailed Kite, Powerful Owl and Masked Owl would be reduced by 2.19 hectares. However, no high-quality habitat is present within the amended ecological study area for these species and these species may only visit the amended ecological study area on occasion to hunt. The amount of habitat removal is small when the amount of available habitat in the locality is considered. No stick nests or large hollows were observed during the field surveys.

Much of the native vegetation within the amended ecological study area is quite fragmented in nature and is in proximity to Ropes Creek, which exhibits a relatively intact riparian corridor and fringing woodland along most of its occurrence. Importantly, the amended proposal would not result in fragmentation of habitat for these species. These species are known to utilise highly modified and partially cleared habitats and are likely to pass through the amended ecological study area on occasion to hunt. The amended ecological study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be likely restricted to foraging. The amended proposal would not affect the movement of these four large predatory bird species between habitat patches.

The vegetation in the amended ecological study area would form a small component of a larger foraging range for these species. The loss of native vegetation from the amended ecological study area would reduce the amount of foraging habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants in the locality, the vegetation within the amended ecological study area is not considered as important for the long-term survival of these species.

**d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)**

The amended proposal would not impact on any declared area of outstanding biodiversity value.

**e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

With respect to the Little Eagle, Square-tailed Kite, Powerful Owl and Masked Owl, the amended proposal is consistent with three Key Threatening Processes (KTP's) listed under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees

The amended proposal may also indirectly contribute to several other KTPs including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.

The extent of native vegetation clearing, and habitat removal associated with the amended proposal is considered unlikely to be significant in terms of available habitat for these species adjacent to the amended ecological study area. Hygiene and weed control measures would reduce or avoid the impact of most other KTPs.

**Conclusion**

These four large predatory birds would potentially be impacted by a small reduction in extent of potential foraging habitat from the amended proposal. No breeding habitat is likely to be impacted. The amended proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the amended proposal is unlikely to result in a significant impact to these species.

## Environment Protection and Biodiversity Conservation Act 1999 assessment

**Green and Golden Bell Frog (*Litoria aurea*)**

The amended ecological study area contains suitable habitat for the Green and Golden Bell Frog. Although there are very few recent records of this species in the locality and no known populations, there is potential for the Green and Golden Bell Frog to disperse along the Ropes Creek riparian corridor. Therefore, the Green and Golden Bell Frog is moderately likely to occur in the habitats in the amended ecological study area.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

**1. lead to a long-term decrease in the size of a population**

The amended ecological study area contains some areas of habitat (PCT 1071) that meet characteristics that have been described for the Green and Golden Bell Frog. This species has not been confirmed in the amended ecological study area. A single record on Ropes Creek eight kilometres north of the amended ecological study area from 2012 may be evidence that a low-density population is active in the locality. This species may possibly disperse as far as 10 kilometres (White & Pyke 2008) and therefore has the potential to occur based on the presence of this suitable habitat and the connectivity corridor provided by Ropes Creek.

The amended proposal would impact up to 0.79 hectares of suitable aquatic habitat in the form of PCT 1071, as well as surrounding exotic grasslands that may be suitable foraging and dispersing habitat. The amended proposal would not directly impact on a known breeding site or key population. The loss of habitat would be to potential foraging and sheltering habitat only. The habitat lost is a very small proportion of the availability of similar-quality farm dam habitats in the locality. Therefore, the amended proposal is unlikely to lead to a long-term decrease in the size of a population.

**2. reduce the area of occupancy of the species**

The Green and Golden Bell is found in a wide range of water bodies across the Cumberland Plain, except fast flowing streams. This species is highly mobile and may disperse up to 10km. The Green and Golden Bell Frog has not been identified on the amended proposal site, therefore the amended proposal is unlikely to directly impact a population. The amended proposal would reduce the area of available foraging and sheltering habitat in the locality by 0.79 hectares. However, considering the availability of similar-quality farm dam habitats in the locality, the amended proposal is unlikely to reduce the area of occupancy of the Green and Golden Bell Frog in the Cumberland Plain.

**3. fragment an existing population into two or more populations**

Fragmentation is unlikely to occur from the amended proposal, as the farm dams along two first order drainage lines which would be removed do not provide any east-west connectivity. The habitat removed would likely represent potential sheltering and foraging habitats for any individuals moving along the Ropes Creek corridor. The Ropes Creek corridor and north-south connectivity would not be impacted by the amended proposal.

**4. adversely affect habitat critical to the survival of a species**

No critical habitat has been listed for the Green and Golden Bell Frog on the EPBC Act Register of Critical Habitat.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long-term evolutionary development
- For the reintroduction of populations or recovery of the species or ecological community.

The most important habitat for the Green and Golden Bell Frog located in the amended ecological study area is occurrence of PCT 1071. A moderate to high abundance of the predatory Eastern Gambusia was identified in these areas and so are somewhat reduced in their capacity to be used as successful breeding habitat. The habitats on site may be used as foraging and sheltering habitat by dispersing individuals and are unlikely to be critical to the species' survival.

**5. disrupt the breeding cycle of a population**

This species has not been recorded at the amended proposal site. No breeding is reasonably expected to occur. The impact would be limited to a reduction in potential sheltering and foraging habitat for dispersing individuals. The breeding cycle of a population is unlikely to be disrupted by the amended proposal.

6. **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The amended proposal would reduce the area of available foraging and sheltering habitat in the locality by 0.79 hectares. However, considering the availability of similar-quality farm dam habitats in the locality, the action is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

7. **result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species' habitat**

Introduced Eastern Gambusia, which are known to prey on the tadpoles of the Green and Golden Bell Frog, are already established in the habitats in the amended ecological study area. Therefore, the amended proposal is unlikely to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

8. **introduce disease that may cause the species to decline, or**

The presence and spread of the Chytrid Fungus is recognised as a Key Threatening Process in Australia and is widely regarded as playing an important role in the decline of the Green and Golden Bell Frog. Chytrid Fungus is already widespread in NSW; however, some populations of this species are free from or resistant to it. It has been suggested that such populations are in areas inhospitable to the growth of the disease, such as fluctuating levels of salinity.

The disease has been recorded in the Parramatta key population. Any work in and around the suitable habitat during clearing would follow the Hygiene Protocol for the Control of Disease in Frogs (Department of Environment and Climate Change 2008b) to reduce the spread of Chytrid fungus. Therefore, the amended proposal is unlikely to introduce disease that may cause the species to decline.

9. **interfere with the recovery of the species.**

There is no recovery plan for the Green and Golden Bell Frog. The Management Plan for the Green and Golden Bell Frog Parramatta Key Population (Department of Environment and Climate Change, 2007b) provides a list of six strategies.

The amended proposal would reduce the area of available foraging and sheltering habitat in the locality by 0.79 hectares, which does not align with recovery of this species. However, given this is a very minor loss of habitat in proportion to the amount of similar-quality habitat available in the locality, the amended proposal is unlikely to interfere with the recovery of the Green and Golden Bell Frog.

**Conclusion**

This species has not been identified in the amended ecological study area and no individuals are expected to be directly impacted. The amended proposal would remove up to 0.79 hectares of suitable aquatic habitat in the form of PCT 1071 and surrounding exotic grasslands that may be suitable foraging and dispersing habitat. The amended proposal would not directly impact on a known breeding site or any habitat critical to the survival of this species. The habitats are likely to represent foraging and shelter for individuals dispersing across the landscape and are a small proportion of the availability of similar quality habitat in the locality. Surveys for this species would be undertaken as part of the pre-clearing process prior to the commencement of clearing and de-watering of ponds. Overall, the amended proposal is considered unlikely to result in a significant impact to the Green and Golden Bell Frog.

**Grey-headed Flying-fox (*Pteropus poliocephalus*)**

The Grey-headed Flying-fox is considered moderately likely to utilise the PCTs within the amended ecological study area as foraging habitat.

The Grey-headed Flying-fox exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. As a result, for this assessment, the impact has been considered in terms of 'important habitat' as opposed the presence of an 'important population'.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

1. **lead to a long-term decrease in the size of an important population of a species**

There are no roost camps in the amended ecological study area and the action would not affect any known permanent roosting, breeding / maternity site. Therefore, it is likely that the impacts of construction and operation of the action would be confined to minor loss of foraging habitat caused by direct clearing or damage to native vegetation during the construction phase. There is also a low risk of vehicle strike during operation.

The amended proposal would remove around 2.19 hectares of potential foraging habitat. Given the relatively widespread nature of similar poor condition vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of local individuals, the amended proposal is not expected to significantly affect important habitat or lead to a long-term decrease in the size of an important population.

2. **reduce the area of occupancy of an important population**

The area of occupancy of the Grey-headed Flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The area occupied by this species would remain the same after the action. No decrease in the area of occupancy for this species expected as a result of the amended proposal.

3. **fragment an existing important population into two or more populations**

Highly mobile species such as bats are expected to be less impacted by fragmentation. The Grey-headed Flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom in differing parts of the landscape. The amended proposal would not fragment an important population of the Grey-headed Flying-fox. Individuals would still be able to disperse between roosts along the east Australian coast. Genetic exchange within the population and dispersal would not be disrupted by the amended proposal.

4. **adversely affect habitat critical to the survival of a species**

This species typically exhibits very large home range and Grey-headed Flying-fox is known to travel distances of at least 50 kilometres from roost sites to access seasonal foraging resources. There are no known roost camps within the amended ecological study area and the amended proposal site does not provide critical roosting habitat. However, there are a number of known roost camps with a 50-kilometre radius of the amended proposal, the closest being the Nationally Important Parramatta Park camp and/or the intermittent Ropes Creek camp. The draft recovery plan for the Grey-headed Flying-fox identifies critical foraging habitat for this species as:

- Productive during winter and spring, when food bottlenecks have been identified
- Known to support populations of >30,000 individuals, within an area of 50-kilometre radius of a camp site

- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (Sept-May)
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

Native vegetation within the amended ecological study area may constitute critical foraging habitat however the affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50-kilometre radius of the Parramatta Park camp and/or the intermittent Ropes Creek camp. Given the extensive nature of high-quality foraging habitats along the escarpment, the amended proposal is not expected to adversely affect foraging habitat critical to the survival of this species in this region.

**5. disrupt the breeding cycle of an important population**

As stated above there would be a minor impact on foraging habitat during the breeding cycle of the species. The amended proposal would not directly impact on a known roost camp / breeding or maternity site. Extensive foraging resources are available in the locality that would provide suitable resources during the maternity season. The habitats in the amended ecological study area are not limiting for this species.

**6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The impacts to foraging habitat are minimal and no evidence of a roost camp has been identified from the amended ecological study area. This impact is not expected to lead to a decline in the species in this region considering the magnitude of this impact and the expanse of high-quality foraging habitat available to local animals along the escarpment.

**7. result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat**

The action is unlikely to result in an invasive species harmful to the Grey-headed Flying-fox becoming established in the habitat. The potential for weed invasion is considered possible with a amended proposal of this nature and appropriate management and mitigation measures would be implemented during construction and operation of the amended proposal to reduce this threat. The management of invasive species would be managed under the construction environmental management plan and during operation of the facility using best practice methods.

**8. introduce disease that may cause the species to decline, or**

There are no known disease issues affecting this species in relation to the action. The action would be unlikely to increase the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the facility. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols to prevent the introduction or spread of pathogens.

The management and mitigation measures for the amended proposal would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

**9. interfere substantially with the recovery of the species.**

The *Draft National Recovery Plan for the Grey-headed Flying-fox* (*Pteropus poliocephalus*) (Department of Environment Climate Change and Water, 2009) outlines the following actions:

- Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
- Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- Monitor population trends for the Grey-headed Flying-fox
- Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan

The recovery actions listed above are largely not applicable to the action and the action is not expected to interfere substantially with the recovery of the species.

**Conclusion**

The Grey-headed Flying-fox would suffer a small reduction in extent of suitable foraging habitat from the action. No breeding camps or other important habitat would be impacted. The action is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The action would not interfere with the recovery of the Grey-headed Flying-fox and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Grey-headed Flying-fox.

**Swift Parrot (*Lathamus discolor*)**

The Swift Parrot (*Lathamus discolor*) is considered moderately likely to occur based on the presence of suitable winter foraging habitat and potential roosting habitat in four large hollow-bearing *Eucalyptus tereticornis* trees.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

**1. lead to a long-term decrease in the size of a population**

The amended ecological study area contains some potential foraging and roosting (hollow-bearing trees) habitat for the Swift Parrot. While the habitat in the amended ecological study area is not optimal, the loss of potential feed trees would directly affect the species opportunity to feed in the area. However, the amended ecological study area is not considered a critical area for the Swift Parrot. The Swift Parrot may utilise trees in the amended ecological study area for foraging intermittently when no other suitable inland (i.e. box ironbark woodlands) or coastal resources (i.e. Spotted Gum or Swamp Mahogany forests) are available. The potential foraging habitat for this species would be reduced by about 2.19 hectares, as well as a loss of up to four large hollow-bearing trees. Within the Cumberland subregion, this potential habitat removal represents less than 0.01 percent of the currently available habitat for this species.

The Swift Parrot does not breed in the amended ecological study area and the extent of habitat remaining in the locality area would provide sufficient resources to sustain future visitation, such that the action itself is unlikely to lead to a long-term decrease in the size of the Australian population.

**2. reduce the area of occupancy of the species**

Swift Parrots are vulnerable to the loss of quantity and quality of key forage tree species. As a large-scale migrant, it has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the region and may utilise trees in the amended ecological study area for foraging intermittently when no other suitable resources are available.

The project would contribute to the loss of potential foraging habitat which would reduce the area of habitat available. However, the action would not reduce the area of occupancy of this species which is estimated at 4,000 square kilometres.

**3. fragment an existing population into two or more populations**

Importantly, the action would not result in fragmentation of habitat for the Swift Parrot. This species is highly mobile and as a regular behaviour flies long distances over open areas to move between suitable foraging habitats. The action would not affect the movement of the Swift Parrot between habitat patches or fragment the population.

**4. adversely affect habitat critical to the survival of a species**

Key habitats for this species on the coast and coastal plains of New South Wales include large stands of Spotted Gum (*Corymbia maculata*), Swamp Mahogany (*Eucalyptus robusta*), Red Bloodwood (*Corymbia gummifera*) and Forest Red Gum (*Eucalyptus tereticornis*) forests. The amended ecological study area supports some Forest Red Gum and therefore suitable habitat for this species is considered to be present. The hollow-bearing trees in the amended ecological study area may also be used by migrating birds to rest.

The habitat within the amended ecological study area is considered to be secondary habitat for the Swift Parrot as this species is not regularly recorded from the area and it is not known as critical habitat.

**5. disrupt the breeding cycle of a population**

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania and migrates to mainland Australia in autumn. As such, the action would not impact on breeding habitat for this species. Important winter foraging grounds would not be impacted.

**6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

Potential foraging habitat for this species would be reduced by about 2.19 hectares. Four hollow-bearing trees that may provide roosting habitat for migrating birds would also be removed. As a large-scale migrant, it has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the region and may utilise trees in the amended ecological study area for foraging intermittently when no other suitable resources are available. The action is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

**7. result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species' habitat**

The main invasive species harmful to the habitat for the Swift Parrot is weeds. Noisy Miners are abundant in and around the habitats in the amended ecological study area which may make the habitat less suitable for the Swift Parrot due to competitive exclusion. The action may result in weed invasion and the removal of habitat may concentrate local miner populations increasing competition. The management of invasive species would be managed under in accordance with mitigation measures listed in Table 8-46 of the REF.

**8. introduce disease that may cause the species to decline, or**

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the facility. This would be adequately mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols to prevent the introduction or spread of pathogens.

The project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

**9. interfere with the recovery of the species.**

The *National Recovery Plan for the Swift Parrot* (Saunders and Tzaros, 2011) aims to achieve and sustain a positive population trend for the Swift Parrot over the life of the Recovery Plan. This will be achieved by implementing the actions set out in this Recovery Plan that minimise threats while protecting and enhancing the species' habitat throughout its range. These objectives would be achieved by implementing recovery actions for each of the following specific recovery objectives:

- Strategy 1: Develop and apply techniques to measure changes in population trajectory in order to measure the success of recovery actions.
- Strategy 2: Manage and protect known Swift Parrot breeding and foraging habitat at the landscape scale.
- Strategy 3: Reduce impacts from Sugar Gliders at breeding sites.
- Strategy 4: Improve understanding of foraging and breeding habitat use at a landscape scale in order to better target protection and restoration measures.

These objectives, and the associated recovery actions outlined in the *National Recovery Plan for the Swift Parrot* (Saunders and Tzaros, 2011) are not applicable to the amended ecological study area or amended proposal. The identified recovery actions mostly relate to identifying the extent and quality of habitat, monitoring, raising community awareness, and coordinating and reviewing the recovery process. There is an action relating to manage and protect Swift Parrot habitat at the landscape scale. However, this action applies to fencing off

habitat on private land to encourage regeneration of habitat, revising forestry practices, developing a strategic management plan for Swift Parrot breeding habitat in Tasmania, and providing Swift Parrot conservation information for consideration during the New South Wales Local Government Local Environmental Planning review process. The recovery actions identified in the *National Recovery Plan for the Swift Parrot* (Saunders and Tzaros, 2011) would not be interfered with by the amended proposal.

**Conclusion**

The Swift Parrot would suffer a small reduction in extent of foraging habitat and loss of potential roosting habitat (four hollow-bearing trees) from the action. The action is unlikely to reduce the population size of the Swift Parrot or decrease the reproductive success of this species. The action would not interfere with the recovery of the Swift Parrot. For the Swift Parrot, impacts are most likely to be significant where a amended proposal or activity may result in loss of habitat in, or adjacent to priority foraging, nesting and roosting sites (Saunders and Tzaros, 2011). The amended proposal would not impact on any priority foraging habitat. As such, after consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Swift Parrot.

# Appendix C Response to Submissions

# Sydney Metro West

## Eastern Creek Precast Facilities – Response to Submissions

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# Response to submissions (Blacktown City Council)

*This appendix outlines the issues raised in the submissions received in response to the public exhibition of the Eastern Creek Precast Facilities Review of Environmental Factors, as well as Sydney Metro's response to these issues.*

## Submissions received

The Review of Environmental Factors (REF) for the proposal was exhibited from 16 November 2020 to 4 December 2020. The exhibited REF documents were made available online via the Sydney Metro website and on the Sydney Metro West interactive portal. Copies of the documents were also provided to Blacktown City Council and St Clair Library to exhibit. Sydney Metro West provided briefings to key stakeholders and distributed a community newsletter to about 1,200 residential properties in the vicinity of the proposal site. The newsletter notified the community about the proposal, provided information about the works and likely construction and operational environmental impacts, and outlined how to make a submission on the REF documents. The Sydney Metro Place Manager also contacted local businesses and residents via a targeted doorknock.

Consultation with the community and stakeholders during the public exhibition period was carried out as described in Chapter 6 of the REF. One submission was received in response to the exhibited REF; from Blacktown City Council. The issues raised in this submission and Sydney Metro's response to the issues raised are provided in Table 1.

### Table 1: Issues raised by Blacktown City Council

| Issue raised | Response to issue |
|---|---|
| **Water Conservation:** A concrete batching plant has high water demands. The reuse of rainwater and stormwater on site should be maximised while ensuring it is fit for purpose. Collecting the treated subsoil water from the bioretention or sewer mining from the sewer at the rear should also be considered. | Sydney Metro has specified a number of water use targets for the construction and operation of the Eastern Creek Precast Facilities. These include reduction in the overall water use and maximising the percentage of non-potable water use as noted in Section 8.15.1 of the exhibited REF.<br><br>The use of non-potable water in concrete production is common industry practice and would be implemented as business as usual. Maximising the use of non-potable water and recycling of operational water in concrete production at the Eastern Creek Precast Facilities would be balanced with durability and quality considerations through specifications on the quality of the non-potable water that can be used.<br><br>Typical measures may include:<br>• The use of a water balance study<br>• The use of water efficient construction methods and equipment<br>• Harvesting of rainwater where feasible and reasonable<br>• Metering of water supplies to allow for comparison against the specified targets<br>• Requirements relating to concrete production operation water passed down through the supply chain.<br><br>The opportunity for collection of non-potable water sources across the amended proposal site would be considered where feasible and reasonable during detailed design. |

| Issue raised | Response to issue |
|---|---|
| **Water Quality:** In addition to the water quality objectives outlined in Table 8-35 of the REF Volume 1, the development needs to consider the following percentages post development pollutant reduction targets and take the higher standard of the two:<br>• 90% gross pollutants<br>• 85% total suspended solids<br>• 65% total phosphorous<br>• 45% total nitrogen<br>• 90% total hydrocarbons.<br>Water quality treatment should be on-lot and not in the regional basin in keeping with other council precincts. | The water management infrastructure to be provided for construction and operation of the amended proposal would be designed to achieve the post development pollutant reduction targets identified.<br>The use of these targets would likely improve the quality of water discharge from the amended proposal site compared to pre-development flows. The exhibited REF identified the receiving environment of Ropes Creek to be of poor water quality given its moderately to highly degraded condition. As the receiving environment currently does not meet the ANZECC guidelines, site discharges from the amended proposal site would likely improve the existing quality of water of the receiving environment towards achieving the ANZECC criteria (as identified in Section 8.8.3 of the REF).<br>Water quality management infrastructure would be predominately located within the amended proposal site, rather than surrounding lands (the regional basin). |

| Issue raised | Response to issue |
|---|---|
| **Fill Levels:** In excess of 7 m of fill may be required in the south-west corner of the development site to grade the site back to the temporary basin. Such filling cannot encroach into the RE1 land or into the proposed conservation area. Where retaining walls are used, these are to be tiered and have a maximum rise of 3 m with a minimum 1.5 m separation for screen planting. | All works (including fill and grading) would take place within the amended proposal site boundary. The majority of the amended proposal site is located within land zoned as IN1 (General industrial) under the Blacktown Local Environmental Plan 2015 (Blacktown LEP) .<br><br>About 0.18 hectares of the north-west corner of the amended proposal site would be located on land zoned as RE1 (Public recreation). This land would be used for the construction and operation of water management infrastructure comprising the proposed basins for the amended proposal. This land is within the land acquired or leased by Sydney Metro from the Office of Strategic Lands for the purpose of the proposal.<br><br>No works would take place within land zoned as E2 (Environmental conservation) under the Blacktown LEP 2015. A proposed environmental protection area would be established on the amended proposal site, with protective fencing, in order to ensure that no works encroach into this conservation area.<br><br>The Council submission regarding the design requirements for retaining walls is noted. The amended proposal design does not propose the use of retaining walls. As described in Section 2.2.2 of the Addendum REF, the sides of the proposed basins would be constructed with reinforced earth batters. |

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