Review of Environmental Factors

Hill Road and Bennelong Parkway Traffic Signals Upgrade

Report prepared by Narla Environmental Pty Ltd

For City of Parramatta Council

July 2022

NARLA
environmental

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Narla Environmental Pty Ltd

www.narla.com.au

Report Certification

Works for this report were undertaken by:

Staff Name	Position	Role
Emily Rix *BSc (Hons)*	Narla Environmental – Project Manager/Ecologist	Document Review, Project Management, Desktop Review
James Kirk *BEnvSci*	Narla Environmental – Project Coordinator/Ecologist	Field Ecologist, Mapping, Reporting
Christopher Moore *BBioCons*	Narla Environmental – Project Manager/Ecologist	Report Review
Jonathan Coy *BEnv*	Narla Environmental – Project Manager/Ecologist	Reporting

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Executive Summary

City of Parramatta Council (CoP) propose to install traffic signals at the Hill Road and Bennelong Parkway Intersection (the proposal area) due to the significant growth the Sydney Olympic Park and Wentworth Point area areas are experiencing. The proposal aims to improve safety and traffic flow through the area in response to increasing traffic volume.

Key features of the proposal are:

- New traffic signals at the intersection of Hill Road and Bennelong Parkway;
- Signalised pedestrian crossings on Hill Road and Bennelong Parkway;
- Dedicated right hand turn from Hill Road into Bennelong Parkway;
- Dedicated right hand turn from Bennelong Parkway into Hill Road; and,
- Reconstruction of footways and ramps to improve accessibility.

The objectives of the proposal are:

- Improve traffic flow;
- Provide for safe and efficient movement of vehicles and pedestrians within the locality; and,
- Minimise environmental impacts.

Clause 2.108 of State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP) permits development, on any land, for the purpose of a road or road infrastructure facilities to be to be carried out by or on behalf of a public authority without consent. As the proposal meets the definitions of 'road infrastructure facilities' provided for by clauses 2.107 and 2.108(2) of the TISEPP, and is being carried out by CoP, it is permissible without consent under TISEPP. As a result, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), and development consent is not required. A review of environmental factors (REF) has been prepared.

Aboriginal Heritage

The proposal area contains no evidence of past Aboriginal occupation. No sites have been previously recorded on the Aboriginal Heritage Information Management System (AHIMS) within 200m of the proposal area (Appendix G). It is noted that some sites are known in the greater locality (<300m away), however no impact to Aboriginal sites is anticipated.

A search of the NSW State Heritage Inventory indicated one item in the direct vicinity of the proposal area is included on the State Heritage Register:

- Newington Armament Depot and Nature Reserve

However, this heritage precinct is located >50m from the proposed activity, therefore it is not expected to be impacted. As such, no s60 applications are required. The Parramatta LEP (2011) revealed no proximal local heritage items that have potential for impact under the proposal.

Biodiversity

Vegetation within the proposal area was comprised of areas of planted native landscaping as well as highly disturbed median strips and traffic islands consisting of common exotic roadside grasses and forbs. Exotic species included *Bidens pilosa*, *Soliva sessilis*, *Medicago polymorpha* and *Plantago lanceolata*.

The area to the north-west of Hill Road contained planted native canopy trees including *Eucalyptus microcorys* (Tallowwood), *Eucalyptus robusta* (Swamp Mahogany), *Casuarina glauca* (Swamp She-Oak) and *Brachychiton populneus* (Kurrajong). The midstorey was made up of similar species. The understorey had small stands of native *Lomandra longifolia* (Spiny-head Mat-Rush) interspersed with areas of exotic pasture grasses like *Eragrostis* spp. and *Cyperus rotundus* (Nut Grass).

The large traffic island to the east of Bennelong Parkway consisted of pasture grasses and exotic herbs such as *Soliva sessilis* (Bindi), *Vicia sativa* (Vetch), *Taraxacum officionale* (Common Dandelion), *Cyperus rotundus* (Nut Grass). A large occurrence of *Ipomea indica* (Morning Glory) was found on the fence line bordering the proposal area.

No threatened flora species were recorded in the proposal area during the field surveys carried out in August 2020. No threatened fauna or suitable threatened fauna breeding habitat was identified within the proposal area. There is however potential for the Green and Golden Bell Frog to utilise native vegetation within the proposal area, as the works are located directly adjacent to known habitat for this species (SOPA 2019). It was determined that no significant impact on this species would result from the proposed activity.

Noise and Vibration

The desktop noise and vibration assessment determined that during construction, noise levels at surrounding receivers are unlikely to exceed day, evening or night time noise management levels or sleep disturbance guidance values during all phases of construction.

Social and Visual

Visual and landscape impacts will occur during construction and operation. Construction impacts will include a changed visual environment from the presence of construction plant, equipment, and temporary ancillary facilities.

The proposal has the potential for both wider regional and local positive benefits in the medium to long term through improved road safety and freight efficiency. However, during construction, the community would experience temporary noise and visual amenity cumulative impacts.

There would be minor impacts associated with air quality. These impacts would be managed using the safeguards and mitigation measures included in this REF.

Traffic and Transport

The proposal would cause temporary disruptions to traffic, including reduced speed limits, potential changes to property access and increased heavy vehicle movements on the existing road network during the construction. Long-term benefits to traffic include reduced traffic delays to local residents.

Table of Contents

Tables

Figures

Glossary

Acronym/Term	Definition
AHIMS	Aboriginal Heritage Information Management System
Aquatic organisms	Organisms that live in water – stored water, river and streams
BC Act	Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
Biodiversity	Variety and number of different species living in an ecosystem or a defined geographic area
Biosecurity Act	Biosecurity Act 2015
Catchment	The area of land draining to a waterway. May also refer to areas served by a wastewater or stormwater system
CEMP	Construction Environmental Management Plan
CoP	City of Parramatta Council
DBH	Diameter at Breast Height
DDA	Disability Discrimination Act 1992
DPI	Department of Primary Industries
Ecologically sustainable development (ESD)	Development that improves the quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends
Ecosystem	A community of organisms, interacting with one another, and the environment in which they live. Processes occurring within an ecosystem are the flow of energy by food chains and food webs and nutrient cycling.
CEEC	Critically Endangered Ecological Community
DPIE	Department of Planning, Industry and Environment
EP&A Act	Environmental Planning and Assessment Act 1979
Emission	Anything given off as a result of a process, for example, gases, heat and odours.
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System, the framework for the management of environmental issues
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products and services
EPA	Environmental Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act	Fisheries Management Act 1994 (NSW)
Freshwater	Water found in lakes, rivers, streams; generally containing less than 1,000 mg/L of dissolved solids (salts)

Acronym/Term	Definition
Groundwater	Water found below the surface, usually in porous rock or soil or in underground aquifers (natural underground formations that contains sufficient saturated, permeable material to yield significant quantities of water)
ha	hectare
Heritage Act	Heritage Act 1977 (NSW)
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LEP	Local Environment Plan – a statutory environmental planning instrument under the EP&A Act
LGA	Local Government Area
NPWS	National Parks and Wildlife Service
OEH	Office of the Environment and Heritage (Now DPIE)
pH	A measure of the alkalinity or acidity of water expressed on a scale from 1 to 14: 1 is most acidic, 7 neutral and 14 most alkaline
Pollutants	Contaminants in water, soil or air that, when in sufficient quantity, may cause environmental degradation
Proposal area	Limit of works area for the Hill Road and Bennelong Parkway Intersection Upgrade
REF	Review of Environmental Factors (this document)
Sediment	Soil or other particles that settle to the bottom of lakes, rivers, oceans and other waters
SEPP	State Environmental Planning Policy – a statutory environmental planning instrument under the EP&A Act
SHR	State Heritage Register
SIS	Species Impact Statement
Stakeholder	A stakeholder is any individual or group, which can affect or is affected by an organisation's activities
Survey Area	Public land within the Bennelong Parkway and Hill Road easements
TCS	Traffic Control Signal
TEC	Threatened Ecological Community
TfNSW	Transport for NSW
Turbidity	This is a measure of suspended material in water that may cause it to look muddy or discoloured. It is measured in Nephelometric Turbidity Units (NTU)
Waterways	All streams, creeks, rivers, estuaries, inlets and harbours
Wetland	A wetland is a low-lying area of land often inundated or permanently covered by shallow water. They play a major role in the water cycle by storing and filtering water and replenishing underground water supplies. Wetlands can also be effective in cleaning polluted water by reducing aquatic plant nutrients, suspended solids and oxygen demands

1. Introduction

1.1 Background Information and Proposed Activity

The proposed activity involves the installation of traffic signals and pedestrian crossings at the intersection of Hill Road and Bennelong Parkway and associated activities. The proposal location currently consists of existing infrastructure (i.e roads and footpaths) surrounded by roadside vegetation including manicured lawns and remnant canopy trees. The proposed activities will involve:

- Installation of new Traffic Control Signals (TCS) including posts and all ancillary fittings at the intersection of Hill Road and Bennelong Parkway including signalised pedestrian crossings on Hill Road and Bennelong Parkway;
- Demolition of existing footpaths, kerb & gutter, kerb ramps, and followed by construction of new kerbside features to coincide with new TCS;
- Provision of one dedicated right turn lane from Hill Road into Bennelong Parkway;
- Provision of two dedicated left turn and two right turn lanes from Bennelong Parkway into Hill Road;
- Reconstruction of footpaths, Cycleways, ramps, and crossings to improve accessibility;
- Installation of new streetlights along Bennelong Parkway and Hill Road;
- Construct stormwater drainage infrastructure as per proposed drainage design;
- Profiling of existing road pavement and installation of detector loops and new road pavement;
- New line markings as per the TCS design plan.
- Relocation of Optus and Ausgrid U/G cables away from the new carriageway to the island;
- Landscaping works; and
- Erection of TfNSW Type 1 fence.

This project has been proposed to improve traffic flow and provide safe and efficient movement of vehicles and pedestrians within the locality of Wentworth Point. A detailed description of the proposed activity is provided in Section 2.4. For the purposes of these works, CoP is the proponent and the determining authority under Part 5 of the EP&A Act.

1.2 Purpose of the Review of Environmental Factors

This REF has been commissioned by CoP to assess the environmental impacts associated with the proposed activity in order to meet the relevant due diligence environmental requirements pursuant to Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act) and the Transport and Infrastructure SEPP 2021 for public works activities.

The purpose of the REF is to:

- Document the likely impacts of the proposal on the environment; and
- Detail protective measures to be implemented to mitigate impacts

The description of the proposal and the identification of associated environmental impacts have been undertaken in consideration of the EP&A Act, clause 228 of the Environmental Planning and Assessment Regulation 2000, the Biodiversity Conservation Act 2016 (BC Act), Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) NSW National Parks and Wildlife Act 1974 (NPWS Act) and the Fisheries Management Act 1994 (FM Act) when determining:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.1 of the EP&A Act;
- The significance of any impact on threatened species as defined by the BC Act and/or the FM Act, and the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report;
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured; and
- 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 Australian Government Department of Environment and Energy for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

Under section 111 of the EP&A Act, CoP is responsible for assessing the impacts of its activities. Consideration of the factors outlined in this report enables Council as the proponent to take into account, to the best possible extent, all matters that may affect or are likely to affect the environment.

1.3 Location of proposed activity

The proposed activity is located at the intersection of Hill Road and Bennelong Parkway, Wentworth Point (**Figure 1**). General photos of proposed location are presented in **Plate 1, Plate 2, Plate 3** and **Plate 4**.

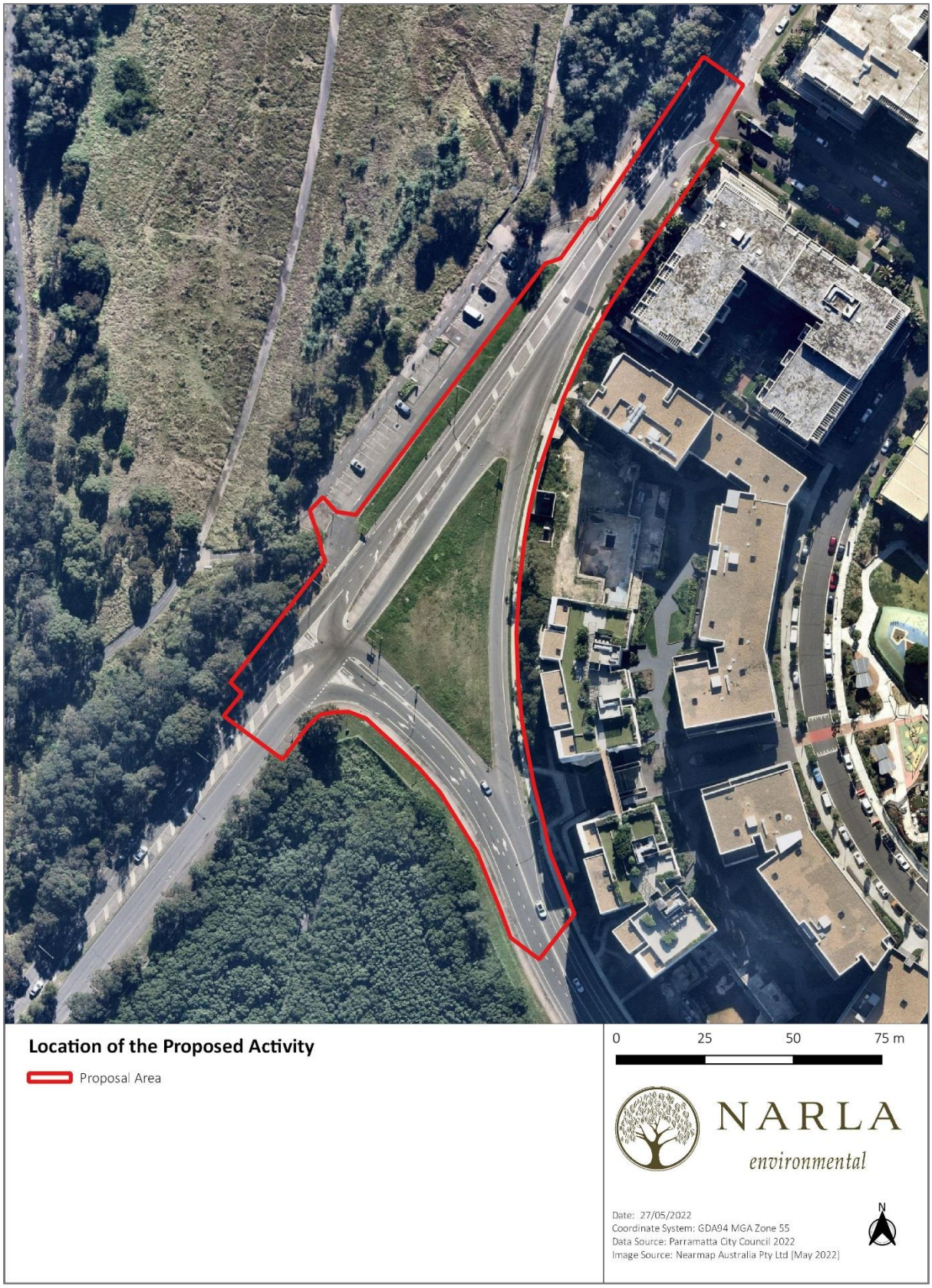

Figure 1. Location of the Proposal Area

Plate 1. Area to the north of Hill Road

Plate 2. Traffic island to the east of Bennelong Parkway

Plate 3. Area to west of Bennelong Road.

Plate 4. Northeast aspect along Hill Road with Bennelong Parkway to the right of frame.

1.4 Description of the proposed activity

CoP and Traffic and Transport Services is proposing to install traffic signals and improve the road infrastructure at the intersection of Hill Road and Bennelong Parkway, Wentworth Point (**Figure 2**; **Appendix A**). The proposed works are to include:

- Installation of new Traffic Control Signals (TCS) including posts and all ancillary fittings at the intersection of Hill Road and Bennelong Parkway including signalised pedestrian crossings on Hill Road and Bennelong Parkway;
- Demolition of existing footpaths, kerb & gutter, kerb ramps, and followed by construction of new kerbside features to coincide with new TCS;
- Provision of one dedicated right turn lane from Hill Road into Bennelong Parkway;
- Provision of two dedicated left turn and two right turn lanes from Bennelong Parkway into Hill Road;
- Reconstruction of footpaths, Cycleways, ramps, and crossings to improve accessibility;
- Installation of new streetlights along Bennelong Parkway and Hill Road;
- Construct stormwater drainage infrastructure as per proposed drainage design;
- Profiling of existing road pavement and installation of detector loops and new road pavement;
- New line markings as per the TCS design plan.
- Relocation of Optus and Ausgrid U/G cables away from the new carriageway to the island;
- Landscaping works; and
- Erection of TfNSW Type 1 fence.

The proposed activity will require the removal of four (4) trees (**Figure 7**), with a further eight (8) trees requiring supervision from a Project Arborist to ensure their retention. Information regarding the vegetation to be impacted is outlined in **Section 5.3.2** and **Table 5.**

Any additional scope of works required that are not included in this REF must be addressed in an amendment to this REF before works commencement.

1.5 Existing infrastructure

1.5.1 Road Infrastructure

Hill Road extends for a distance of approximately 4 kilometres, and acts as an important connection between Parramatta Road and Bennelong Parkway. Hill Road is also experiencing an increasing amount of traffic volume due to the high rate of growth in the Sydney Olympic Park and Wentworth Point areas. The latest traffic data indicates a total of 9,075 vehicles pass through the intersection between 7:00am and 6:00pm, with 3,414 vehicles during peak hours (Matirx 2016).

The proposal area consists of a dual lane in each direction along Hill Road and the Bennelong Parkway. The existing lane widths are approximately 3.5 metres (**Plate 4**; **Figure 2**). Minimal property accesses are present along either Hill Road or Bennelong Parkway with only one driveway to residential apartments located to the west. Access to parking spaces is located to the north of Hill Road.

1.5.2 Surrounding Land

The works will span approximately 140 metres of Hill Road and 80 metres of Bennelong Parkway and are situated within the City of Parramatta Local Government Area (LGA). The proposal is bordered by private residences and commercial buildings to the east, Millennium Park to the west and wetlands to the south.

1.5.2.1 Native Vegetation

Vegetation surrounding the proposal is largely comprised of fragmented, exotic dominated median strips and traffic islands. Some planted native vegetation exists within the north-west of the proposal area, where *Eucalyptus*

robusta, Eucalyptus microcorys and *Casuarina glauca* among other planted natives are growing within historical 'plantation' areas.

1.5.2.2 Heritage Values

The proposal area contains no evidence of past Aboriginal occupation. No sites have been previously recorded on the Aboriginal Heritage Information Management System (AHIMS) within 200m of the proposal area (**Appendix G**). It is noted that some sites are known in the greater locality (<300m away), however no impact to Aboriginal sites is anticipated.

A search of the NSW State Heritage Inventory indicated one item in the direct vicinity of the proposal area is included on the State Heritage Register:

- Newington Armament Depot and Nature Reserve.

This heritage precinct is located >50m from the proposed activity, therefore it is not expected to be impacted. As such, no s60 applications are required. The Parramatta LEP (2011) revealed no proximal local heritage items that have potential for impact under the proposal.

Figure 2. Proposed Future Road Layout.

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2. Proposal objectives and development criteria

2.1 Objectives of the proposal

The objectives of the proposal are to:

- Improve traffic flow;
- Provide for safe and efficient movement of vehicles and pedestrians within the locality; and
- Minimise environmental impacts.

2.2 Strategic need for the proposal

The Sydney Olympic Park and Wentworth Point area is currently experiencing significant growth. As a consequence, the traffic volumes in the area have increased and are putting pressure on the existing infrastructure. City of Parramatta is receiving complaints from residents and motorists regarding the delays in Bennelong Parkway to access Hill Road during the morning and afternoon peak hours. As a result of the delay, the right turn lane overflows into the left lane and creates excessive queuing. The installation of traffic signals at this intersection will improve traffic flow at the intersection and reduce congestion in the area. Traffic and Transport Services is proposing to install traffic signals at the intersection of Hill Road and Bennelong Parkway, Wentworth Point over 2 years 2020/21 and 2021/22. These works when constructed will improve vehicle movement at the intersection and reduce traffic congestion in the area. The proposed new traffic signals will support the growth in the Sydney Olympic Park/Wentworth Point area and reduce traffic congestion in the area.

2.3 Alternatives and selection of the preferred option

2.3.1 Option 1: Do nothing

This option involves the existing intersection remaining as is. Traffic efficiency would not be improved and as a result, intersection delays would increase and traffic queues would extend into adjacent intersections.

2.3.2 Option 2: Construction of Traffic Light Signal at the intersection of Bennelong Parkway and Hill Road

Option 2 involves the construction of traffic light signals at the intersection of Hill Road and Bennelong Parkway in order to provide for safe and efficient movement of vehicles and pedestrians around the area as the population grows. The proposed traffic signals are being designed in accordance with the requirements of the Disability Inclusion Action Plan and will provide signalised pedestrian and bicycle crossing facilities in Hill Road and Bennelong Parkway. This is the preferred option. An analysis of both options is presented in **Table 1**.

Table 1. An analysis of each option against the proposal's objectives.

Proposal Objectives	Analysis (Option 1)	Analysis (Option 2)
Improve traffic flow	Option 1 will not improve traffic flow	Option 2 will improve traffic flow and reduce banked traffic along Hill Road and Bennelong Parkway.
Provide for safe and efficient movement of vehicles and pedestrians within the locality	Option 1 does not provide sufficient efficient movement for vehicles or pedestrians within the locality.	Option 2 will provide safe and efficient movement for vehicles and pedestrians along Hill Road and Bennelong Parkway.

Proposal Objectives	Analysis (Option 1)	Analysis (Option 2)
Minimise environmental impacts	Option 1 is not expected to impact the surrounding environment, except for the current ongoing impacts such as edge effects and rubbish disposal.	Environmental impacts are minor. A small portion of exotic, roadside groundcover vegetation will require removal to facilitate the traffic signals. No significant increase in noise or light spill. Potential impacts will be minimised by implementation of the safeguards as identified in this REF.

2.4 Construction Activities

Construction activities will be guided by a Construction Environmental Management Plan (CEMP) to ensure work is carried out to CoP specifications within the proposal area. Detailed work methodologies will be identified by the construction contractor. The staging of construction will be sequenced so as to complete construction within the minimum possible timeframe, while maintaining traffic flow through the work zones at all times.

2.4.1 Construction Methodology

The following methodology and sequence will be employed for implementation of the project:

- Council will open tenders to select and appoint principal contractor for implementing the project:
    - Four (4) trees will require removal to facilitate the proposed works, with an additional eight (8) experiencing a major encroachment of their rootzone (**Table 5**; **Figure 7**). Works within the vicinity of the additional eight (8) trees are to be supervised by a Project Arborist to ensure their survival.
    - Installation of new Traffic Control Signals (TCS) including posts and all ancillary fittings at the intersection of Hill Road and Bennelong Parkway including signalised pedestrian crossings on Hill Road and Bennelong Parkway;
    - Demolition of existing footpaths, kerb & gutter, kerb ramps, and followed by construction of new kerbside features to coincide with new TCS;
    - Provision of one dedicated right turn lane from Hill Road into Bennelong Parkway;
    - Provision of two dedicated left turn and two right turn lanes from Bennelong Parkway into Hill Road;
    - Reconstruction of footpaths, Cycleways, ramps, and crossings to improve accessibility;
    - Installation of new streetlights along Bennelong Parkway and Hill Road;
    - Construct stormwater drainage infrastructure as per proposed drainage design;
    - Profiling of existing road pavement and installation of detector loops and new road pavement;
    - New line markings as per the TCS design plan.
    - Relocation of Optus and Ausgrid U/G cables away from the new carriageway to the island;
    - Erection of a site compound and laydown areas to be located in the median island;
    - Landscaping works; and
    - Erection of TfNSW Type 1 fence.

2.4.2 Construction Timeline

Construction work is estimated to have a duration of approximately 4 months, once approved.

2.4.3 Construction Hours

Works will take place in accordance with the Interim Construction Noise Guideline (DECC 2009):

- Monday to Friday 7.00am to 5.00pm
- Saturday 8.00am to 5.00pm
- No work on Sunday or public holidays

There is potential for works to be undertaken outside these hours. If work outside standard hours is required then they will be undertaken in accordance with the NSW Interim Construction Noise Guidelines.

2.4.4 Plant and Equipment

A variety of plant and equipment will be required for the construction. The final plant and equipment will be determined by the construction contractors however an indicative list is provided below.

- Excavator;
- Loader;
- Bobcat;
- Roller/Compactor;
- Profiler;
- AC laying machine;
- Concrete and Asphalt saw-cutter;
- Haulage trucks;
- Chainsaw, cherry picker; and
- Vacuum trucks.

2.4.5 Traffic Management

Traffic management will be required during construction. The work would be staged to minimise traffic impacts.

2.4.6 Changes to the Scope of Work

If the scope of work or construction methods described in this document change significantly following the awarding of the contract, supplementary environmental impact assessment must be prepared for the amended components.

2.5 Adherence to Principals of Ecologically Sustainable Development

The most common and broadest definition of Ecologically Sustainable Development (ESD) is 'development that improves the quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends' (Environment Australia 1992). The proposal must be considered in accordance with the four principles of ESD as outlined in section 6(2) of the Protection of the Environment Administration Act 1991 and Schedule 2 of the EP&A Regulation.

These principles are described below:

- The precautionary principle;
    - If there are threats of serious or irreversible damage to the environment, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- Intergenerational equity;
    - The present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
- Conservation of biological diversity and ecological integrity;
    - These are fundamental considerations to the sustainability of development.

- Improved valuation, pricing and incentive mechanisms;
    - Cost-effective market mechanisms to attribute externalities.

The principles of Ecologically Sustainable Development have been incorporated from the conception of the proposal, through to and as part of, the environmental impact assessment process. The potential environmental risks associated with the proposal have been identified. Appropriate mitigation measures have been recommended for implementation during the construction and operational phases of the proposal. The project aims to have minimal impacts to the surrounding environment by being located predominantly within the footprint of the existing road. This minimises the requirement to disturb vegetation and fauna habitat within the locality. Active impact mitigation measures will be put in place to prevent significant impact to any known or potentially occurring threatened fauna, flora or ecological community. Such mitigation measures are discussed throughout this report.

3. Statutory and Planning Framework

3.1 Local Environment Plans (LEP)

3.1.1 Parramatta Local Environmental Plan 2011

The proposed activity is located within the Parramatta LGA on Land zoned as ():

- E2: Environmental Conservation
- E3: Environmental Management

Table 2 includes a summary of the planning information relevant to the proposal area.

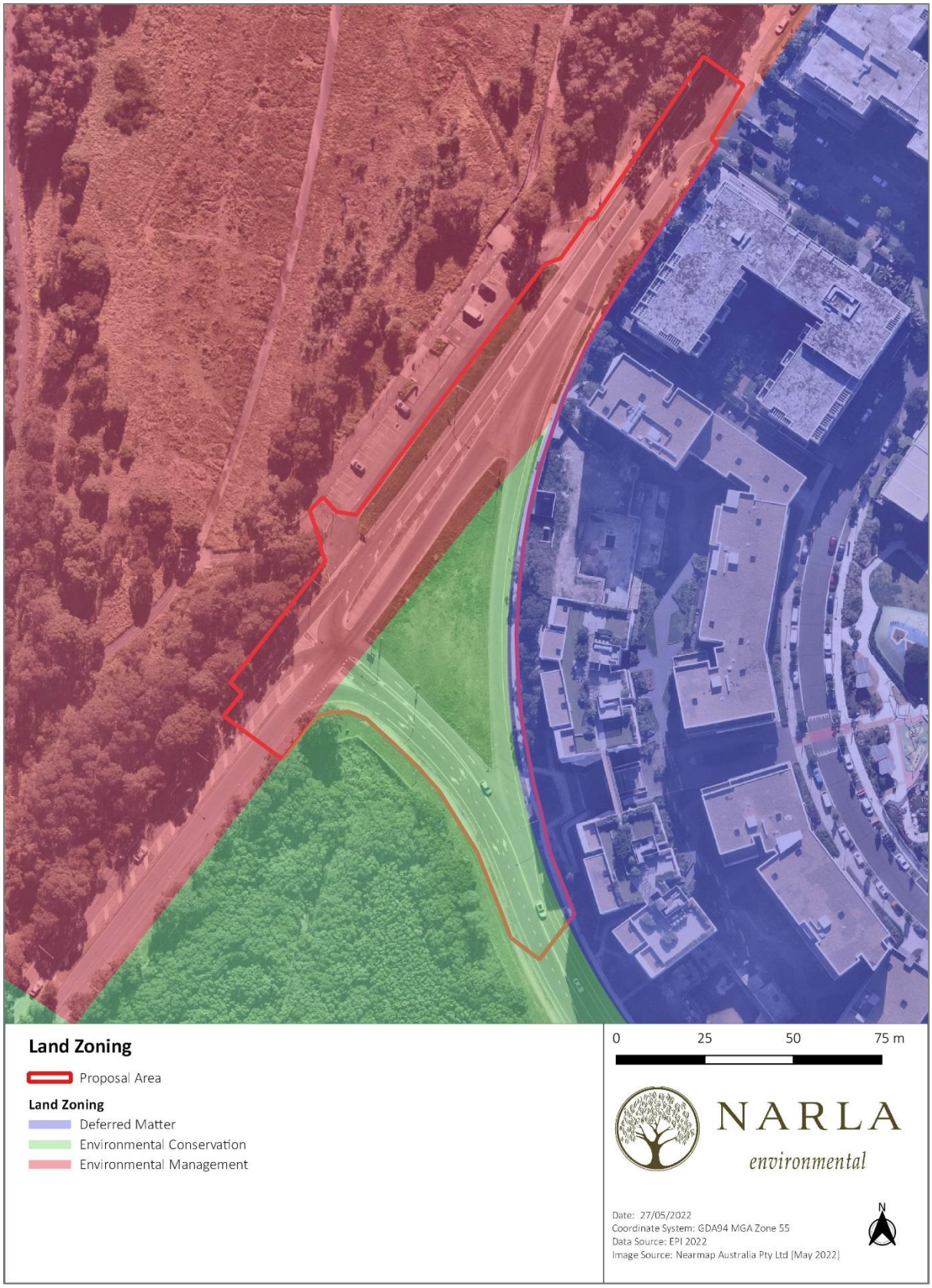

Figure 3. Land Zoning within the Proposal Area

Table 2. Zoning and Objectives

Zoning	Zone E2 Environmental Conservation	Zone E3 Environmental Management
Objectives of the Zone	▪ To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. ▪ To prevent development that could destroy, damage or otherwise have an adverse effect on those values.	▪ To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values. ▪ To provide for a limited range of development that does not have an adverse effect on those values.
Permitted without consent	▪ Environmental protection works; ▪ Flood mitigation works	▪ Flood mitigation works; ▪ Home occupations
Permitted with consent	▪ Environmental facilities; ▪ Oyster aquaculture; ▪ Roads	▪ Building identification signs; ▪ Business identification signs; ▪ Community facilities; ▪ Dwelling houses; ▪ Environmental facilities; ▪ Environmental protection works; ▪ Home-based child care; ▪ Home businesses; ▪ Home industries; ▪ Information and education facilities; ▪ Oyster aquaculture; ▪ Pond-based aquaculture; ▪ Roads; ▪ Tank-based aquaculture
Is activity permissible under this legislation?		
✓ Yes ☐ No		
Justification		
The proposal falls within the scheme of *'Roads';* which are permitted with consent under the Parramatta LEP 2011. However, assessments of activities under the EP&A Act as prescribed in SEPP Infrastructure do not require assessment under an LEP or associated DCP.		

3.2 Commonwealth Legislation

3.2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Approval from the Environment Minister is required if an action is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or if it is listed as a matter of national significance.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
Threatened Ecological Communities No threatened ecological communities listed under the EPBC Act are located within the proposal area. **Threatened Flora** No habitat for Commonwealth threatened flora or terrestrial fauna will be impacted by the proposed activity. **Threatened Fauna** It is likely that the vulnerable *Pteropus poliocephalus* (Grey-headed Flying-fox), and the endangered *Lathamus discolor* (Swift Parrot), may forage in the planted native vegetation surrounding and/or overhanging the proposal area. These species are highly mobile and nomadic species and will forage or pass over the proposal area during part of their lifecycle. No breeding is likely to occur for either species. The lifecycle of either of these species will not be significantly impacted as they are highly mobile and unlikely to rely on any of the trees proposed for removal for foraging and/or breeding. There is also potential for the vulnerable *Litoria aurea* (Green and Golden Bell Frog) to utilise habitat within the proposal area, as the works are located directly adjacent to known habitat for this species (SOPA 2019). Such habitat includes Woo-la-ra which is considered to be a movement corridor for this species, as well as Narrawang Wetland which is a breeding pond. **Assessment of Significance** A Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Assessment of Significant Impact Criteria was carried out for *Litoria aurea* (Green and Golden Bell Frog; **Appendix F**). It was determined that no significant impact on this species would result from the proposed activity.

3.3 State Legislation

3.3.1 Environmental Planning and Assessment Act 1979

The NSW Environmental Planning and Assessment Act 1979 (EP&A Act) and its associated regulations provide the framework for assessing environmental impacts and determining planning approvals for developments and activities in NSW. The EP&A Act also establishes State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

Under the EP&A Act, CoP is classified as a proponent and a determining authority (under Part 5 of the Act). A project can be assessed by a determining authority under Part 5 of the Act if it:

- may be carried out without development consent;
- is not a prohibited development; and
- is carried out, or approved, by a determining authority.

This REF has been prepared to determine if the proposal is likely to have a significant impact on the environment. If a determining authority decides an activity is likely to significantly affect the environment, it must either apply the Biodiversity Offsets Scheme or prepare a Species Impact Statement (SIS).

The proposed work is unlikely to have a significant impact on the environment or a threatened species, population or ecological community, and is not on land that is declared critical habitat. Therefore, an SIS is not required to be prepared, nor is the BOS applied.

CoP intends to carry out the proposed activity under Part 5 of the EP&A Act. Accordingly, they must satisfy Sections 5.5 and 5.7 of that Act by examining, and taking into account to the fullest extent possible, all matters that are likely to affect the environment. This REF is intended to assist, and ensure compliance, with the EP&A Act including Sections 5.5 and 5.7.

Clause 228 of the EP&A Regulation lists factors that must be taken into account when considering the likely impact of an activity on the environment. Consideration of these factors is presented in section 6.2.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
The proposed activity is considered development that does not need consent under section 4.1 of the EP&A Act. This means that the activity may be carried out, in accordance with the ISEPP by or on behalf of Council as a public authority without the need for development consent. However, as the proposed activity is not 'exempt development', it required an assessment under Part 5 of the EP&A Act comprising this REF.

3.3.2 Biodiversity Conservation Act 2016

The Biodiversity Conservation Act 2016 (BC Act) aims to conserve and protect certain classes of threatened; vulnerable and endangered species, populations and ecological communities.

Impacts to species, populations, or ecological communities listed under the BC Act have been assessed against section 7.3 being the test for determining whether proposed development or activity will be likely to significantly affect threatened species or ecological communities, or their habitats (Test of Significance).

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
There is potential for the endangered *Litoria aurea* (Green and Golden Bell Frog) to utilise habitat within the proposal area, as the works are located directly adjacent to known habitat for this species (SOPA 2019). Such habitat includes Woo-la-ra which is considered to be a movement corridor for this species, as well as Narrawang Wetland which is a breeding pond. A Test of Significance (5-part test) pursuant to section 7.3 of the BC Act was required due to potential impacts from the proposed activity on this species (**Appendix E**).

3.3.3 Water Management Act 2000

The Water Management Act 2000 (WM Act) provides the statutory framework for works along rivers, lakes and estuaries. The Act's definition of 'river' includes any watercourse, including an artificially improved channel, but not a piped drain. The definition of 'lake' includes any body of natural or artificial still water, including a wetland. In an urban context, the Act would apply to any river, creek, (open) drainage channel, lake or pond.

A Controlled Activity Approval under s91 of the WM Act is not required as the proponent is a public authority and therefore exempt under s38 of the WM Regulation 2011.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
A Controlled Activity Approval under s91 of the WM Act is not required as the proponent is a public authority and therefore exempt under s38 of the WM Regulation 2011.

3.3.4 National Parks and Wildlife Act 1974

The NPW Act provides protection for National Parks, Nature Reserves, State Conservation Areas and Flora Reserve estates, only Aboriginal Heritage (other state heritage subject to Heritage Act 1977). Certain activities require permit under the NPW Act before proceeding including working within a National Park.

The NPW Act provides specific protection for Aboriginal objects and places by making it an offence to destroy, deface, damage, or move them from the land. The Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales as adopted under the NPW Act and regulations, provides guidance to individuals and organisations to exercise due diligence when carrying out activities that may harm Aboriginal objects and to determine whether they should apply for consent in the form of an Aboriginal Heritage Impact Permit (AHIP). An assessment for non-Aboriginal Heritage under the Heritage Act 1977 has been addressed in section 5.1.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
The proposal area is not located within or near a national park or any other conservation estate. A search of the Aboriginal Heritage Information Management System (AHIMS) revealed there were no registered Aboriginal objects or places within or near the proposal area. Desktop assessment revealed the site did not contain any Aboriginal objects or landforms that suggest Aboriginal objects are likely. The due diligence approach for this assessment deems no further assessment for Aboriginal heritage is required.

3.3.5 Fisheries Management Act 1994

The provisions of the Fisheries Management Act 1994 (FM Act) relating to the development approval process operate similarly to the BC Act. The Act identifies threatened aquatic species, populations and ecological communities and requires a test of significance if such species could be impacted by the activity.

Activities that trigger the requirement for City of Parramatta to notify Fisheries include:

- Dredging or reclamation of waterways, including removal of snags or aquatic vegetation;
- Temporary or permanent blockage of fish passage requires a permit under section 219.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
No threatened species or ecological communities listed under the FM Act are considered likely to occur within the proposal area. There is no Key Fish Habitat as declared under the FM Act within the proposal area. The proposed activity will no cause an obstruction to any mapped watercourse or any Key Fish Habitat.

3.3.6 Wilderness Act 1987

The *Wilderness Act 1987* applies to the protection and management of wilderness areas. A 'wilderness area' means lands (including subterranean lands) declared to be a wilderness area under this Act or the *National Parks and Wildlife Act 1974*. The objective of this Act is to provide for the permanent protection of wilderness areas, the proper management of wilderness areas, and to promote the education of the public in the appreciation, protection and management of wilderness. Wilderness areas shall be managed to restore and protect unmodified areas of their plant and animal communities. Wilderness areas shall also be managed to preserve the capacity of an area to evolve without significant human interference and permit opportunities for solitude and appropriate self-reliant recreation.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
The proposal area and surrounds are not classified as a wilderness area.

3.3.7 Rural Fires Act 1997

The Rural Fires Act 1997 is implemented by the Rural Fire Service and aims to provide for the prevention, mitigation and suppression of bush and other fires in local government areas and rural fire districts. The Act also includes an aim of coordinating bush firefighting and prevention, protection of persons from injury and death and property from damage due to fires. Under this Act there is a continuous chain of command from the Commission to the firefighter within the NSW Rural Fire Service. It has an emphasis on having regard to the principles of ecologically sustainable development when carrying out firefighting and prevention activities included in this Act.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
The proposal area occurs entirely outside mapped *Bushfire Prone Land*. The proposal is not expected to impact upon bushfire risk or current protections.

3.3.8 Protection of the Environment Operations Act 1997 (PoEO Act)

Under this Act, should an activity involve the pollution of waters, defined under the Act as any chemical, biological, physical change to existing water quality (i.e. turbidity, release of untreated wastewater) an Environment Protection License should be sought from DPIE under the PoEO Act. In addition, the Act relates to any pollution of the environment through noise, air and waste. The Act also obliges the Contractor to notify DPIE when a "pollution incident" occurs that causes or threatens "material harm" to the environment.

The PoEO Act also establishes the licensing framework and classification system for managing and regulating waste in NSW. The Act was amended on 28 April 2008 updating the way wastes are classified and replaces the Environmental Guidelines: Assessment, Classification & Management of Liquid & Non-liquid Wastes. See **section 6.1** for further information regarding the removal and disposal of site waste as outlined by the Proposal.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
The hours of operation will be: Works will only take place generally in accordance with the Interim Construction Noise Guideline (DECC 2009): ▪ Monday to Friday 7:00am to 5:00pm ▪ Saturday 8:00am to 5:00pm ▪ No work on Sunday or public holidays There should be minimal air pollution as the proposed materials are not fibrous, however; all soil and dust should be kept wet to reduce the incidence of particle matter. The use of trucks and vehicles to transport personnel and materials to and from site are not expected to increase local pollution levels significantly beyond standard levels. Effort will be taken to minimise vehicle use and idling of unused vehicles. A number of stormwater outlets flow from the proposal area to Nuwi Wetland, an estuarine wetland containing mangroves which are protected under the Fisheries Act 1994. Sedimentation and erosion control measures shall be put in place during the entire construction of the proposed activity to avoid any spills and sedimentation from entering stormwater inlets which drain to nearby waterways and wetlands. Planning advice on previous projects has recommended that the sedimentation and erosion control measures be taken from 'The Blue Book' 'Managing Urban Stormwater: Soils and Construction' (Landcom 2004). Planned project works are not expected to result in excess excavated spoil. Construction methodology by the project is designed to have minimal disturbance to the site which includes excavation for the creation of kerb ramps at the pedestrian crossings and some footpaths which will require reconstruction to improve access to the kerb ramps. Any excess spoil should be removed from site as not to cause any potential for sedimentation occurrence into nearby drains or local waterways. Any spoil not suited for retaining on-site shall be removed to an approved disposal facility. If any asbestos is found on site, works will be stopped immediately and the location of the asbestos reported to the Project Manager. Appropriate measures to remove this waste to approved asbestos landfill sites as dictated by Council and in accordance with the Protection of the Environment Operations (Waste) Regulation 2014 and SafeWork NSW Codes of Practice will take place.

3.3.9 Heritage Act 1977

The NSW Heritage Act 1977 is a statutory tool designed to conserve the cultural heritage of NSW and used to regulate development impacts on heritage assets. Works to item listed on the State Heritage Register (SHR) or likely to disturb archaeological remains will require approval from the Heritage Council under s60 of the Act.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
A search of the NSW State Heritage Inventory indicated there were no items listed on the SHR that are within or near the proposal area. One (1) Heritage Item (Newington Armament Depot and Nature Reserve) occurs within approximately 100m of the proposal area. This item will not be impacted by the proposal. Within the vicinity of the proposal, no Heritage items have been mapped within the Heritage Register within the Parramatta LEP. An assessment under the Heritage Act 1977 has been addressed in Section 5.2.

3.3.10 Biosecurity Act 2015

The Biosecurity Act 2015 includes mechanisms to control the impact of weeds and pest animals through the monitoring, reporting and effectiveness of weed management. Council has an obligation to control Environmental Weeds under this Act on their land. It also has an obligation to prevent Environmental Weeds from spreading to adjoining land.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
Two (2) Priority weed species were found within the Proposal Area: ▪ *Senecio madagascariensis* (Fireweed); and ▪ *Lantana camara* (Lantana) The proponent will ensure that the proposed activity does not facilitate the introduction or encourage growth of these weeds. This will be achieved through careful selection of construction materials. Contractors on the site are to ensure footwear is correctly cleaned prior to entering and leaving the site to mitigate against further spread.

3.4 State Environmental Planning Policies (SEPP)

3.4.1 State Environmental Planning Policy (Transport and Infrastructure) 2021

The aim of the TISEPP is to facilitate the effective delivery of infrastructure across NSW it assists the NSW Government, local councils and the communities they support by simplifying the process for providing infrastructure like schools, hospitals, roads, railways, emergency services, water supply and electricity delivery. The policy includes specific planning provisions and development controls for 25 types of infrastructure works or facilities.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
Clause 2.108 of TISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. As the proposal is for the upgrade of an existing road (intersection), to be carried out on behalf of City of Parramatta Council, it can be assessed under Part 5 of the EP&A Act.

3.4.2 State Environmental Planning Policy (Resilience and Hazards) 2021 Chapter 2 – Coastal Management

The aim of State Environmental Planning Policy (Resilience and Hazards) 2021 (RHSEPP): Chapter 2 – Coastal Management is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Chapter, including the management objectives for each coastal management area, by:

- managing development in the coastal zone and protecting the environmental assets of the coast, and
- establishing a framework for land use planning to guide decision-making in the coastal zone, and
- mapping the 4 coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the Coastal Management Act 2016.

Is activity permissible under this legislation?
✓ Yes ☐ No
Justification
The Proposal area is mapped within the 'proximity area for coastal wetlands'. Clause 2.8 of the RHSEPP outlines that development consent must not be granted to development on land identified as "proximity area for coastal wetlands" on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development will not significantly impact on— ▪ the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or ▪ the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest. As the proposal is for the upgrade of Bennelong Parkway and Hill Road intersection, to be carried out by CoP, it is to be assessed under Part 5 of the EP&A Act. Development consent from council is not required.

3.5 Government Agency and Stakeholder Involvement

3.5.1 TISEPP Consultation

A public authority, or person acting on behalf of a public authority, must not carry out specified development that this Policy provides with consent unless the authority or person has:

- Given written notice of the intention to carry out the development to the specified authority in relation to the development; and
- Taken into consideration any response to the notice that is received from that authority within 21 days after the notice is given.

4. Consultation

The Sydney Olympic Park and Wentworth Point area is currently experiencing significant growth. As a consequence, the traffic volumes in the area have increased and are putting pressure on the existing infrastructure. City of Parramatta is receiving complaints from residents and motorists regarding the delays in Bennelong Parkway to access Hill Road during the morning and afternoon peak hours. As a result of the delay, the right turn lane overflows into the left lane and creates excessive queuing. The installation of traffic signals at this intersection will improve traffic flow at the intersection and reduce congestion in the area.

When consultation at planning stage was carried out, the community overwhelmingly supported the Council initiative. At design stage all stakeholders including SOPA, TfNSW and utilities (Optus, Telstra, Optus, Sydney Water, Ausgrid) were consulted and their concerns were taken onboard and addressed in the design process.

5. Environmental Assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered, including:

- Potential impacts on Matters of National Environmental Significance (MNES) listed under the EPBC Act;
- Potential impacts on threatened species, populations, and ecological communities listed under the BC Act;
- Potential impacts on Aboriginal heritage listed under State Heritage Register and AHIMS Register; and
- The factors specified in the guidelines Is an EIS required? (DUAP 1995/1996) as required under clause 228 (1) of the Environmental Planning and Assessment Regulation 2000 and the Roads and Related Facilities EIS Guideline (DUAP 1996).

The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are considered in section 6.2. Site specific safeguards and management measures are provided to mitigate the identified potential impacts.

5.1 Aboriginal Heritage

A desktop assessment for the potential impacts on Aboriginal heritage during construction and operation of the proposal have been assessed in this REF. The potential impacts, and safeguards to mitigate them, are summarised below.

An search of the AHIMS database was carried out on 26th of May 2022 with a 200m buffer centred on the nearest lot (Lot 48/SP98609). The proposal area for the desktop Aboriginal Heritage assessment is defined as the intersection of Bennelong Parkway and Hill Road. This assessment was comprised of:

- An overview of the Aboriginal history of the proposal area;
- A search of the AHIMS Register maintained by the Office of Environment and Heritage (OEH 2019a).

No records were identified within a 200m buffer of the proposal area. The AHIMS results report can be found in Appendix G. It is understood that Aboriginal Heritage items are located in the greater locality (>300m), however it is not expected that these items will be impacted by the proposal.

5.1.1 Potential Impacts

The proposal will be largely restricted to existing road and pavement. It is highly unlikely any Aboriginal Heritage items will occur within the proposal area. Safeguards are provided to address the unexpected circumstance that Aboriginal Heritage items and sites are unearthed or encountered during the works.

The operation of the proposal would not adversely impact Aboriginal heritage significance of archaeological potential along the proposal area. Suggested safeguards and management measures for Aboriginal heritage are presented in Table 3.

5.2 Non-Aboriginal Heritage

The following databases were reviewed to identify any listed or potential heritage items in the proposal area:

- Searches of national and state heritage databases:
    - Australian Heritage Database (National and Commonwealth heritage lists); and
    - NSW Heritage Division State Heritage Inventory.
- Searches of the Parramatta Local Environmental Plan (LEP):
    - There are no non-aboriginal heritage items located within proximity to the proposal area (200m). A search of the NSW State Heritage Inventory indicated that there are no items in the vicinity of the proposal that are included on the SHR, therefore no s60 applications are required. The nearest heritage item listed on the SHR is the Newington Armament Depot and Nature Reserve which is located approximately 100m from the proposal area at Holker Street Homebush Bay; and
    - The Paramatta LEP lists no items within proximity to the proposal area.

It is assessed that the proposal is unlikely to have an adverse impact upon non-Aboriginal archaeological or cultural heritage items.

5.2.1.1 Potential Impacts

The proposal will be largely restricted to existing road and pavement. It is not expected that the Newington Armament Depot and Nature Reserve will be impacted if the recommended safeguards and measures in **Table 3** are undertaken.

Table 3. Heritage safeguards and management measures

Consideration	Environmental safeguards	Responsibility	Timing
Soil surface disturbance	Soil surface disturbance is to be limited to the existing road pavement and road verges which have been extensively, historically disturbed.	Contractor	Construction
Aboriginal Heritage – unexpected finds (e.g. artefacts or scar trees)	All personnel working on site will be made aware of relevant statutory responsibilities. The Standard Management Procedure – Unexpected Heritage Items (Roads and Maritime, 2015) should be followed in the event that an unknown or potential Aboriginal object, including skeletal remains, is found during construction. Work is to only re-start once the re-start once the requirements of the procedure have been satisfied.	Contractor	Construction

5.3 Biodiversity

Background searches of existing information in order to identify potential biodiversity constraints along the proposal site were undertaken. This included a search of relevant databases, including but not limited to:

- Searches of Commonwealth and State databases to determine whether any threatened flora and fauna species, populations, ecological communities, migratory species and critical habitats as detailed in State and Commonwealth legislation occur or are likely to occur within a 10km radius of the proposal area. Specifically, a search of the Bionet database (DPIE 2020) and the Department of Agriculture, Water and the Environment Protected Matters database within a 10km search radius were undertaken in August 2020; and
- Accurate mapping of vegetation communities and flora through site assessment, aerial photographic interpretation, broad-scale vegetation mapping, and elevation data to stratify vegetation and habitats in the investigation area.

A field survey was undertaken on the 27th August 2020 for threatened flora and fauna species and their habitats. Flora species targeted during survey are listed in **Appendix D.** The fauna survey method included habitat assessment throughout the proposal area, including searches for evidence of threatened fauna, and opportunistically recording fauna species active at the time of the survey.

5.3.1 Database Search

A thorough literature review of local information relevant to the ecology and natural environment of the locality of the City of Parramatta LGA was undertaken. Online databases were utilised to obtain threatened species and biodiversity data recorded from, or modelled within the proposal area and its surrounds.

Searches utilising NSW Wildlife Atlas (Bionet) and the Commonwealth Protected Matters Search Tool were conducted to identify all current threatened and migratory flora and fauna records within the City of Parramatta LGA. This data was used to assist in establishing the presence or likelihood of any such ecological values as occurring on or adjacent to the proposal area, and helped inform the Ecologist on what to look for during the site assessment. The following documents were also reviewed as part of the preparation of this report:

- Parramatta LEP 2011;
- The Native Vegetation of the Sydney Metropolitan Area. Volume 1: Technical Report (OEH 2016a); and
- The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles (OEH 2016b).

Soil landscape and geological mapping (Chapman et al 2009) was examined to gain an understanding of the environment on the proposal area and assist in determining whether any threatened flora or ecological communities may occur there.

Table 4. Bionet Search (10 x 10km)

Scientific Name	Common Name	BC Act	EPBC Act	No. Records
	Fauna			
Anthochaera phrygia	Regent Honeyeater	CE	CE	5
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	19
Botaurus poiciloptilus	Australasian Bittern	E	E	8
Calidris canutus	Red Knot	P	E	10
Calidris ferruginea	Curlew Sandpiper	E	CE	351
Calidris tenuirostris	Great Knot	V	CE	2
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	1
Charadrius leschenaultii	Greater Sand-plover	V	V	1
Circus assimilis	Spotted Harrier	V	-	4
Dasyurus maculatus	Spotted-tailed Quoll	V	E	1
Epthianura albifrons	White-fronted Chat	E	-	254
Falco subniger	Black Falcon	V	-	1
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	2
Glossopsitta pusilla	Little Lorikeet	V	-	7
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	338
Hieraaetus morphnoides	Little Eagle	V	-	6
Hirundapus caudacutus	White-throated Needletail	P	V	19
Ixobrychus flavicollis	Black Bittern	V	-	3
Lathamus discolor	Swift Parrot	E	CE	10
Limicola falcinellus	Broad-billed Sandpiper	V	-	2
Limosa limosa	Black-tailed Godwit	V	-	14
Litoria aurea	Green and Golden Bell Frog	E	V	15981
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	4
Miniopterus australis	Little Bent-winged Bat	V	-	1
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	84
Myotis macropus	Southern Myotis	V	-	28
Neophema pulchella	Turquoise Parrot	V	-	2
Ninox connivens	Barking Owl	V	-	2
Ninox strenua	Powerful Owl	V	-	65
Numenius madagascariensis	Eastern Curlew	P	CE	26
Pandion cristatus	Eastern Osprey	V	-	5
Petroica boodang	Scarlet Robin	V	-	2
Petroica phoenicea	Flame Robin	V	-	1
Phascolarctos cinereus	Koala	V	V	3
Pommerhelix duralensis	Dural Land Snail	E	E	5
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	445
Ptilinopus superbus	Superb Fruit Dove	V	-	1
Rostratula australis	Australian Painted Snipe	E	E	3
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	8
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	2
Sternula albifrons	Little Tern	E	-	7
Stictonetta naevosa	Freckled Duck	V	-	1
Tyto longimembris	Eastern Grass Owl	V	-	2

Scientific Name	Common Name	BC Act	EPBC Act	No. Records
Tyto novaehollandiae	Masked Owl	V	-	1
Xenus cinereus	Terek Sandpiper	V	-	1
Flora				
Acacia clunies-rossiae	Kanangra Wattle	V	-	1
Acacia pubescens	Downy Wattle	V	V	84
Callistemon linearifolius	Netted Bottle Brush	V	-	5
Darwinia biflora	-	V	V	2
Dillwynia tenuifolia	-	V	-	1
Epacris purpurascens var. purpurascens	-	V	-	8
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	1
Eucalyptus scoparia	Wallangarra White Gum	E	V	1
Genoplesium baueri	Bauer's Midge Orchid	E	E	4
Melaleuca deanei	Deane's Paperbark	V	V	1
Persoonia hirsuta	Hairy Geebung	E	E	1
Pimelea curviflora var. curviflora	-	V	V	4
Prostanthera marifolia	Seaforth Mintbush	CE	CE	1
Rhodamnia rubescens	Scrub Turpentine	CE	-	5
Syzygium paniculatum	Magenta Lilly Pilly	E	V	6
Tetratheca juncea	Black-eyed Susan	V	V	1
Wilsonia backhousei	Narrow-leafed Wilsonia	V	-	109
Zannichellia palustris	-	E	-	5

5.3.1.1 Hydrology, geology and soils

The proposal area is situated within the Birrong soil landscape (Chapman et al 2009). The Birrong soil landscape is characterised by gently undulating alluvial floodplains. Local relief <5m, slopes <3%. Broad concave valleys. Extensively cleared of vegetation with small relict stands of *Eucalypt spp.* dominated woodland.

There are no watercourses in the proposal area, however Haslams Creek is situated directly south of the proposal area. Haslams Creek flows directly into the Parramatta River. In addition, a number of stormwater outlets flow from the proposal area to Nuwi Wetland. Acid Sulfate Risk mapping assigns the land as 'Disturbed Terrain' (**Figure 4**).

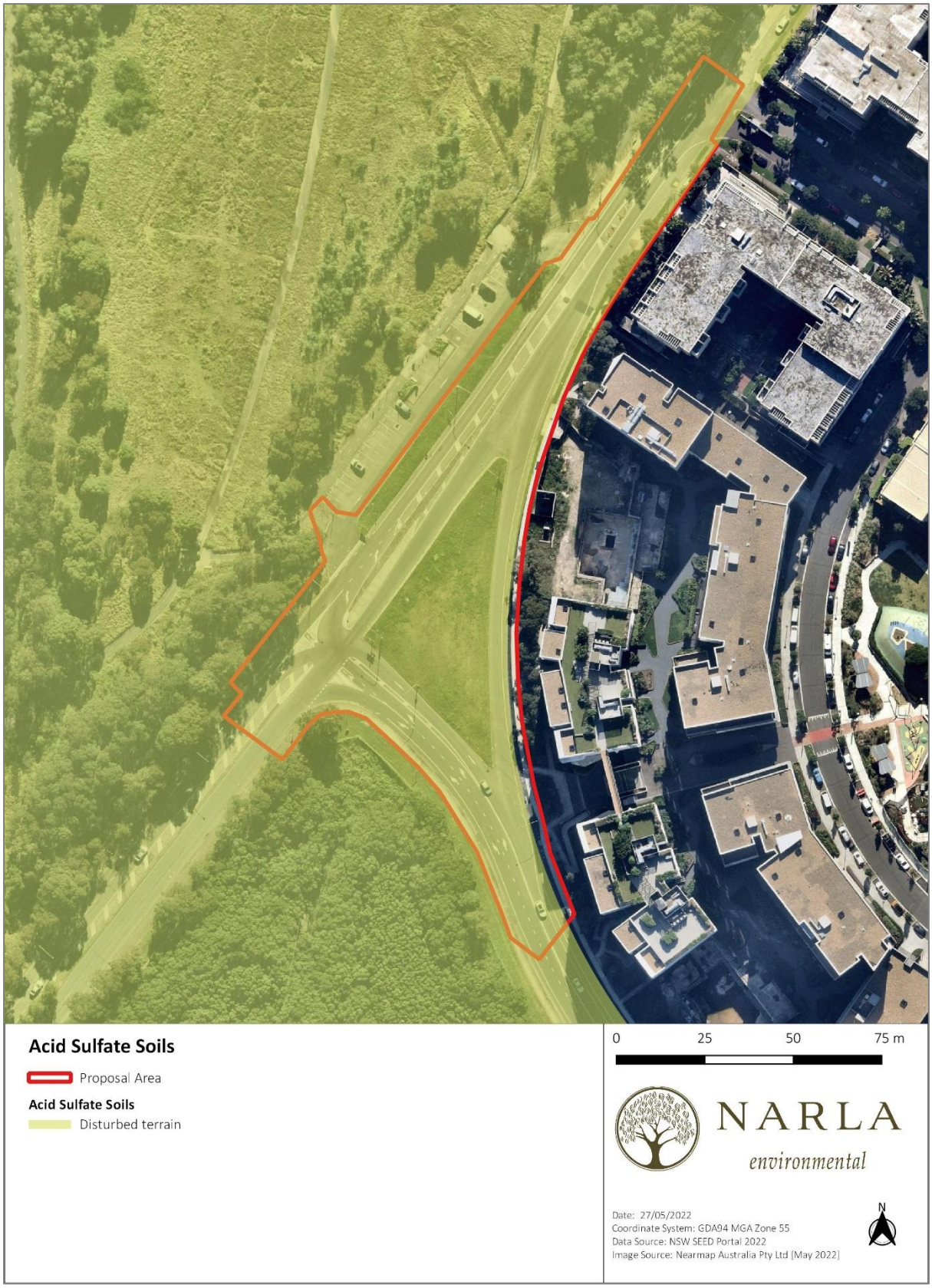

Figure 4. Acid Sulfate Soils Risk Mapping

5.3.1.2 Historical Vegetation Mapping

The Native Vegetation of Sydney Metropolitan Area (OEH 2016a) mapping indicates the presence of one vegetation community represented within the proposal area (Figure 5):

- 'Urban_E/N: Urban Exotic/Native'.

5.3.1 Existing Environment

5.3.1.1 Vegetation Communities

Vegetation within the proposal area was comprised of planted native landscaping as well as highly disturbed median strips and traffic islands consisting of common exotic roadside grasses and forbs. Exotic species included *Bidens pilosa, Soliva sessilis*, *Medicago polymorpha* and *Plantago lanceolata*.

The area to the north of Hill Road contained planted native canopy trees including *Eucalyptus microcorys* (Tallowwood), *Eucalyptus robusta* (Swamp Mahogany), *Casuarina glauca* (Swamp She-Oak) and *Brachychiton populneus* (Kurrajong). The midstorey was made up of similar species. The understorey had small stands of native *Lomandra longifolia* (Spiny-head Mat-Rush) interspersed with areas of exotic pasture grasses such as *Eragrostis* spp. and *Cyperus rotundus* (Nut Grass).

The large traffic island to the east of Bennelong Parkway consisted of pasture grasses and exotic herbs such as *Soliva sessilis* (Bindi), *Vicia sativa* (Vetch), *Taraxicum officionale*., *Cyperus rotundus* (Nut Grass). A large occurrence of *Ipomea indica* (Morning Glory) was found on the fence line bordering the proposal area.

No threatened flora species were recorded in the proposal area during the field surveys carried out in August 2020. No threatened fauna or suitable threatened fauna breeding habitat was identified within the proposal area. There is however potential that the proposal area is used as a movement corridor for *Litoria aurea* (Green and Golden Bell Frog), which is listed as Endangered under the BC Act 2016 and Vulnerable under the EPBC Act 1999.

The characteristic features that lead Narla to select the vegetation community is provided in a detailed summary in Table 5.

Figure 5. Historical Vegetation Mapping (OEH 2016a)

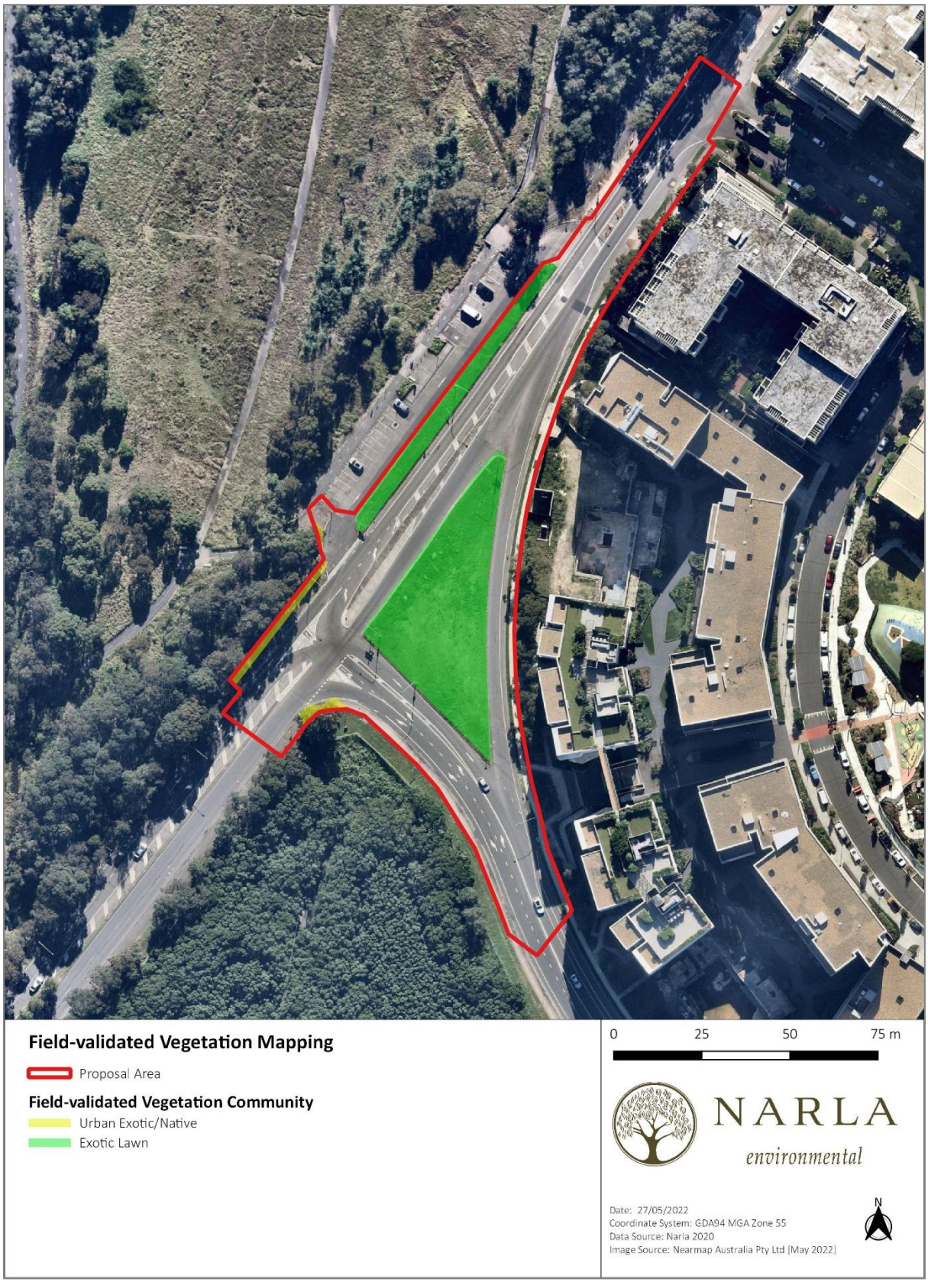

Figure 6. Field-validated Vegetation Mapping

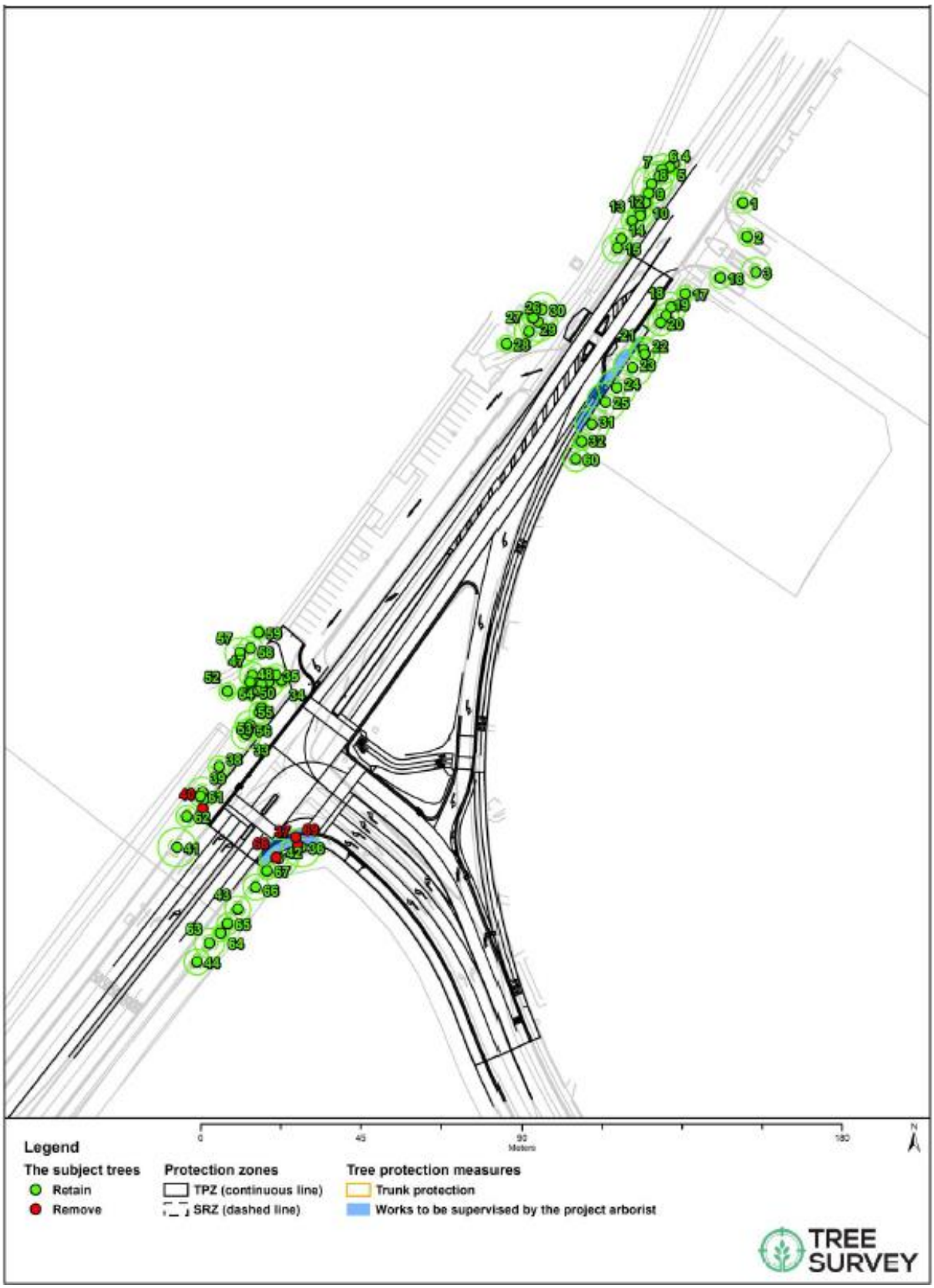

Figure 7. Tree Protection Plan (Tree Survey 2022).

Table 5. Summary of Vegetation Composition, structure and condition within the proposal area

Urban Exotic/ Native	
	
Extent within proposal area (approximate)	0.019 ha (4 trees requiring removal)
Description of Vegetation within the proposal area	
Vegetation within this area was reflective of historically planted mixed natives, and displayed a good condition canopy and midstory which was comprised of *Eucalyptus microcorys* (Tallowwood), *Eucalyptus robusta* (Swamp Mahogany), *Casuarina glauca (*Swamp She-Oak) and *Brachychiton populneus* (Kurrajong). The understorey had small stands of native *Lomandra longifolia* (Spiny-head Mat-Rush) interspersed with areas of exotic pasture grasses such as *Eragrostis spp.* and *Cyperus rotundus* (Nut Grass). Floristic diversity was low as the area was either covered with mulch or was reflective of disturbed bare earth.	

Exotic Lawn	
	
Extent within proposal area (approximate)	0.18 ha
Description of Vegetation within the proposal area	
The large traffic island to the east of Bennelong Parkway consisted of exotic pasture grasses and herbs such as *Soliva sessilis* (Bindii), *Vicia sativa* (Vetch), *Taraxacum officionale., Cyperus rotundus* (Nut Grass). The area to the west of Bennelong Parkway consisted of a median strip populated by similar species as the traffic island. A large occurrence of *Ipomea indica* (Morning Glory) was found on the fence line bordering the proposal area.	

5.3.1.2 Threatened flora

The NSW Wildlife Atlas (Bionet) (DPIE 2020) database search revealed a suite of threatened flora species (**Table 4**). Despite thorough in-field searches, no other flora species of conservation significance listed under either "Rare or Threatened Australian Plants" (RoTAP) (Briggs and Leigh 1996), BC Act or EPBC Act were confirmed on or immediately adjacent the proposal area.

5.3.1.3 Priority and environmental weeds

Two (2) Priority weed species were found within the proposal area. These were:

- *Lantana camara;* and
- *Senecio madagascariensis.*

The full list of the flora species including exotic species and priority weeds recorded is presented in **Appendix C.**

5.3.1.4 Threatened fauna

The NSW Wildlife Atlas (Bionet) (DPIE 2020) database search revealed a suite of threatened fauna species (**Table 4**). An Assessment of Likely Occurrence (**Appendix D**) identified the potential presence of a range of threatened species within the proposal area.

A thorough assessment of fauna habitat availability across the proposal area was conducted as a priority. The habitat assessment provided an understanding of the threatened fauna species that may potentially occur in the proposal area during part of their lifecycle.

Areas of Planted Native vegetation within the proposal area may provide foraging habitat for threatened fauna, including:

- Little Lorikeet;
- Swift Parrot;
- Regent Honeyeater;
- Grey-headed Flying Fox; and
- Green and Golden Bell Frog.

An assessment of likely occurrence for all threatened species deemed as having potential to occur in the proposal area is presented in **Appendix D**. The full list of the fauna species including exotic species and priority weeds recorded is presented in **Appendix C**.

5.3.2 Potential Impacts

5.3.2.1 Removal of native vegetation

A total of four (4) trees are located within, or directly adjacent to the proposed construction footprint and cannot be retained under the current proposal (**Figure 7**). These trees have been assessed as a low priority for retention by the Project Arborist (Tree Survey 2022) and are recommended for removal. Safeguards and mitigation measures designed to reduce the impact of vegetation removal are provided in **Section 6.1**. The areas in which the works are taking place are either within the footprint of the existing road, or within areas that are largely bare earth or dominated by exotic grasses. The potential loss of vegetation associated with the proposal has been quantified by overlaying the proposal footprint onto Narla's vegetation mapping (**Figure 6**). The results are summarised in **Table 5**.

5.3.2.2 Loss of threatened flora

No threatened flora species were identified during site assessment. Habitat for threatened flora is considered sub-optimal due to the severely fragmentated and highly disturbed nature of the site. No significant impact to threatened flora or their habitats will occur as a result of the proposal.

5.3.2.3 Loss of threatened fauna habitat

No hollow-bearing trees were identified within the proposal area. Owing to the location of the proposal area, vegetation within the proposal area is highly unlikely to provide any suitable breeding habitat for highly mobile threatened fauna, including Little Lorikeet, Swift Parrot, Regent Honeyeater and Grey-headed Flying-fox. These species may forage on nectar when trees are flowering, and pass through the proposal area. It is unlikely that these species will be significantly impacted as there are no canopy trees proposed for removal as a result of the proposed activity.

There is however potential for the Green and Golden Bell Frog to utilise native vegetation within the proposal area, as the works are located directly adjacent to known habitat for this species (SOPA 2019). Such habitat includes Woo-la-ra which is considered to be a movement corridor for this species, as well as Narrawang Wetland which is a breeding pond. No breeding habitat for this species was observed within the proposal area. A number of mitigation measures as listed in Table 6 will be implemented to reduce potential impacts to this species.

5.3.2.4 Habitat fragmentation

The proposal will not divide any areas of continuous habitat. Vegetation within the proposal area is highly fragmented due to its location and condition. The Planted Native vegetation that connects to Millennium Park will not be fragmented by the removal of select trees to facilitate construction.

5.3.2.5 Impacts to hydrology

The construction phase of the proposal presents a low risk to degradation of any downstream aquatic habitat. A number of stormwater outlets flow from the proposal area to Nuwi Wetland, an estuarine wetland containing mangroves which are protected under the Fisheries Act 1994. Sedimentation and erosion control measures shall be put in place during the entire construction of the proposed activity to avoid any spills and sedimentation from entering stormwater inlets which drain to nearby waterways and wetlands. Planning advice on previous projects has recommended that the sedimentation and erosion control measures be taken from 'The Blue Book' 'Managing Urban Stormwater: Soils and Construction' (Landcom 2004). To prevent risk of exacerbated erosion, sedimentation or pollution events, works will not take place prior, during or immediately post periods of above average rainfall.

5.3.2.6 Light spill

The proposed works include the installation of Traffic Control Signals (TCS) and new street lighting which has the potential to increase light intensity and spill into the adjacent Nuwi Wetland and Woo-la-ra. Artificial light is known to adversely affect many species and ecological communities. It can change behaviour and/or physiology, reducing survivorship output. It can also have an indirect effect by changing the availability of habitat or food resources. It can attract predators and invasive pests, both of which may pose a threat to threatened species (Department of the Environment and Energy 2020). To mitigate the effects of additional lighting on flora and fauna, any new lighting within the proposal area should comply with the 'National Light Pollution Guidelines for Wildlife' (Department of the Environment and Energy 2020) as well as additional mitigation measures outlined in Table 6.

5.3.2.7 Pathogens

While pathogens were not observed or tested for in the proposal area, the potential for pathogens to occur would be treated as a risk during construction.

5.3.2.8 Conclusion on significance of impacts

No native vegetation (trees or shrubs) are proposed for removal as a result of the proposed activity. However, the proposal may impact on potential movement corridors for Green and Golden Bell Frog. A Test of Significance (5-Part Test) in accordance with section 7.3 of the NSW Biodiversity Conservation Act (BC Act) was carried out for this species (Appendix E), as well as a Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Assessment of Significant Impact Criteria (Appendix F). It was determined that no significant impact on this species would result from the proposed activity.

5.3.3 Biodiversity Offsets

In accordance with Roads and Maritime Services (RMS) policy (considered to be best practice for road upgrades), biodiversity offsets are to be provided where more than one hectare of 'high conservation value' vegetation is cleared and/or more than five hectares of habitat for threatened species is cleared (Roads and Maritime Services 2011).

In accordance with RMS offset guidelines, this proposal does not trigger the need for offsets as there are no impacts to listed critically endangered ecological communities.

In accordance with the BC Act, the NSW Biodiversity Offset Scheme (BOS) is only triggered if the proponent determines that the proposed action will cause a 'significant impact' to a threatened species, population or ecological community. Following preparation of 'Tests of Significance' (5-part test) for occurring and potentially occurring threatened species, populations and ecological communities, it was confirmed that the proposed action will not trigger the BOS.

5.3.4 Safeguards and management measures

Suggested safeguards and management measures for Biodiversity are presented in **Table 6.**

Table 6. Biodiversity safeguards and management measures

Consideration	Environmental safeguards	Responsibility	Timing
Light spill impacts to native fauna	▪ The proposed works include the installation of Traffic Control Signals (TCS) and new street lighting which has the potential to increase light intensity and spill into the adjacent Nuwi Wetland and Woo-la-ra. Lighting for the proposed works should therefore incorporate the following design principles (as listed in Department of the Environment and Energy 2020) to reduce impacts to adjacent fauna habitat: ◦ Start with natural darkness and only add light for specific purposes. ◦ Use adaptive light controls to manage light timing, intensity and colour. ◦ Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill. ◦ Use the lowest intensity lighting appropriate for the task. ◦ Use non-reflective, dark-coloured surfaces. ◦ Use lights with reduced or filtered blue, violet and ultra-violet wavelengths. Lights with low blue light content will align with the recent Sydney Olympic Park Town Centre upgrades where LED lights of 3000k have been installed.	City of Parramatta	Pre-construction / Design phase
Protect native flora and fauna, minimise edge effects	▪ Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal are to be investigated during detailed design and implemented where practicable and feasible.	Contractor	Pre-clearance
Green and Golden Bell Frog habitat	▪ Prior to the construction phase of the development, the proponent will be required to commission the services of a qualified and experienced Ecologist with a minimum tertiary degree in Science, Conservation, Biology, Ecology, Natural Resource Management, Environmental Science or Environmental Management. The Ecologist must be licensed with a current Department of Primary Industries Animal Research Authority permit and New South Wales Scientific License issued under the BC Act. The Ecologist will be commissioned to:	Contractor Ecologist	Pre-clearance

Consideration	Environmental safeguards	Responsibility	Timing
	◦ Undertake an extensive pre-clearing survey for Green and Golden Bell Frogs prior to the removal of any vegetation. This will involve a hand search for frogs and other wildlife within the footprint of the proposed works. Grasses and groundcovers should then be immediately cut using hand tools to a height of <50mm. All cut material should be immediately removed from the site to avoid Green and Golden Bell Frogs from sheltering in cut material overnight.		
Unexpected threatened species finds	▪ An unexpected finds procedure will be implemented in the event that a threatened species is unexpectedly encountered during the construction process. This includes unexpected finds of Green and Golden Bell Frogs particularly after warm weather and rain. This should be outlined within toolbox talks and/or inductions. If a frog is found, the Parklands Ecologist from Sydney Olympic Park Authority can be contacted on 0409300242 to organise removal.	Contractor	Construction
Protect native flora and fauna and avoid inadvertent impacts	▪ Consistent with the approved best practice methods: ◦ The limits of clearing within the construction site are to be delineated using appropriate signage and barriers, identified on site construction drawings and during construction staff induction; ◦ Vegetation to be retained, should be clearly identified and protected by suitable fencing, signage or markings.	Contractor	Construction
Habitat management and impact minimisation	▪ As a minimum the contractor should ensure: ◦ No vegetation clearing removal beyond limits identified in this REF; ◦ Avoiding identified exclusion zones and protected habitat features; ◦ Avoiding mixing of topsoil with woody debris materials; ◦ Separation of woody vegetation suitable for re-use during construction and rehabilitation or revegetation works; ◦ Implementation of staged clearing; ◦ All tree removal work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in accordance with Australian Standard AS4373-2007, Pruning of Amenity Trees (AS4373), the Work Health and Safety Act 2011, and Work Health and Safety Regulations 2017.	Contractor	Construction

Consideration	Environmental safeguards	Responsibility	Timing
Impacts to Native Vegetation	▪ Four (4) trees are required to be removed to facilitate the proposed works. In order to ensure no long-term, net loss of foraging habitat, each native tree removed should be replaced through planting in a nearby council reserve at a ratio of one tree to replace each tree removed. The authority (City of Parramatta) may choose to provide a contractor with a suitable location nearby within Council land for the plantings (where required).	City of Parramatta	Construction
Encroachment within Tree Protection Zones (TPZ)	▪ Minor Encroachment (10%): o The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ. o Detailed root investigations should not be required. o Tree protection must be installed. ▪ Major Encroachment (>10%): o The project arborist must demonstrate the tree(s) would remain viable. o Root investigation by non-destructive methods may be required for any trees proposed for retention. o Consideration of relevant factors, including root location and distribution, tree species, condition, site constraints, and design factors. o The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ. o The project arborist will be required to supervise any work within the TPZ. o Tree protection must be installed.	City of Parramatta Project Arborist	Construction
Tree Protection	▪ All tree removal work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in accordance with Australian Standard AS4373-2007, Pruning of Amenity Trees (AS4373), the Work Health and Safety Act 2011, and Work Health and Safety Regulations 2017. ▪ Minor vegetation trimming may be required to accommodate construction clearances. Standard pruning specifications are outlined below: o Pruning must not exceed 10% of the overall canopy volume. o No limbs greater than 100mm in diameter are to be removed.	City of Parramatta Project Arborist	Construction

Consideration	Environmental safeguards	Responsibility	Timing
	○ The final pruning cut shall be at the branch collar or growth point in accordance with AS4373. ○ All tree pruning work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in accordance with AS4373 and the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998). ○ If proposed vegetation trimming does not meet the specifications outlined above, the project arborist must undertake an assessment of impacts on a case-by-case basis. ▪ The TPZ is an area that is isolated from the work zone to ensure no disturbance or encroachment occurs in this zone. Activities generally excluded from the TPZ (unless otherwise approved under the development consent) include, but are not limited to: ○ Machine excavation and trenching. ○ Ripping or cultivation of the soil. ○ Storage of building materials, waste, and waste receptacles. ○ Disposal of waste materials and chemicals including paint, solvents, cement slurry, fuel, oil, and other toxic liquids. ○ Movement and storage of plant, equipment, and vehicles. ○ Soil level changes, including the placement of fill material. ○ Mechanical removal of vegetation. ○ Affixing of signage or hoardings to trees. ○ Other physical damage to the trunk or root system. ○ Any other activity that is likely to cause damage to the tree ▪ Trunk protection must be installed at the locations shown in the Tree Protection Plan (Tree Survey 2022). ▪ If temporary access for vehicle, plant, or machinery is required within the TPZ ground protection shall be installed. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. ▪ The area within the TPZ should be mulched with good quality composted wood chip/leaf mulch and should be maintained at a depth of 150mm-200mm. Mulching around the base of the tree will		

Consideration	Environmental safeguards	Responsibility	Timing
	provide nutrients and organic matter to the soil as it breaks down, improving and maintaining the overall health of the trees. ▪ The demolition of all existing structures inside or directly adjacent to the TPZ of trees to be retained must be undertaken in consultation with the project arborist. Any machinery is to work from inside the footprint of the existing structures or outside the TPZ, to minimise soil disturbance and compaction. If it is not feasible to locate demolition machinery outside the TPZ of trees to be retained, ground protection will be required. The demolition should be undertaken inwards into the footprint of the existing structures, sometimes referred to as the 'top-down, pull back' method. ▪ The project arborist must supervise and certify that all excavations and root pruning are in accordance with AS4373 and AS4970. All excavations (including root investigations) within the TPZ must be carried out using tree-sensitive methods under the supervision of the project arborist. ▪ If underground services are required to be installed, they should be routed outside of the TPZ. If underground services need to be installed within the TPZ, they must be installed using tree-sensitive excavation methods under the supervision of the project arborist. Alternatively, boring methods such as horizontal directional drilling (HDD) may be used for underground service installation, providing the installation is at a minimum depth of 800mm below grade. Excavations for entry/exit pits must be located outside the TPZ. ▪ Any conflicting roots greater than 50mm in diameter identified during the supervised excavations shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning (>50mm) must be documented and carried out by the project arborist.		
Site Inspections – Project Arborist	▪ In accordance with AS4970, inspections must be conducted by the project arborist at the following key project stages: o Prior to any work commencing on-site (including demolition, earthworks, or site clearing) and following the installation of tree protection. o During any excavations, building works, and any other activities carried out within the TPZ of any tree to be retained & protected. o A minimum of once per 12 weeks (every 3 months) during the construction phase for trees with a major encroachment within the TPZ. o After all major construction has ceased, following the removal of tree protection.	City of Parramatta Project Arborist	Before, During and After Construction

Consideration	Environmental safeguards	Responsibility	Timing
Landscaping / Revegetation	▪ Any landscaping or revegetation within the project area should incorporate species from Sydney Turpentine-Ironbark Forest, which will complement the adjacent planting within Sydney Olympic Park.	City of Parramatta	Construction
Stockpiles, plant and ancillary sites	▪ Cover stockpiles to prevent erosion and sedimentation ▪ Avoid stockpiling of materials within the dripline of canopy trees	Contractor	Construction
Stormwater	▪ Sedimentation and erosion control measures shall be put in place during the entire construction of the proposed activity to avoid any spills and sedimentation from entering stormwater inlets which drain to nearby waterways and wetlands. ▪ Sedimentation and erosion control measures should be taken from 'The Blue Book' 'Managing Urban Stormwater: Soils and Construction' (Landcom 2004). ▪ To prevent risk of exacerbated erosion, sedimentation or pollution events, works will not take place prior, during or immediately post periods of above average rainfall.	Contractor	Construction
Biosecurity - Weed, Pest Species and Pathogen Management	▪ Implement appropriate weed control methods and weed disposal; ▪ Implement appropriate hygiene protocols where there are potential or known pathogen risks.	Contractor	Construction

5.4 Noise and Vibration

A desktop assessment for the potential impacts on noise and vibration during construction and operation of the proposal have been assessed in this REF.

Noise and vibration guidelines for construction and operations are based on the publications managed by the Environmental Protection Authority (EPA). The guidelines relevant to this assessment include:

- Operational Noise – Road Noise Policy (RNP) (EPA 2011);
- Noise Criteria Guideline (RMS 2015);
- AS 2436 – 2010 Guide to noise and vibration control on construction, demolition and maintenance sites;
- Construction Noise – Interim Construction Noise Guideline (ICNG) (DECC 2009);
- Construction Vibration (human comfort) – Assessing Vibration – a technical guideline (DEC 2006); and
- Construction Vibration (damage limits) – German Standard DIN 4150, Part 3: Structural Vibration in buildings: Effects on Structures.

In summary, the methodology for the noise and vibration assessment included the following:

- Identifying noise and vibration sensitive receivers and defining the proposal area;
- Establishing noise and vibration assessment criteria;
- Prediction of construction and operational noise levels;
- Assessing predicted noise and vibration levels against the relevant criteria to identify potential impacts; and
- Identify safeguards and management measure to be implemented to minimise impacts.

5.4.1 Existing Environment

The proposal area is predominantly situated in an urban landscape. It is expected that the works required for the proposed activity will generate moderate noise and vibration.

5.4.1.1 Sensitive Receivers

The areas surrounding the proposed project can be described as being mixed residential and commercial. A single recreational area is located approximately 100m away. Given the nature of the area, no other sensitive receivers are expected to be impacted by the proposal.

5.4.2 Criteria

5.4.2.1 Construction Noise Criteria

The DECC (2009) Interim Construction Noise Guideline recommends that, where works are likely to occur over more than two consecutive nights, maximum noise levels should be analysed in terms of the extent and number of times the maximum noise exceeds the RBL. Additionally, the DECCW (2011) Road Noise Policy discusses a guideline aimed at limiting the level of sleep disturbance due to environmental noise being that a L^{AF1} 1-minute level of any noise should not exceed the ambient L^{A90} noise level by more than 15 dB(A).

Sound power levels (L_w) produced by construction plant anticipated to be used were sources from AS 2436 – 2010 Guide to noise and vibration control on construction, demolition and maintenance sites. The sound power level of each item of equipment/plant was then distance attenuated from the proposal areas. Propagation calculations take into account sound intensity losses due to hemi-spherical spreading. Minor losses such as; atmospheric absorption, directivity and ground absorption are not taken into account in the calculations. As a result, predicted noise levels are expected to be conservative. Received noise at each assessed distance, from each item of plant on site, is added (where appropriate) to determine the total received noise at that distance from construction activities and compared to the criteria.

Received noise levels produced by anticipated activities, during the construction of the proposed activity are shown in **Table 7** for a variety of distances to a typical receiver, with no noise barriers or acoustic shielding in place and with each plant item operating at full power.

Table 7. Predicted Plant Item Noise Levels dB(A)

Plant Activity	L_w dB(A)	Distance from Source (m)				
		50m	100m	200m	500m	1000m
Backhoe	104	62	56	50	42	36
Compressor	100	58	52	46	38	32
Bulldozer	104	62	56	50	42	36
Dump Truck	103	61	55	49	41	35
Excavator	103	61	55	49	41	35
All plant combined		68	62	56	48	42

The sound power levels show in **Table 7** are maximum levels produced when machinery is operating under full load.

The construction noise criteria are set for noise levels determined as $L_{10(15min)}$. During a full 15-minute period the machinery items to be used on site will operate at maximum sound power levels for sound power levels for only brief stages. At other times the machinery may produce lower sound levels while carrying out activities not requiring full power. In addition, mobile machinery will likely move about during the 15 minutes, variously altering the directivity of the noise source with respect to individual receivers.

The construction work is expected to be complete within 4 months of its commencement, however, it is unlikely that the any part of the project will be in any one place for more than 1 consecutive weeks and as such the construction noise criterion should be considered as being Background + 20 dB(A). As a consequence, in a worst-case configuration, exceedances of this criterion could occur when construction activity is within close proximity of sensitive receivers along the proposal area. It is unlikely that all of the machinery would be operating at full power at the same time for an extended period.

Noise Management Levels (NMLs) for noise at sensitive receivers and how they should be applied is presented (**Table 8**). Restrictions to the hours of construction may apply to activities that generate noise at sensitive receivers above the 'highly noise affected' noise management level. The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Table 8. General construction noise management levels

Time period	Criteria	Notes
Recommended standard hours of work	Noise affected (RBL + 10dB)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15\ minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. 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.

Time period	Criteria	Notes
	Highly noise affected (>75dB[A])	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: ▪ 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; and ▪ 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 + 5dB)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected levels. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

5.4.2.2 Construction Vibration Criteria

There are two types of vibration criteria that are used when assessing impacts. The first is the human comfort criteria, which as the name suggests is designed to minimise impacts that may disrupt day to day activities of humans. The other form of vibration criteria is designed to avoid damage to buildings and structures.

5.4.2.3 Human Comfort Criteria

When assessing vibration, the NSW EPA classifies vibration as one of three types:

- Continuous – where vibration occurs uninterrupted and can include sources such as machinery and constant road traffic;
- Impulsive – where vibration occurs over a short duration (typically less than two seconds) and occurs less than three times during the assessment period, which is not defined. This may include activities such as occasional dropping of heavy equipment or loading / unloading activities; and
- Intermittent – occurs where continuous vibration activities are regularly interrupted, or where impulsive activities recur. This may include activities such as rock hammering, drilling, pile driving and heavy vehicle or train passbys.

Where the vibration is classed as intermittent, the DECC uses a vibration dose value (VDV) to assess levels of vibration (**Table 9**) VDV is calculated using the acceleration rate of the vibration event and the time over which it occurs. This method is more sensitive to the level of vibration than its duration and is a measure of the total quantity of vibration perceived. The VDV method is the most suitable for assessing human comfort amenity from intermittent vibration sources.

Table 9. Acceptable vibration dose values (VDV's) for intermittent vibration (m/s1.75) 1-80 Hz

Location	Day time (7am – 10pm)		Night time (10pm - 7am)	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas (e.g. Hospitals)	0.10	0.20	0.10	0.20
Residential buildings	0.20	0.40	0.13	0.26
Offices, schools, churches, etc	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.6

5.4.2.4 Criteria for building structures (including heritage)

When assessing potential vibration impacts on building structures, the velocity and direction of the movement is measured. The measurement is referred to as the Peak Particle Velocity (PPV), presented in mm/s.

Vibration from construction activities, with regard to building damage, is assessed using the German standard DIN 4150-3:2015 Effects of Vibration on Structures (DIN Guideline). The DIN Guideline values for PPV measured at the foundation of various structures are summarised in Table 10.

Table 10. Guideline values of vibration velocity, for evaluating the effects of short-term vibration DIN 4150

Type of structure	Guideline values for velocity, v_i (mm/s)		
	Vibration at the foundation at a frequency of:		
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50
Dwellings and buildings of similar design	5	5 to 15	15 to 20
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and area of great intrinsic value	3	8 to 10	8 to 10
*For frequencies above 100Hz, at least the values specified in this column shall be applied			

The Construction Noise and Vibration Guideline (RMS 2016) recommends safeworking distances for achieving human comfort and cosmetic building damage criteria for a range of different plant and equipment. Although it is noted that these distances are indicative and vary depending on local geotechnical conditions; these offsets have been considered for the initial assessment of potential vibration impacts during the construction of the proposal (Table 11).

Table 11. Recommended safe working distances for vibration-intensive plant and equipment (RMS 2016)

Plant	Rating	Safe working distance (m)	
		Cosmetic Damage (BS7385-2 1993)	Human Response (DECC 2006)
Vibratory Roller	<50 kN (typically 1-2 tonne)	5	15 to 20
	<100 kN (typically 2-4 tonne)	6	20
	<200 kN (typically 4-6 tonne)	12	40
	<300 kN (typically 7-13 tonne)	15	100
	>300 kN (typically 13-18 tonne)	20	100
	>300 kN (> 18 tonne)	25	100
Small hydraulic hammer	300 kg – 5 to 12 tonne excavator	2	7
Medium hydraulic hammer	900 kg – 12 to 18 tonne excavator	7	23
Large hydraulic hammer	1600 kg – 18 to 34 tonne excavator	22	736
Vibratory pile driver	Sheet piles	2 to 20	20
Pile boring	≤800 mm	2 (Nominal)	4
Jackhammer	Hand held	1 (Nominal)	2

5.4.2.5 Buried Services

DIN 4150-3:2015 provides guidance for evaluating the effects of short-term vibration on buried services (**Table 12**).

Table 12. DIN 4150-3:2015 guidance for evaluating effects of short-term vibration on buried services

Pipe Material	Guideline value for velocity measure on the pipe (mm/s)
Steel (including welded pipes)	100
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
Masonry, plastic	50

5.4.3 Safeguards and management measures

Suggested safeguards and management measures for noise and vibration are presented in **Table 13.**

Table 13. Noise and vibration safeguards and management measures

Consideration	Environmental safeguards	Responsibility	Timing
Noise and vibration	The contractor should ensure: ▪ All potential significant noise and vibration generating activities associated with the activity is kept to a minimum; ▪ A monitoring program to assess performance against relevant noise and vibration criteria; ▪ Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures; and ▪ Contingency measures to be implemented in the event of noncompliance with noise and vibration criteria.	Contractor	Pre-clearance
Noise and vibration	All sensitive receivers (e.g. local residents) likely to be affected will be notified at least five business days prior to starting any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: ▪ The proposal; ▪ The construction period and construction hours; ▪ Contact information for senior project management staff; ▪ Complain and incident reporting; and ▪ How to obtain further information.	Contractor	Pre-clearance
Site induction	All personnel working on site will receive training (such as a site induction) to ensure awareness of requirements of the noise and vibration issues associated with the project. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers.	Contractor	Pre-clearance / Construction
Noise and vibration	Where possible, works outside of standard construction hours will be planned so that noisier works are carried out in the earlier part of the evening or night time.	Contractor	Pre-clearance / Construction

Consideration	Environmental safeguards	Responsibility	Timing
Construction Noise Management Plan (CNMP)	A CNMP should be prepare prior to construction works that includes noise monitoring during the project.	Contractor	Pre-clearance / Construction

5.5 Social and Visual

A desktop assessment for the potential impacts on social and visual during construction and operation of the proposal have been assessed in this REF. The potential impacts, and safeguards to mitigate them, are summarised below.

5.5.1 Methodology

For the assessment of landscape character and visual impact, the impact area includes all areas from which the proposal would be potentially seen. The visual impact assessment was carried out in accordance with Transport for NSW Guidelines for Landscape Character and Visual Impact Assessment - Environmental impact assessment practice note EIA-N04 (2020).

The methodology for the preparation of the socio-economic and land use assessment involved a two-stage process, as follows:

- Identifying the scope of assessment and defining the proposal area based on the likely range of potential socio-economic and land use impacts and the communities most likely to be affected by the proposal; and
- Identifying safeguards and management measures to avoid, minimise or mitigate potential socio-economic and land use impacts identified in the assessment.

5.5.2 Existing Environment

The area surrounding the proposal area is comprised of the following land zones:

- DM – Deferred Matter
- E2 – Environmental Conservation
- E3 – Environmental Management
- RE1 – Public Recreation
- SP2 - Infrastructure

5.5.3 Potential Impacts

5.5.3.1 Construction - Visual

Minor, short-term impacts on visual amenity from minor clearing of roadside weed vegetation.

Short term visual impacts include earthworks, generation of waste, traffic barriers and temporary signage would result in a more cluttered streetscape Construction worksites would be restored following the completion of construction. Measures to ameliorate the impacts are summarised in Section 5.5.4.

5.5.3.2 Construction – Social

During construction, potential impacts on access and connectivity in the proposal area would generally relate to:

- Temporary traffic delays and disruptions for motorists and other road users along Bennelong Parkway and Hill Road due to the implementation of traffic management measures, such as temporary lane closures or stoppages and reductions in speed limits;
- Temporary increased construction traffic on Bennelong Parkway and Hill Road, including light and heavy vehicles used to deliver equipment, materials and spoil, and construction workers accessing the work site; and

- Access to private properties would be maintained during construction. Where temporary changes are required, suitable access arrangements would be implemented in consultation with affected property owners.

5.5.3.3 Operation

Due to highly disturbed, historically cleared landscape, the landscape character has been assessed as having low sensitivity to change as a result of the minor clearing of exotic weeds within small median strips along Bennelong Parkway and Hill Road.

5.5.4 Safeguards and management measures

Suggested safeguards and management measures for visual and social impacts are presented in Table 14.

Table 14. Visual and social safeguards and management measures

Consideration	Environmental safeguards	Responsibility	Timing
Visual impact of work sites	Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) should be managed to minimise visual impacts. This is to include avoiding temporary light spill, rehabilitation of disturbed areas, appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials.	Contractor	Construction
Visual impact of work sites	Any compound and ancillary facilities are to be decommissioned and the sites rehabilitated to their existing condition or as otherwise agreed with the landowner on completion of works.	Contractor	Construction
Emergency vehicle access	Access for emergency vehicles should be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.	Contractor	Pre-construction / Construction
Complaints	A complaint handling procedure and register should be included in the CEMP or in accordance with the protocols of CoP.	Contractor	Construction

5.6 Waste and Pollution

5.6.1 Policy

Waste management will be undertaken in accordance with the Waste Avoidance and Resource Recovery Act 2001. The objectives of this Act that area applicable to the proposal are:

- To encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development;
- To ensure that resource management options are considered against a hierarchy of the following order:
    - Avoidance of unnecessary resource consumption;
    - Resource recovery (including reuse, reprocessing, recycling and energy recovery);
    - Disposal;
- To provide for the continual reduction in waste generation;
- To minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste; and
- To assist in the achievement of the objectives of the Protection of the Environment Operations Act 1997 (POEO Act).

It is not intended that substantial waste will be produced during the course of the proposed activity.

Pollution will be managed in accordance with the POEO Act and its regulations as amended.

5.6.2 Potential impacts

Construction would generate waste streams typical of road construction, including:

- Green waste from any trimmed/cleared vegetation;
- Bitumen, concrete and asphalt from profiling and removal of any existing road surfaces;
- Roadside materials (i.e. guide posts, guard rails, traffic signage);
- Excess fill material from any excavation of soils and fill embankments during construction;
- Exhaust fumes from vehicles, plant and machinery;
- Oil, grease and other liquid wastes from the maintenance of construction plant and equipment;
- General wastes and sewage from site compounds and offices;
- Plant and equipment maintenance waste including liquid wastes from cleaning, repairing and maintenance; and
- Packaging materials from items delivered to sites, such as pallets, creates, cartons, plastics and wrapping materials.

Any remaining surplus material would be stockpiled in a suitable location, or disposed of to a licensed facility following validation assessment of the type of waste classification.

Unintended impacts or hazards may include:

- Spills
- Incorrect disposal (dumping) of solid waste
- Inappropriate stockpiling of materials.

5.6.3 Safeguards and management measures

Suggested safeguards and management measures for waste are presented in **Table 15.**

Table 15. Waste and pollution management safeguards and management measures

Consideration	Environmental safeguards	Responsibility	Timing
Waste Generation	The contractor is to ensure they have the following procedures in place before project commencement: ▪ Measures to avoid and minimise waste associated with the project; ▪ Classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal) ▪ Classification of wastes received from off-site for use in the project and management options; ▪ Reduce amount of time vehicles, machinery and plant are used (i.e. do not leave vehicles or machines idling unnecessarily). ▪ Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemption; ▪ Procedures for storage, transport and disposal; and ▪ Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions.	Contractor	Life of Project
Spills	The contractor is to ensure they have the following procedures in place before project commencement: ▪ All staff inducted and informed of their legal responsibilities in accordance with the POEO Act. ▪ CEMP Available at all times ▪ Standard Operating Procedures (SOP) ▪ Spill Kit	Contractor	Life of Project
Dumping or Inappropriate Stockpiling of Solid Wastes	The contractor is to ensure they have the following procedures in place before project commencement: ▪ All staff inducted and informed of their legal responsibilities in accordance with the POEO Act. ▪ No stockpiling or parking of heavy machinery under tree drip lines. All stockpiling to be undertaken away from trees proposed to be retained. ▪ All stockpiles to be covered to prevent dust, erosion and sedimentation. ▪ All proposed stockpiling areas clearly delineated from 'no-go-zones' ▪ CEMP Available at all times ▪ Standard Operating Procedures (SOP)	Contractor	Life of Project

5.7 Traffic and transport

A desktop assessment for the potential impacts on traffic and transport during construction and operation of the proposal have been assessed in this REF. The potential impacts, and safeguards to mitigate them, are summarised below.

5.7.1 Existing Environment

Hill Road extends for a distance of approximately 4 kilometres, and acts as an important connection between Parramatta Road and Bennelong Parkway. Hill road is also under an increasing amount of traffic volume to the high rate of growth in the Sydney Olympic Park and Wentworth Point areas. The proposal area consists of a dual lane in each direction along Hill Road and the Bennelong Parkway. The existing lane widths are about 3.5 metres (**Plate 4**). Minimal property accesses are present along either Hill Road or Bennelong Parkway with only one driveway to residential apartments located to the west.

5.7.2 Potential Impacts

Construction would be planned to minimise impacts on traffic. Standard traffic management measure will be used to minimise short-term traffic impacts, and ensure that traffic flow along Bennelong Parkway and Hill Road is maintained throughout construction.

Parking area off Hill Road will be impacted during works to the extent that the entry to the carpark will not be accessible. However the exit would be able to be used as temporary entry to allow for parking during construction.

5.7.2.1 Local Access

It is unlikely that the proposed activity will require access to residential or commercial properties. Where temporary disruptions are required, alternative access would be identified in consultation with any impacted property owners and this process will be managed by CoP. The need for temporary access requirements would be identified during detailed design and construction staging planning. During these works access to private property will not be significantly impacted by the works. All residences will be given notice as to the dates and times of the works and is property entrances are likely to be blocked only for a short period (maximum of 15 minutes at a time).

5.7.2.2 Increased Travel Times

During construction, the speed limit would be reduced to 40km per hour, where required throughout the proposal area. This would temporarily delay travel time across the proposal area when lane closures are in place. There will also be increased travel times if traffic needs to be temporarily redirected onto other nearby roads (unlikely to be necessary), as this would also increase the volume of traffic along these roads. The improved road surface and conditions will improve travel times in the long-term.

5.7.3 Safeguards and management measures

Suggested safeguards and management measures for impacts to traffic are presented in Table 16.

Table 16. Visual and social safeguards and management measures

Consideration	Environmental safeguards	Responsibility	Timing
Traffic and transport	If required, a Traffic Management Plan (TMP) is to be prepared and implemented. The TMP should include: ▪ Measures to maintain access to local roads and properties ▪ Site specific traffic control measures (including signage) to manage and regulate traffic movement ▪ Requirements and methods to consult and inform the local community of impacts on the local road network ▪ Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads ▪ A response plan for any traffic incidents within the construction zone	Contractor	Pre-clearance
Property Access	Access to properties is to be maintained during construction. Where that is not feasible, alternate arrangements will be made in consultation with the CoP Project Manager.	Contractor / City of Parramatta	Construction
Reduce speeds, traffic delays and disruptions during construction	Road users, local communities and sporting user groups will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Contractor	Construction

5.8 Other Considerations

Table 17. Other Impacts

Areas of Outstanding Biodiversity Value declared under the BC Act	No Areas of Outstanding Biodiversity Value (AOBV) declared under the BC Act is present within or in the vicinity of the proposed work location.
Wilderness (either nominated or declared)	Not applicable.
Vegetation of cultural landscape values	There is no known vegetation of cultural landscape value associated with the proposal area, nor within close vicinity. This is reflective of the proposal areas highly disturbed, urban history.
Recreation values	The Proposal may positively impact upon recreational values. The proposal (intersection upgrade) will create a shared path which will be delineated and signposted in accordance with NSW Bicycle Guidelines. This will increase the accessibility of Millennium Parklands by cyclists and recreational bike riders.
Education and scientific values	Nil.
Interests of external stakeholders (e.g.: adjoining landowners, leaseholders)	Parts of the proposed upgrade come in to close proximity of private residences and public amenities. Such land and the locations where encroachment is evident should be identified to site workers. Consultation should occur with residents adjoining areas of works prior to upgrade work taking place. This may take place through direct communication with affected residents (e.g. letter box drop or door visit) or through indirect means such as website notification, temporary signage at entry points and possibly an advertisement in a local newspaper.

6. Environmental Management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and license and/or approval requirements required prior to construction are also listed.

6.1 Summary of suggested safeguards and management measures

An impact assessment has been undertaken to determine which environmental issues are relevant to the Proposal. Only those with a medium to high adverse are further discussed in this document. Descriptions of the impact level definitions are provided in Table 18.

Suggested environmental safeguards and management measures outline in this REF (Table 19) are to be incorporated into the Construction Environmental Management Plan (CEMP). These safeguards and management measures will minimise any potential adverse impacts arising from the proposal works on the surrounding environment and are summarised in Table 19.

Table 18. Description of Impact Levels

Impact Levels	
The potential importance of each impact has been estimated, taking into account all the criteria used to analyse the nature of the impact, including the following: ▪ The level of confidence in predicting the impact; ▪ The reversibility of the impact; ▪ The effectiveness of the proposed methods to manage or mitigate the impact; ▪ Compliance with any relevant policies or plans; ▪ The extent of public interest; ▪ Whether further information is required to confidently determine the impact of the activity Subjective methods have been utilised for assessing impact levels of the proposal with consideration being given to the size and intensity of the activity.	
Descriptor	**Description**
Negligible	No adverse social or environmental impact. No noticeable impact on the community, low financial loss.
Low	Some reversible impacts but readily managed with minimum financial cost.
Medium	Reversible impact on environment. Impacts managed with moderate financial cost, possibly with outside assistance. Measurable adverse environmental or social impact. Will result in annoyance or nuisance to community.
High	Significant impact on environment, possibly irreversible. Impacts either unmanageable or managed at a high cost with outside assistance. Potential for major off-site release with detrimental effects. Irreversible impact due to cost or other factors.
Positive	Effective mitigation measures available, positive impact to environment and community.

Table 19. Potential environmental impacts and proposed ameliorative measures

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
Abhe1	Soil surface disturbance	▪ Soil surface disturbance is to be limited to the existing road pavement and road verges which have been extensively, historically disturbed.	Contractor	Construction	Low
Abhe2	Aboriginal Heritage – unexpected finds (e.g. artefacts or scar trees)	▪ All personnel working on site will be made aware of relevant statutory responsibilities. ▪ The Standard Management Procedure – Unexpected Heritage Items (Roads and Maritime, 2015) should be followed in the event that an unknown or potential Aboriginal object, including skeletal remains, is found during construction. ▪ Work is to only re-start once the re-start once the requirements of the procedure have been satisfied.	Contractor	Construction	Low
Biod1	Light spill impacts to native fauna	▪ The proposed works include the installation of Traffic Control Signals (TCS) and new street lighting which has the potential to increase light intensity and spill into the adjacent Nuwi Wetland and Woo-la-ra. Lighting for the proposed works should therefore incorporate the following design principles (as listed in Department of the Environment and Energy 2020) to reduce impacts to adjacent fauna habitat: ◦ Start with natural darkness and only add light for specific purposes. ◦ Use adaptive light controls to manage light timing, intensity and colour. ◦ Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill. ◦ Use the lowest intensity lighting appropriate for the task. ◦ Use non-reflective, dark-coloured surfaces. ◦ Use lights with reduced or filtered blue, violet and ultra-violet wavelengths. Lights with low blue light content will align with the recent Sydney Olympic Park Town Centre upgrades where LED lights of 3000k have been installed.	City of Parramatta	Pre-construction / Design phase	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
Biod2	Protect native flora and fauna, minimise edge effects	▪ Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal are to be investigated during detailed design and implemented where practicable and feasible.	Contractor	Construction	Low
Biod3	Green and Golden Bell Frog habitat	▪ Prior to the construction phase of the development, the proponent will be required to commission the services of a qualified and experienced Ecologist with a minimum tertiary degree in Science, Conservation, Biology, Ecology, Natural Resource Management, Environmental Science or Environmental Management. The Ecologist must be licensed with a current Department of Primary Industries Animal Research Authority permit and New South Wales Scientific License issued under the BC Act. The Ecologist will be commissioned to: o Undertake an extensive pre-clearing survey for Green and Golden Bell Frogs prior to the removal of any vegetation. This will involve a hand search for frogs or other wildlife within the footprint of the proposed works. Grasses and groundcovers should then be immediately cut using hand tools to a height of <50mm. All cut material should be immediately removed from the site to avoid Green and Golden Bell Frogs from sheltering in cut material overnight.	Contractor Ecologist	Pre-clearance	Low
Biod4	Unexpected threatened species finds	▪ An unexpected finds procedure will be implemented in the event that a threatened species is unexpectedly encountered during the construction process. This includes unexpected finds of Green and Golden Bell Frogs particularly after warm weather and rain. This should be introduced within toolbox talks or inductions. If a frog is found, the Parklands Ecologist from Sydney Olympic Park Authority can be contacted on 0409300242 to organise removal.	Contractor	Pre-clearance	Low
Biod5	Protect native flora and fauna and avoid inadvertent impacts	▪ Consistent with the approved best practice methods: o The limits of clearing within the construction site are to be delineated using appropriate signage and barriers,	Contractor	Construction	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
		identified on site construction drawings and during construction staff induction; ◦ Vegetation to be retained, should be clearly identified and protected by suitable fencing, signage or markings.			
Biod6	Habitat management and impact minimisation	▪ As a minimum the contractor should ensure: ◦ No vegetation clearing removal beyond limits identified in this REF; ◦ Avoiding identified exclusion zones and protected habitat features; ◦ Avoiding mixing of topsoil with woody debris materials; ◦ Separation of woody vegetation suitable for re-use during construction and rehabilitation or revegetation works; ◦ Implementation of staged clearing; ▪ All tree removal work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in accordance with Australian Standard AS4373-2007, Pruning of Amenity Trees (AS4373), the Work Health and Safety Act 2011, and Work Health and Safety Regulations 2017.	Contractor	Construction	Low
Biod7	Impacts to Native Vegetation	▪ Four (4) trees are required to be removed to facilitate the proposed works. In order to ensure no long-term, net loss of foraging habitat, each native tree removed should be replaced through planting in a nearby council reserve at a ratio of one tree to replace each tree removed. The authority (City of Parramatta) may choose to provide a contractor with a suitable location nearby within Council land for the plantings (where required).	Contractor	Construction	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact

Biod8	Encroachment within Tree Protection Zones (TPZ)	▪ Minor Encroachment (10%):
		  ○ The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ.
		  ○ Detailed root investigations should not be required.
		  ○ Tree protection must be installed.
		▪ Major Encroachment (>10%):
		  ○ The project arborist must demonstrate the tree(s) would remain viable.
		  ○ Root investigation by non-destructive methods may be required for any trees proposed for retention.
		  ○ Consideration of relevant factors, including root location and distribution, tree species, condition, site constraints, and design factors.
		  ○ The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ.
		  ○ The project arborist will be required to supervise any work within the TPZ.
		▪ Tree protection must be installed.
			Contractor	Construction	Low

Biod9	Tree Protection	▪ All tree removal work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in accordance with Australian Standard AS4373-2007, Pruning of Amenity Trees (AS4373), the Work Health and Safety Act 2011, and Work Health and Safety Regulations 2017.
		▪ Minor vegetation trimming may be required to accommodate construction clearances. Standard pruning specifications are outlined below:
		  ○ Pruning must not exceed 10% of the overall canopy volume.
		  ○ No limbs greater than 100mm in diameter are to be removed.
			Contractor	Construction	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
		◦ The final pruning cut shall be at the branch collar or growth point in accordance with AS4373. ◦ All tree pruning work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in accordance with AS4373 and the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998). ◦ If proposed vegetation trimming does not meet the specifications outlined above, the project arborist must undertake an assessment of impacts on a case-by-case basis. ▪ The TPZ is an area that is isolated from the work zone to ensure no disturbance or encroachment occurs in this zone. Activities generally excluded from the TPZ (unless otherwise approved under the development consent) include, but are not limited to: ◦ Machine excavation and trenching. ◦ Ripping or cultivation of the soil. ◦ Storage of building materials, waste, and waste receptacles. ◦ Disposal of waste materials and chemicals including paint, solvents, cement slurry, fuel, oil, and other toxic liquids. ◦ Movement and storage of plant, equipment, and vehicles. ◦ Soil level changes, including the placement of fill material. ◦ Mechanical removal of vegetation. ◦ Affixing of signage or hoardings to trees. ◦ Other physical damage to the trunk or root system. ◦ Any other activity that is likely to cause damage to the tree ▪ Trunk protection must be installed at the locations shown in the Tree Protection Plan (Tree Survey 2022). ▪ If temporary access for vehicle, plant, or machinery is required within the TPZ ground protection shall be installed. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. ▪ The area within the TPZ should be mulched with good quality composted wood chip/leaf mulch and should be maintained at a depth of 150mm-			

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
		200mm. Mulching around the base of the tree will provide nutrients and organic matter to the soil as it breaks down, improving and maintaining the overall health of the trees. ▪ The demolition of all existing structures inside or directly adjacent to the TPZ of trees to be retained must be undertaken in consultation with the project arborist. Any machinery is to work from inside the footprint of the existing structures or outside the TPZ, to minimise soil disturbance and compaction. If it is not feasible to locate demolition machinery outside the TPZ of trees to be retained, ground protection will be required. The demolition should be undertaken inwards into the footprint of the existing structures, sometimes referred to as the 'top-down, pull back' method. ▪ The project arborist must supervise and certify that all excavations and root pruning are in accordance with AS4373 and AS4970. All excavations (including root investigations) within the TPZ must be carried out using tree-sensitive methods under the supervision of the project arborist. ▪ If underground services are required to be installed, they should be routed outside of the TPZ. If underground services need to be installed within the TPZ, they must be installed using tree-sensitive excavation methods under the supervision of the project arborist. Alternatively, boring methods such as horizontal directional drilling (HDD) may be used for underground service installation, providing the installation is at a minimum depth of 800mm below grade. Excavations for entry/exit pits must be located outside the TPZ. ▪ Any conflicting roots greater than 50mm in diameter identified during the supervised excavations shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning (>50mm) must be documented and carried out by the project arborist.			

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact

Biod10	Site Inspections – Project Arborist	▪ In accordance with AS4970, inspections must be conducted by the project arborist at the following key project stages:
		  ○ Prior to any work commencing on-site (including demolition, earthworks, or site clearing) and following the installation of tree protection.
		  ○ During any excavations, building works, and any other activities carried out within the TPZ of any tree to be retained & protected.
		  ○ A minimum of once per 12 weeks (every 3 months) during the construction phase for trees with a major encroachment within the TPZ.
		▪ After all major construction has ceased, following the removal of tree protection.
			City of Parramatta	Before, during and after Construction	Low

Biod11	Landscaping / Revegetation	▪ Any landscaping or revegetation within the project area should incorporate species from Sydney Turpentine-Ironbark Forest, which will complement the adjacent planting within Sydney Olympic Park.	City of Parramatta	Construction	Negligible
Biod12	Stockpiles, plant and ancillary sites	▪ Cover stockpiles to prevent erosion and sedimentation ▪ Avoid stockpiling of materials within the dripline of canopy trees	City of Parramatta	Construction	Medium
Biod13	Stormwater	▪ Sedimentation and erosion control measures shall be put in place during the entire construction of the proposed activity to avoid any spills and sedimentation from entering stormwater inlets which drain to nearby waterways and wetlands. ▪ Sedimentation and erosion control measures should be taken from 'The Blue Book' 'Managing Urban Stormwater: Soils and Construction' (Landcom 2004).	Contractor	Construction	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
		▪ To prevent risk of exacerbated erosion, sedimentation or pollution events, works will not take place prior, during or immediately post periods of above average rainfall.			
Biod14	Biosecurity - Weed, Pest Species and Pathogen Management	▪ Implement appropriate weed control methods and weed disposal; ▪ Implement appropriate hygiene protocols where there are potential or known pathogen risks.	Contractor	Construction	Low
Novi1	Noise and vibration	▪ The contractor should ensure: o All potential significant noise and vibration generating activities associated with the activity is kept to a minimum; o A monitoring program to assess performance against relevant noise and vibration criteria; o Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures; and o Contingency measures to be implemented in the event of noncompliance with noise and vibration criteria.	Contractor	Pre-clearance	Medium
Novi2	Noise and vibration	▪ All sensitive receivers (e.g. local residents) likely to be affected will be notified at least five business days prior to starting any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: o The proposal; o The construction period and construction hours; o Contact information for senior project management staff; o Complain and incident reporting; and o How to obtain further information.	Contractor	Pre-clearance	Medium
Novi3	Site induction	▪ All personnel working on site will receive training to ensure awareness of requirements of the noise and vibration issues associated with the project. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers.	Contractor	Pre-clearance / Construction	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
Novi4	Noise and vibration	▪ Where possible, works outside of standard construction hours will be planned so that noisier works are carried out in the earlier part of the evening or night time.	Contractor	Pre-clearance / Construction	Low
Sovi1	Visual impact of work sites	▪ Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) should be managed to minimise visual impacts. This is to include avoiding temporary light spill, rehabilitation of disturbed areas, appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials.	Contractor	Construction	Medium
Sovi2	Visual impact of work sites	▪ Compound and ancillary facilities are to be decommissioned and the sites rehabilitated to their existing condition or as otherwise agreed with the landowner on completion of works.	Contractor	Construction	Low
Sovi3	Emergency vehicle access	▪ Access for emergency vehicles should be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.	Contractor	Pre-construction / Construction	Low
Sovi4	Complaints	▪ A complaint handling procedure and register should be included in the CEMP or in accordance with the protocols of CoP.	Contractor	Construction	Low
Wast1	Waste Generation	▪ The contractor is to ensure they have the following procedures in place before project commencement: ◦ Measures to avoid and minimise waste associated with the project; ◦ Classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal) ◦ Classification of wastes received from off-site for use in the project and management options; ◦ Reduce amount of time vehicles, machinery and plant are used (i.e. do not leave vehicles or machines idling unnecessarily);	Contractor	Life of Project	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
		◦ Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemption; ◦ Procedures for storage, transport and disposal; and ◦ Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions.			
Wast2	Spills	▪ The contractor is to ensure they have the following procedures in place before project commencement: ◦ All staff inducted and informed of their legal responsibilities in accordance with the POEO Act. ◦ CEMP Available at all times ◦ Standard Operating Procedures (SOP) ◦ Spill Kit	Contractor	Life of Project	Low
Wast3	Dumping or Inappropriate Stockpiling of Solid Wastes	▪ The contractor is to ensure they have the following procedures in place before project commencement: ◦ All staff inducted and informed of their legal responsibilities in accordance with the POEO Act. ◦ No stockpiling under tree drip lines. All stockpiling to be undertaken away from trees proposed to be retained. ◦ All stockpiles to be covered to prevent dust, erosion and sedimentation. ◦ All proposed stockpiling areas clearly delineated from 'no-go-zones' ◦ CEMP Available at all times ◦ Standard Operating Procedures (SOP)	Contractor	Life of Project	Low
Traf1	Traffic and transport	▪ If required, a Traffic Management Plan (TMP) is to be prepared and implemented. The TMP should include: ◦ Measures to maintain access to local roads and properties	Contractor	Pre-clearance	Medium

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
		◦ Site specific traffic control measures (including signage) to manage and regulate traffic movement ◦ Requirements and methods to consult and inform the local community of impacts on the local road network ◦ Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads ◦ A response plan for any traffic incidents within the construction zone			
Traf2	Property Access	▪ Access to properties is to be maintained during construction. Where that is not feasible, alternate arrangements will be made in consultation with the CoP Project Manager.	Contractor / City of Parramatta	Construction	Low
Traf3	Reduce speeds, traffic delays and disruptions during construction	▪ Road users, local communities and sporting user groups will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Contractor	Construction	Low
GENERAL CONSIDERATIONS					
Topography, geology and soils					
Tgs1	Erosion and sedimentation	The contractor is to implement the following safeguards: ▪ A Construction Environmental Management Plan (CEMP) incorporating environmental safeguards recommended in this REF. The CEMP is to be approved by CoP prior to commencement of works;	Contractor	Construction	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
		▪ An Erosion and Sedimentation Control Plan (ESCP) subplan consistent with the Blue Book (Landcom 2004) is to be incorporated into the CEMP and implemented prior to commencement of any works; ▪ Always follow the recommendations of the Blue Book (Landcom 2004) prior to any construction works and adopt the required measures to minimise impacts on the environment; and ▪ Adequate erosion and sediment controls are to be maintained regularly until the proposed works are completed (including the removal of any built-up soils and materials). ▪ Vehicles, plant and equipment are to be restricted to designated areas. ▪ A CoP approved Construction Environmental Management Plan (CEMP) incorporating environmental safeguards recommended in this REF; ▪ All works are to be scheduled a week following any rain events. ▪ In the event of rainfall, all material and debris (dispersible materials) in the excavation area are to be covered.			

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
Tgs2	Contaminated Land/Material	The contractor is to implement the following safeguards: ▪ Current SDS and Spill kits are to be kept on all machinery; ▪ All incidents involving spills are to be reported and discussed at Toolbox/pre-start meetings; ▪ All re-fuelling of vehicles and equipment will be undertaken in 'spill safe' bunded areas, at the compound site; ▪ In the event of a spill or paint contamination of a waterway, works are to immediately cease and the CoP Project Manager is to be notified, and the incident reported to the EPA immediately; ▪ If any soils are identified that are discoloured, unusual in odour, or showing signs of asbestos contamination, should be flagged for assessment by an experienced environmental consultant; ▪ Minimise potential for ponding or water logging areas on the site; ▪ If storage of chemicals and fuels are required these should be stored within designated bunded areas, identified with appropriate signage; ▪ Record all stored chemicals on a register with their MSDS's; ▪ Ensure all tools and machinery are in good working order and without fuel, oil or hydraulic leaks; ▪ Repair or remove faulty equipment immediately; ▪ Include emergency procedures for chemical/fuel spills in the CEMP.	Contractor	Construction	Low

No.	Consideration	Environmental safeguards	Responsibility	Timing	Residual Impact
		Air Quality			
Airq1	Dust and air pollution	The proponent is to implement the following safeguards: ▪ Only well serviced vehicles, machinery and other plant or equipment is to be used during works; ▪ Dust suppression techniques should be utilised to minimise dust pollution; ▪ Ongoing surveillance for dust generation is to be undertaken; ▪ Works are to cease in high-wind conditions, where dust suppression cannot be adequately undertaken; ▪ All trucks transporting materials are to be covered at all times; ▪ Machinery and vehicles are not to be left running or idling when not in use; Odour or air pollutant emission complaints will be dealt with promptly and the source will be eliminated wherever practicable. Details of the complaint will be recorded.	Contractor	Construction	Low

6.2 Licensing and approvals

Licences and approvals required for the proposal are listed in **Table 20**.

Table 20. Licences and approvals required for the proposal

Instrument	Requirement	Timing
Roads Act 1993	Road Occupancy Permit would need to be obtained as necessary prior to construction commencing.	Prior to start of the activity
Permission to enter from private landowners and residents	Permission to enter from private landowners and residents must be obtained to access proposal work sites.	Before accessing any private property

7. Conclusion

The proposed Bennelong Parkway and Hill Road Intersection upgrade is subject to assessment under Division 5.1 of the EP&A Act. This 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.

The preferred option minimises impacts to the environment whilst best meeting the project objectives of improved safety and travel efficiency for motorists and pedestrians. Minor impacts include; Traffic and Transport, including temporary impacts to property access and increased traffic times during road works. Impacts are to be avoided or minimised through implementation of the safeguards and management measures as recommended in this REF.

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act.

The proposal is not likely to have a significant impact on Matters of National Environmental Significance or Commonwealth land within the meaning of the EPBC Act. A referral to the Department of Agriculture, Water and the Environment is not required.

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9. Certification

Pursuant to the various provisions of the Environmental Planning and Assessment Act 1979 and the Environmental Planning and Assessment Regulation 2000 an environmental assessment of the proposed activity has been undertaken. This REF provides a true and fair review of the Proposal in relation to its potential effects on the environment. This assessment meets the objectives of the principles of Ecologically Sustainable Development (ESD). On the basis that the activity will, if carried out in accordance with the identified mitigation measures, not be significant. Activity is authorised to proceed.

Assessing Officer

Emily Rix

Narla Environmental –

Ecologist

Authorising Officer

Chris Moore

Narla Environmental –

Senior Ecologist

10. Appendices

Appendix A. Proposed Design

Appendix B. Considerations of Important Environmental Factors - Clause 228(2) Factors

Appendix C. Flora and Fauna Species Lists (Narla Environmental 2020)

Appendix D. Assessment of Likely Occurrence

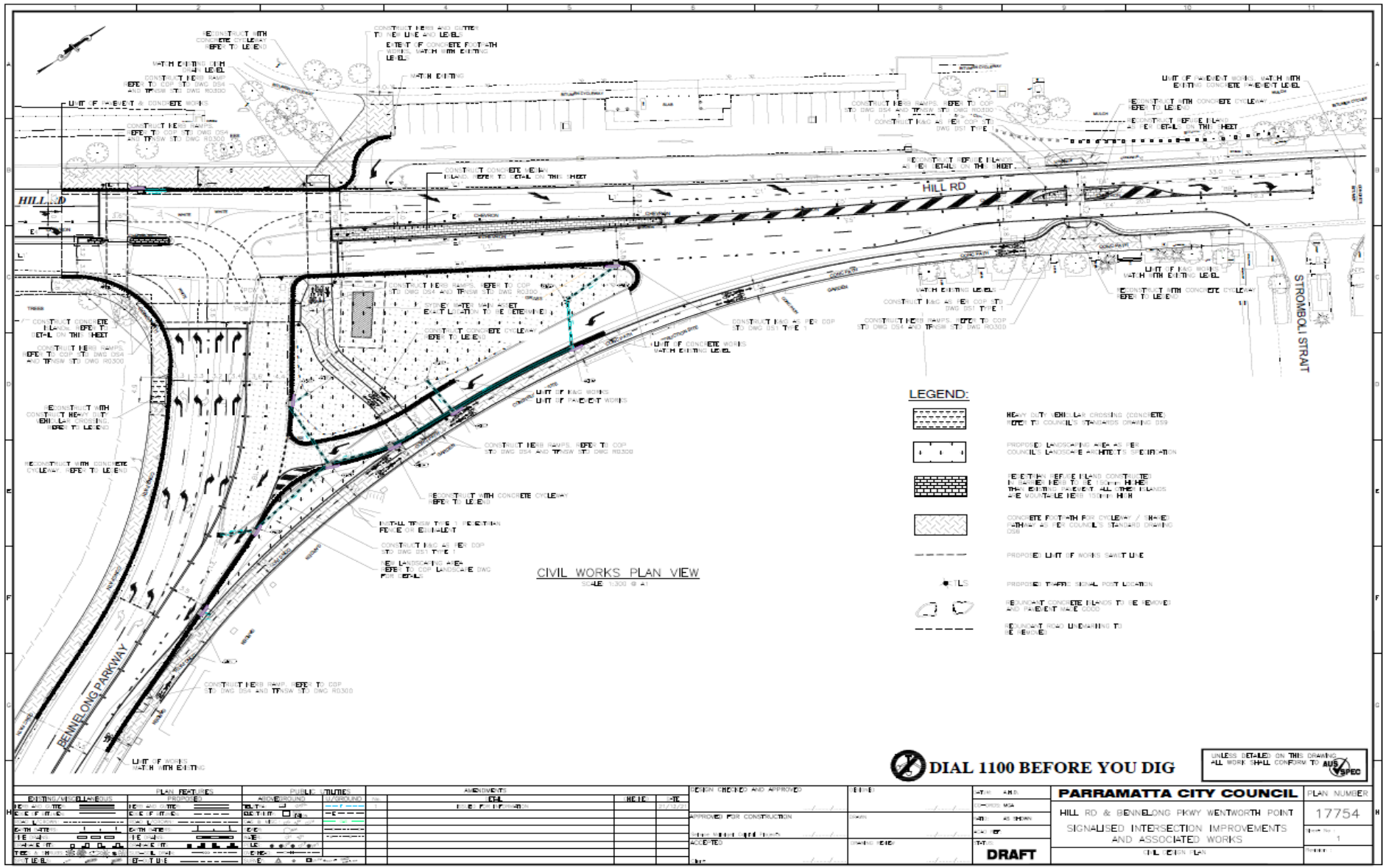
Appendix E. Biodiversity Conservation Act 2016 Test of Significance (5-part Test)

Appendix F. EPBC Act Assessment of Significant Impact Criteria.

Appendix G. AHIMSs Search Results

Appendix H. Arboricultural Impact Assessment and Tree Protection Plan (Tree Survey 2022)

Appendix A. Proposed Design



Appendix B. Considerations of Important Environmental Factors - Clause 228(2) Factors

In the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, consideration of the likely impact on the environment of the proposed work is summarised below:

Clause 228 factor	Review of Environmental Factors finding	Impact
Any environmental impact on a community	There will be negligible (if any) dust, visual, odour, or social impacts on the community. By upgrading the Bennelong Parkway and Hill Road Intersection, the proposal will contribute to an improvement of the local infrastructure as well as the freight network, and to improve road safety. Short term impacts that may result during construction include: ▪ Minor traffic and access impacts; and ▪ Minor, and temporary noise impacts to sensitive receivers. Any potential impacts have been assessed and mitigation measures provided in **Section 6.1.**	Long term positive impacts Short term negative impacts
A transformation of a locality	The proposed activity will not cause a transformation of the locality, as the works involve only a relatively minor upgrade and maintenance along an existing road.	Nil
Any environmental impact on the ecosystem of the locality	There will be no significant impacts on ecosystems of the locality as outlined in **Section 6.1.** All impacts on threatened species, populations and communities have been considered and can be adequately mitigated.	Short-term negative impact Long-term positive impact
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	The works are temporary and will not significantly reduce aesthetic, scientific, or other environmental quality or value of the locality. The proposed action will improve the asset in the long term for the community through the provision of a safer route for road travel.	Negligible short-term impact Long-term positive impact

Clause 228 factor	Review of Environmental Factors finding	Impact
Any effect upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or any other special value for present or future generations	The desktop analysis deemed that Aboriginal objects are unlikely to be present within the proposal area due to past levels of historic disturbance and landform types. The current aesthetic, cultural, historical, social and environmental values will be retained by the proposed activity. The site is not associated with, and will not impact any non-aboriginal heritage values.	Negligible short-term impact No long-term impact
Any impact on the habitat of any protected fauna (within the meaning of the Biodiversity Conservation Act 2016)	There will be no significant impacts on habitat of protected fauna from within or around the locality as outlined in Section 6.1 of this report. All impacts on protected fauna have been considered and can be adequately mitigated.	Minor long-term negative
Any endangering of any species of animal or plant or other form of life, whether living on land, in water or in the air	It is unlikely that there will be a significant impact on habitat of threatened flora or fauna from within or around the locality as no native vegetation (trees or shrubs) is proposed for removal. All impacts on threatened species, populations and communities have been considered and can be adequately mitigated. The majority of species occurring within the proposal area (impact area) are exotic. No species of animal, plant or other form of life, whether living on land, in water or in the air are likely to be significantly impacted by the proposal.	Negligible long-term negative
Any long-term effects on the environment	The proposal would have a long-term positive effect on the environment through improvements to the road network.	Long term positive impacts

Clause 228 factor	Review of Environmental Factors finding	Impact
Any degradation of the quality of the environment	The works may cause very minor, short-term impacts on the environment from limited ground disturbance and the removal of exotic vegetation. The impact is restricted and will be mostly remediated following the disturbance. Furthermore, local environmental conditions may improve, as effort will be made to focus on removal of environmentally detrimental priority weeds. The work will not cause or lead to a degradation of the quality of environment at this locality.	Short-term negative impacts Long term positive impacts
Any risk to the safety of the environment	A low risk to the environment is associated with the works. Potential for a minor chemical spill (e.g. petrol, oil or concrete) is possible. When undertaken in compliance with the safeguards outlined in **Section 6.1**, the work will not impact the risk to the environment.	Short-term negative impacts
Any reduction in the range of beneficial uses of the environment	No reduction in the range of beneficial uses of the environment will result as part of the works.	Nil
Any pollution of the environment	No pollution of the environment is proposed or likely. When undertaken in compliance with the safeguards outlined in **Section 6.1**, the work will not impact the environment. A CEMP should be developed to address site works and waste management procedures in detail. The CEMP will detail, the location of site compounds, stockpile sites, machinery used, refuelling procedures.	Unlikely short-term negative impacts.
Any environmental problems associated with the disposal of waste	Any waste generated as a result of the works would be dealt with in accordance with the principles of the Protection of Environment Operations Act (1997). The safeguards outlined in **Section 6.1** will ensure appropriate and legal disposal of wastes generated by this proposal. When undertaken in compliance with the safeguards outlined in **Section 6.1**, the work will not cause or contribute to environmental problems associated with the disposal of waste. All waste is to be disposed of at a licensed waste facility.	Short term negative impact

Clause 228 factor	Review of Environmental Factors finding	Impact
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	No increase in the demands for resources that are likely to become in short supply.	Nil
Any cumulative environmental effect with other existing or likely future activities	No significant cumulative environmental effect is likely as a result of the proposed activity. The proponent is unaware of any other existing or future developments in the area that the proposal could interact with and result in a cumulative impact.	Nil
Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	There is no impact on coastal processes and coastal hazards, including those under projected climate change conditions that will result as part of the proposed activity.	Nil

Matters of National Environmental Significance

An EPBC Act Protected Matters Search was undertaken to identify known or potential Matters of National Environmental Significance (MNES) within a 5 km radius of the proposal area.

The identified MNES and site-specific responses are listed below.

1. Wetlands of International Importance

No Wetlands of International Importance listed under the EPBC Act occurs within the search area (5km).

2. Listed Threatened Ecological Communities

No Threatened Ecological Community (TEC) listed under the BC Act occurs within the proposal area.

3. Listed Threatened Species

In total, 69 threatened species listed under the EPBC Act, were predicted or known to occur within 5km of the proposal area. No EPBC Act listed species were identified within the proposal area.

As assessment of likely occurrence revealed one (1) species, *Litoria aurea* (Green and Golden Bell Frog), may utilise habitat within the proposal area, as the works are located directly adjacent to known habitat for this species (SOPA 2019). Such habitat includes Woo-la-ra which is considered to be a movement corridor for this species, as well as Narrawang Wetland which is a breeding pond. A Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Assessment of Significant Impact Criteria was carried out for *Litoria aurea* (Green and Golden Bell Frog; Appendix F). It was determined that no significant impact on this species would result from the proposed activity.

4. Listed Migratory Species

In total, 58 migratory species listed under the EPBC Act, or their habitat, were known to occur, or are predicted to occur within 5 km of the proposal area. Due to the marginal, and sub-optimal habitat the proposed activity is unlikely to substantially modify, destroy or isolate this habitat, resulting in the establishment of a harmful invasive species or seriously disrupt the lifecycle or migration of an ecologically significant population of a migratory species.

Appendix C. Flora and Fauna Species Lists (Narla Environmental 2020)

Table 21. Flora List

Scientific Name	Exotic	Canopy	Midstorey	Groundcover	Bio Act Status
Bidens pilosa				x	
Brachychiton populneus		x	x		
Casuarina glauca			x		
Cirsium vulgare	x			x	
Cupaniopsis anacardioides			x		
Cyperus rotundus	x			x	
Eragrostis spp.	x			x	
Eucalyptus microcorys		x			
Eucalyptus robusta		x			
Foeniculum vulgare	x			x	
Ipomea indica	x			x	
Lantana camara	x		x		Priority
Lomandra longifolia				x	
Medicago polymorpha	x			x	
Melaleuca quinquenervia		x			
Plantago lanceolata	x			x	
Senecio madagascariensis	x				Priority
Soliva sessilis	x			x	
Taraxacum officionale				x	
Vicia sativa				x	

Table 22. Fauna List

Class	Scientific Name	Common Name
Aves	*Acridotheres tristis*	Common Myna
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo
Aves	*Corvus coronoides*	Australian Raven
Aves	*Dacelo novaeguineae*	Laughing Kookaburra
Aves	*Eolophus roseicapilla*	Galah
Aves	*Gymnorhina tibicen*	Australian magpie
Aves	*Manorina melanocephala*	Noisy Miner
Aves	*Strepera graculina*	Pied Currawong
Aves	*Trichoglossus moluccanus*	Rainbow Lorikeet

Appendix D. Assessment of Likely Occurrence

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Coastal and Wading Birds							
Botaurus poiciloptilus	Australasian Bittern	E	E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west.	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Nests are built in secluded places in densely-vegetated wetlands on a platform of reeds	Nil. No suitable foraging habitat located within the proposal area.	No
Calidris ferruginea	Curlew Sandpiper	E	CE	It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period.	Forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed.	Nil. No suitable foraging habitat located within the proposal area.	No
Calidris tenuirostris	Great Knot	V	V	In NSW, the species has been recorded at scattered sites along the coast down to about Narooma.	Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons.	Nil. No suitable foraging habitat located within the proposal area.	No
Charadrius leschenaultii	Greater Sand-plover	V	V	Breeds in central Asia from Armenia to Mongolia, moving further south for winter. In Australia the species is commonly recorded in parties of 10-20 on the west coast. The species is apparently rare on the	Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	Nil. No suitable foraging habitat located within the proposal area.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
				east coast, usually found singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries.			
Limicola falcinellus	Broad-billed Sandpiper	V		Breeds in northern Siberia before migrating southwards in winter to Australia. In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. There are few records for inland NSW.	Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayment's, lagoons, saltmarshes and reefs as feeding and roosting habitat.	Nil. No suitable foraging habitat located within the proposal area.	No
Limosa limosa	Black-tailed Godwit	V		Breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland.	Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats.	Nil. No suitable foraging habitat located within the proposal area.	No
Rostratula australis	Australian Painted Snipe	E	E	The Australian Painted Snipe is restricted to Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently,	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	Nil. No suitable foraging habitat located within the proposal area.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
				swamps near Balldale and Wanganella.			
Sternula albifrons	Little Tern	E	-	Migrates from eastern Asia. In NSW, it arrives from September to November, occurring mainly north of Sydney. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months.	Almost exclusively coastal, preferring sheltered environments; however, may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records).	Nil. No suitable foraging habitat located within the proposal area.	No
Xenus cinereus	Terek Sandpiper	V	-	A rare migrant to the eastern and southern Australian coasts, being most common in northern Australia, and extending its distribution south to the NSW coast in the east. The two main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary. The latter has been identified as nationally and internationally important for the species.	In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries. Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.	Nil. No suitable foraging habitat located within the proposal area.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Frogs							
Litoria aurea	Green and Golden Bell Frog	E	V	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands.	Inhabits marshes, dams and stream-sides, particularly those containing Bullrushes (*Typha* spp.) or Spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	Soaks, pools and waterbodies not present within the proposal area. Many records within a 10km radius as the existing Sydney Olympic Park GGBF population exists within proximity to the proposal area. Native grasses and groundcover vegetation may be utilised as a movement corridor for this species.	Yes

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Forest and Woodland Birds							
Anthochaera phrygia	Regent Honeyeater	CE	CE	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years.	The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Dusky Woodswallow's are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range.	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 and very occasionally in moist forests or rainforests	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Epthianura albifrons	White-fronted Chat	E	-	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon.	Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. Open-cup nests built in low vegetation.	Nil. No suitable breeding or foraging habitat within the impact area.	No
Glossopsitta pusilla	Little Lorikeet	V	-	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury.	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Ixobrychus flavicollis	Black Bittern	V	-	The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. The species also occurs in the south-west of Western Australia. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland.	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds. Nests, built in spring are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks.	Nil. No suitable habitat found within the proposal area.	No
Lathamus discolor	Swift Parrot	E	CE	In NSW mostly occurs on the coast and south west slopes.	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera,* Forest Red Gum *E. tereticornis,* Mugga Ironbark *E. sideroxylon, and* White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana*, Blackbutt *E. pilularis,* and Yellow Box *E. melliodora*.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Petroica boodang	Scarlet Robin	V	-	In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter.	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No
Petroica phoenicea	Flame Robin	V	-	In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands.	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. Often occurs in recently burnt areas; however, habitat becomes unsuitable as vegetation closes up following regeneration. In winter lives in dry forests, open woodlands, heathland and in pastures and native grasslands, with or without scattered trees. In winter, occasionally seen in heathland or other shrublands in coastal areas.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Ptilinopus superbus	Superb Fruit-Dove	V	-	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. There are records of vagrants as far south as eastern Victoria and Tasmania.	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. The nest is a structure of fine interlocked forked twigs, giving a stronger structure than its flimsy appearance would suggest, and is usually 5-30 metres up in rainforest and rainforest edge tree and shrub species.	Nil. No rainforest or similar vegetation was present within the works area.	No
Stictonetta naevosa	Freckled Duck	V	-	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times.	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. Nests are usually located in dense vegetation at or near water level.	Nil. No suitable habitat located within the	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Diurnal Birds of Prey							
Circus assimilis	Spotted Harrier	V	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population.	Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months.	Nil. No suitable habitat present within the works area.	No
Falco subniger	Black Falcon	V	-	Widely, but sparsely, distributed in NSW, mostly occurring in inland regions. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993).	Black Falcons nest along tree-lined creeks and rivers of inland drainage systems. Eggs are laid in the abandoned stick nests of other birds, usually high in a tree.	Nil. No suitable habitat present within the works area.	No
Haliaeetus leucogaster	White-bellied Sea Eagle	V	-	Distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial	Nil. No suitable habitat present within the works area.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
				coast, and along all major inland rivers and waterways.	habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.		
Hieraaetus morphnoides	Little Eagle	V	-	Throughout New South Wales, mostly in the central west.	Open eucalypt forest, woodland or open woodland, including she-oak or Acacia woodlands and riparian woodlands of interior NSW.	Nil. No suitable habitat present within the works area.	No
Pandion cristatus	Eastern Osprey	V	-	Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas.	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. .	Nil. No suitable habitat present within the works area.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Owls							
Ninox connivens	Barking Owl	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with strongholds in the western slopes and plains.	Occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests.	Nil. No suitable habitat present within the works area.	No
Ninox strenua	Powerful Owl	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains.	Woodland, open sclerophyll forest, tall open wet forest and rainforest. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts.	Nil. No suitable habitat present within the works area.	No
Tyto longimembris	Eastern Grass Owl	V	-	In NSW they are more likely to be resident in the north-east. Eastern Grass Owl numbers can fluctuate greatly, increasing especially during rodent plagues.	They rest by day in a 'form' - a trampled platform in a large tussock or other heavy vegetative growth. Always breeds on the ground. Nests are found in trodden grass, and often accessed by tunnels through vegetation.	Nil. No suitable habitat present within the works area.	
Tyto novaehollandiae	Masked Owl	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains.	Woodland, open sclerophyll forest, tall open wet forest and sometimes rainforest. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Nil. No suitable habitat present within the works area.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Large Parrots							
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 important foods. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.	Nil. No suitable habitat present within the works area.	No
Neophema pulchella	Turquoise Parrot	V	-	The Turquoise Parrot's 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. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Nests in tree hollows, logs or posts.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Bats							
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Tall (greater than 20m) moist habitats. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No
Miniopterus australis	Little Bent-winged Bat	V		East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	None. No caves/suitable artificial structures present on site and no hollows being removed.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Miniopterus orianae oceanensis	Large Bent-winged Bat	V		Eastern Bentwing-bats occur along the east and north-west coasts of Australia.	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes.	Nil. No caves proposed for removal.	No
Myotis macropus	Southern Myotis	V	-	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.	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.	None. No caves/suitable artificial structures present on site and no tree-hollows being removed. No open waterbodies for foraging.	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria.	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.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	None. No tree-hollows being removed.	No
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m.	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	None. No tree-hollows being removed.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Other Mammals							
Dasyurus maculatus	Spotted-tail Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld.	Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites.	None. No tree-hollows being cleared. No caves on site.	No
Phascolarctos cinereus	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands.	Eucalypt woodlands and forests.	Minor impact to foraging habitat. No anticipated impact to breeding habitat.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Snails							
Pommerhelix duralensis	Dural Land Snail	E	E	The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. *Pommerhelix duralensis* in the strict sense is found in an area of north-western Sydney between Rouse Hill - Cattai and Wiseman's Ferry, west from Berowra Creek. The species is definitely found within the Local Government Areas of The Hills Shire, Hawkesbury Shire and Hornsby Shire. Records from the Blue Mountains City, Penrith City and Parramatta City may represent this species.	The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris. It favours sheltering under rocks or inside curled-up bark. It does not burrow nor climb. The species has also been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris.	None.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
				Flora			
Acacia clunies-rossiae	Kanangra Wattle	V		Kanangra Wattle grows in the Kowmung and Coxs River areas entirely within Kanangra-Boyd and Blue Mountains National Parks.	Grows in dry sclerophyll forest on skeletal soils on rocky slopes, or on alluvium along creeks.	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No
Acacia pubescens	Downy Wattle	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 on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. 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.	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No
Callistemon linearifolius	Netted Bottle Brush	V	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Three of the remaining populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve and	Grows in dry sclerophyll forest on the coast and adjacent ranges.	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
				Spectacle Island Nature Reserve. The species has also been recorded from Yengo National Park.			
Darwinia biflora	-	V	V	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively.	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa*. The vegetation structure is usually woodland, open forest or scrub-heath.	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No
Epacris purpurascens var. purpurascens	-	V	-	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South.	Found in a range of habitat types, most of which have a strong shale soil influence.	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally in conservation reserves.	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	Outside natural distribution.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
Genoplesium baueri	Bauer's Midge Orchid	E	E	The species has been recorded from locations between Ulladulla and Port Stephens. 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.	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No
Melaleuca deanei	Deane's Paperbark	V	V	Deane's Paperbark occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas.	The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone.	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No
Pimelea curviflora var. curviflora		V	V	Confined to the coastal area of the Sydney and Illawarra regions. Populations are known between northern Sydney and Maroota in the north-west. New population discovered at Croom Reserve near Albion Park in Shellharbour LGA in August	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowalnd Grassy Woodland habitat at Albion Park on the Illawaraa coastal plain.	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
				2011. Formerly recorded around the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly.			
Rhodamnia rubescens	Scrub Turpentine	E	-	Rhodamnia rubescens is currently known to occur in coastal districts north from Batemans Bay in New South Wales (NSW), approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland.	Suitable habitat for *R. rubescens* is likely to occur in the following vegetation types: Subtropical Rainforests, Warm Temperate Rainforests, Littoral Rainforests, and Wet Sclerophyll Forests. It may also occur as a pioneer in adjacent areas of dry sclerophyll and grassy woodland associations (Keith 2004; Floyd 2008;). *Rhodamnia rubescens* has been documented occurring in association with *Acacia melanoxylon, Acmena smithii, Breynia oblongifolia, Corymbia intermedia, Endiandra discolor, Eucalyptus bosistoana, E. tereticornis, Glochidion sumatranum, Guioa semiglauca, Lophostemon suaveolens and Mallotus philippensis.*	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No
Syzygium paniculatum	Magenta Lilly Pilly	E	V	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest.	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	No habitat. The landscape is too disturbed and historically cleared with co-occurring species not present.	No

Scientific Name	Common Name	NSW Status (BC Act)	EPBC Act Status	Distribution (DPIE 2020)	Habitat (DPIE 2020)	Habitat or species on site directly or indirectly impacted	Impact Assessment Required
					riverside gallery rainforests and remnant littoral rainforest communities.		
Tetratheca juncea	Black-eyed Susan	V	-	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock.	The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape.	Nil. The proposal area is not located on the Awaba soil landscape; therefore, it is unlikely that this species would occur within the proposal area.	No
Wilsonia backhousei	Narrow-leafed Wilsonia	V		In NSW Narrow-leaf Wilsonia is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney (Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park).	This is a species of the margins of salt marshes and lakes.	No habitat. The landscape is too disturbed and historically cleared.	No
Zannichellia palustris	-	E	-	In NSW, known from the lower Hunter and in Sydney Olympic Park.	Grows in fresh or slightly saline stationary or slowly flowing water. Flowers during warmer months. NSW populations behave as annuals, dying back completely every summer.	No habitat. The landscape is too disturbed and historically cleared.	No
Key: V = vulnerable ; E = Endangered; CE = Critically Endangered							

Appendix E. Biodiversity Conservation Act 2016 Test of Significance (5-part Test)

Biodiversity Conservation Act 2016 – Test of Significance (5-part Test) for *Litoria aurea* (Green and Golden Bell Frog) BC Act Status: Endangered		
(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 proposed activity is unlikely to have an adverse impact on the life cycle of the species such that a viable population of this species is likely to be placed at risk of extinction. The proposed activity may impact on planted native vegetation, including grasses and groundcovers, that may be utilised by this species as a movement corridor. Only a small area adjacent to a road is proposed for removal, and the vegetation will be searched for individuals prior to its removal.	
(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	Not Applicable
	(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	The proposal will involve the removal of 0.019ha of Planted Native vegetation which may be used by this species as a movement corridor.
	(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	Fragmentation of habitat will not occur. Approximately 0.019ha of habitat will be removed, which may be used by this species as a movement corridor. This area is adjacent to a road and would be sub-optimal for this species. A larger, continuous area of suitable habitat would be retained adjacent to the project area.
	(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 removal of vegetation for the proposed activity is unlikely to be important for the long-term survival of this species. The vegetation is close to a roadside and would only be used as a movement corridor for this species. It does not provide suitable foraging and breeding habitat. The removal of

Biodiversity Conservation Act 2016 – Test of Significance (5-part Test) for *Litoria aurea* (Green and Golden Bell Frog) BC Act Status: Endangered		
		vegetation will not fragment the movement corridor, allowing this species to continue to move across the landscape. Larger areas of more suitable habitat will be retained in areas surrounding the project area.
(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 proposed activity is not likely to have an adverse effect on any declared area of outstanding biodiversity value, 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.	The proposed activity will result in the following Key Threatening Processes (KTPs) listed under Schedule 4 of the BC Act: ▪ Clearing of native vegetation The proposed works may also involve the importation of soil, compost or mulch which may be a potential source of chytrid fungus (a recognised key threatening process). If materials are to be imported for landscaping processes, they are to be sterilised according to industry standards prior to importation to site.	
References Department of Planning, Industry and Environment (DPIE) (2020) NSW BioNet. Threatened Biodiversity Data Collection NSW Government (2017) NSW Legislation: Biodiversity Conservation act 2016 No 63, Schedule 4: Key Threatening Processes https://www.legislation.nsw.gov.au/acts/2016-63.pdf		

Appendix F. EPBC Act Assessment of Significant Impact Criteria.

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Assessment of Significant Impact Criteria for *Litoria aurea* (Green and Golden Bell Frog)	
EPBC Act Status: Vulnerable	
Significant impact criteria An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
▪ Lead to a long-term decrease in the size of an important population;	The proposed activity is not likely to lead to a long-term decrease in the size of an important population. The proposed activity involves the removal of approximately 0.019ha of Planted Native vegetation which may be used by this species as a movement corridor. It does not provide suitable foraging and breeding habitat. This area is adjacent to a road and would be sub-optimal for this species. A larger, continuous area of suitable habitat would be retained adjacent to the project area.
▪ Reduce the area of occupancy of an important population;	The proposed activity will not reduce the area of occupancy of an important population. Approximately 0.019ha of Planted Native vegetation will be removed, which may be used by this species as a movement corridor. This area is adjacent to a road and would be sub-optimal for this species. Areas of highly suitable habitat within the surrounding locality will be retained.
▪ Fragment an existing important population into two or more populations;	Fragmentation of habitat will not occur. Approximately 0.019ha of habitat will be removed, which may be used by this species as a movement corridor. This area is adjacent to a road and would be sub-optimal for this species. A larger, continuous area of suitable habitat would be retained adjacent to the project area.
▪ Adversely affect habitat critical to the survival of a species;	The proposed activity will not adversely affect habitat critical to the survival of this species as no such habitat occurs within the proposal area.
▪ Disrupt the breeding cycle of an important population;	The proposed activity will not disrupt the breeding cycle of an important population. No breeding habitat is present within the proposal area.
▪ Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	The removal of vegetation for the proposed activity is unlikely to decrease availability of habitat for this species to the extent that the species is likely to decline. The vegetation is close to a roadside and would only be used as a movement corridor for this species. It does not provide suitable foraging and breeding habitat. The removal of vegetation will not fragment the movement corridor, allowing this

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Assessment of Significant Impact Criteria for *Litoria aurea* (Green and Golden Bell Frog)	
EPBC Act Status: Vulnerable	
Significant impact criteria An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
	species to continue to move across the landscape. Larger areas of more suitable habitat will be retained surrounding the project area.
▪ Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	It is unlikely the proposed activity will result in invasive species becoming established, considering the project area is already highly degraded.
▪ Introduce disease that may cause the species to decline; or	The proposed works may involve the importation of soil, compost or mulch which may be a potential source of chytrid fungus (a cause of amphibian chytrid fungus disease). If materials are to be imported for landscaping processes, they will be sterilised according to industry standards prior to importation to site.
▪ Interfere with the recovery of the species.	The proposed activity will not interfere with the recovery of the species. No breeding or foraging habitat will be impacted, and the vegetation surrounding the project area will continue to allow this species to move across the landscape. There is potential that individuals may be impacted during the works, and as such, the mitigation measures outlined in this report should be implemented.
References Department of the Environment (2014) Approved Conservation Advice for *Litoria aurea* (Green and Golden Bell Frog) http://www.environment.gov.au/biodiversity/threatened/species/pubs/1870-conservation-advice.pdf.	

Appendix G. AHIMSs Search Results

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : parra4
Client Service ID : 685879

Polina Zadorojnaya
5 Kamber Road
Terrey Hills New South Wales 2084
Attention: Polina Zadorojnaya
Email: polina.z@narla.com.au

Date: 26 May 2022

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 48, DP:SP98609, Section : - with a Buffer of 200 meters, conducted by Polina Zadorojnaya on 26 May 2022.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.

A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

Appendix H. Arboricultural Impact Assessment and Tree Protection Plan (Tree Survey 2022)

TREE SURVEY

ARBORICULTURAL IMPACT ASSESSMENT & TREE PROTECTION PLAN

Intersection Upgrade
Hill Road & Bennelong Parkway, Wentworth Point
Version 1

Prepared for:
Narla Environmental Pty Ltd

12 July 2022

Document information

Title:	Hill Road & Bennelong Parkway, Wentworth Point
Report type:	Arboricultural Impact Assessment (AIA) & Tree Protection Plan (TPP)
Prepared by:	 **Phil Witten** Principal Arborist & GIS Analyst Diploma of Arboriculture │AQF 5 Graduate Certificate of Arboriculture │AQF 8 Registered Consulting Arborist No. 2458 Advanced QTRA │TRAQ Qualification
Contact details:	**Tree Survey Pty Limited** ☎ 0425 536 670 ✉ phil@treesurvey.com.au 💻 www.treesurvey.com.au ➢ PO Box 125, Hornsby NSW 1630, Australia

Document status

Document status	Date	Revision description
Version 1	12/07/22	Final version

Abbreviations

Abbreviation	Description
AQF	Australian Qualifications Framework
AS	Australian Standards
DBH	Diameter at Breast Height
Id	Identification
m	Metre
mm	Millimetre
NDE	Non-Destructive Excavation
NO	Number
NSW	New South Wales
sp.	Species
SRZ	Structural Root Zone
TPZ	Tree Protection Zone
VTA	Visual Tree Assessment

Contents

1 Background

1.1 Introduction

Tree Survey was commissioned by Narla Environmental to prepare an Arboricultural Impact Assessment (AIA) and Tree Protection Plan (TPP) for the proposed upgrade of the Hill Road & Bennelong Parkway intersection, Wentworth Point.

The purpose of this report is to:

- Identify the trees within and adjacent to the proposed disturbance footprint.
- Assess the current health and condition of the subject trees.
- Assess the potential impacts of the development on the subject trees.
- Evaluate the significance of the subject trees and assess their suitability for retention.

1.2 The proposal

The key features of the proposal are summarised as follows:

- Construction of a heavy-duty vehicular crossing, shared pathway, pedestrian refuge, kurb and guttering, drainage, and pavement works.
- Site restoration, including landscaping plantings and vegetation.

1.3 Documents and plans referenced

The conclusions and recommendations of this report are based on the Australian Standard, AS 4970-2009, Protection of Trees on Development Sites (AS4970), the findings from the site inspections, and analysis of the documents/plans listed in **Table 1**.

Table 1: Documents and plans

Document	Author	Version	Date
Civil Plan	City of Parramatta Council	1	21/12/21
Detail Survey	City of Parramatta Council	-	-
-	-	-	-

The civil plan has been used as a map layer in the **Arboricultural Impact Assessment** and **Tree Protection Plan**.

1.4 Council tree preservation

The Parramatta Development Control Plan (DCP) 2011 defines a protected tree as:

- Any tree or palm - whether indigenous, endemic, exotic, or introduced species with a height equal to or exceeding 5 metres.
- Any tree or mangrove vegetation located on public land, irrespective of size.
- Any tree or plant, irrespective of size that:
    - Is listed in a Register of Significant Trees.
    - Forms part of a heritage item.
    - Is within a heritage conservation area
    - Forms part of an Aboriginal object.
    - Is within an Aboriginal place of heritage significance.

Trees and vegetation that fall within these specifications are protected unless listed as an exempt species. Trees that do not meet the prescribed dimensions have generally not been included in this report.

1.5 The subject trees

A total of **69** trees were assessed and included in this report. The subject trees were assessed in accordance with a visual tree assessment (VTA) as formulated by Mattheck & Breloer (1994)[1], and practices consistent with modern arboriculture. The following limitations apply to this methodology:

- Trees were inspected from ground level, without the use of any invasive or diagnostic tools and testing. Trees within adjacent properties or restricted areas were not subject to a complete visual inspection (i.e., defects and abnormalities may be present but not recorded).
- Diameter at breast height (DBH) has been accurately measured using a diameter tape (where access to the trees was available). Tree height and canopy spread were estimated unless otherwise stated.
- Tree protection zones have been calculated in accordance with AS4970 using the DBH measurements.

A tree retention assessment has been undertaken in accordance with the Institute of Australian Consulting Aboriculturalists (IACA) Significance of a Tree, Assessment Rating System (STARS). For further information on STARS see **Appendices**. Further information, observations, and measurements specific to each of the subject trees can be found in **Chapter 3**.

[1] VTA is an internationally recognised practice in the visual assessment of trees as formulated by Mattheck & Breloer (1994). Principle explanations and illustrations are contained within the publication, Field Guide for Visual Tree Assessment by Mattheck, C., and Breloer, H. Arboricultural Journal, Vol 18 pp 1-23 (1994).

2 Arboricultural Impact Assessment (AIA)

2.1 Impact assessment

The Australian Standard, Protection of Trees on Development Sites (AS4970), describes two zones that need to be considered when undertaking an arboricultural impact assessment:

- **Tree protection zone (TPZ):** The TPZ is the combination of crown and root area that requires protection during the construction process so that the tree can remain viable. The TPZ is calculated by measuring the DBH and multiplying it by twelve (12). The resulting value is applied as a radial measurement from the centre of the trunk to delineate the TPZ.
- **Structural root zone (SRZ):** The SRZ is the area of the root system used for stability, mechanical support, and anchorage of the tree.

Encroachment within the TPZ is acceptable, providing that the arborist can demonstrate that the tree will remain viable. There are three (3) levels of encroachment defined by AS4970:

- **Nil encroachment (0%): No encroachment within the TPZ.**
- **Minor encroachment (<10%): The encroachment is less than 10% of the TPZ.**
- **Major encroachment (>10%): The encroachment is greater than 10% of the TPZ.**

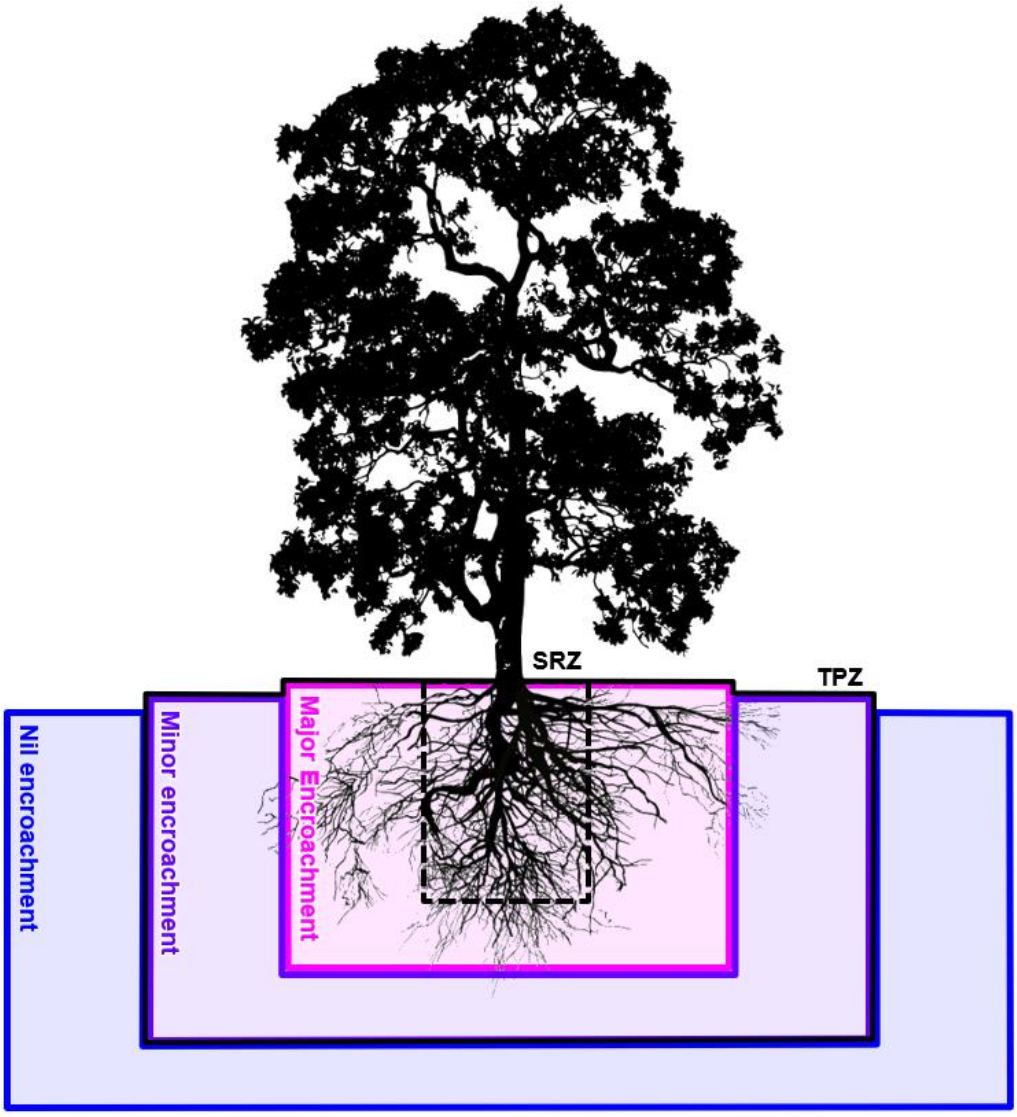


Figure 1: Three (3) levels of encroachment

2.2 Mitigating the impacts

Encroachment within the TPZ should be compensated with a range of mitigation measures to ensure that impacts to the subject tree(s) are reduced or restricted wherever possible. Mitigation should be increased relative to the level of encroachment within the TPZ to ensure the subject tree(s) remain viable. The table below outlines requirements under AS4970, and mitigation measures required within each category of encroachment. These mitigation measures will only apply if trees are proposed to be retained.

Table 2: Mitigation measures

Encroachment	Mitigation Measures
Nil encroachment (0%)	• N/A
Minor encroachment (<10%)	• The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ. • Detailed root investigations should not be required. • Tree protection must be installed.
Major encroachment (>10%)	• The project arborist must demonstrate the tree(s) would remain viable. • Root investigation by non-destructive methods may be required for any trees proposed for retention. • Consideration of relevant factors, including root location and distribution, tree species, condition, site constraints, and design factors. • The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ. • The project arborist will be required to supervise any work within the TPZ. • Tree protection must be installed.

3 Results

Table 3 shows the results of the arboricultural assessment. Key points are:

3.1 Encroachment within the TPZ

A summary of trees impacted directly by the proposed construction footprint is outlined below:

- **Nil encroachment (0%):** A total of **51** trees are located outside the construction footprint.
- **Minor encroachment (<10%):** A total of **6** trees will be subject to minor encroachment.
- **Major encroachment (>10%):** A total of **12** trees will be subject to major encroachment.

3.2 Tree removal and retention

A summary of the total proposed tree removals is outlined below :

- **Retain:** A total of **65** trees are proposed for retention.
- **Remove:** A total of **4** trees are proposed for removal.

Table 3: Results of the arboricultural assessment

Id.	Botanical name	Height (metres)	Spread (metres diameter)	Health	Structure	Age class	Tree significance	Useful life expectancy	Priority for retention	DBH 1 (millimetres diameter)	DBH 2 (millimetres diameter)	DBH 3 (millimetres diameter)	DBH Combined (millimetres diameter)	DRB (millimetres diameter)	TPZ (metres radius)	SRZ (metres radius)	Encroachment	% Encroachment within TPZ	Other notes	Proposal
1	*Magnolia grandiflora*	6	7	Fair	Fair	Mature	Medium	Medium	Medium	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
2	*Magnolia grandiflora*	5	5	Fair	Fair	Mature	Low	Medium	Low	150	150	-	210	250	2.5	1.8	**Nil**	**0%**	-	**Retain**
3	*Livistona australis*	7	4	Fair	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Nil**	**0%**	-	**Retain**
4	*Eucalyptus amplifolia*	14	5	Fair	Fair	Mature	Medium	Medium	Medium	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
5	*Eucalyptus amplifolia*	7	3	Fair	Fair	Semi-mature	Low	Short	Low	150	-	-	150	200	2.0	1.7	**Nil**	**0%**	Suppressed canopy.	**Retain**
6	*Eucalyptus fibrosa*	12	7	Good	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Nil**	**0%**	-	**Retain**
7	*Eucalyptus fibrosa*	12	8	Good	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Nil**	**0%**	-	**Retain**
8	*Eucalyptus fibrosa*	10	9	Good	Fair	Mature	Medium	Medium	Medium	350	300	-	460	500	5.5	2.5	**Nil**	**0%**	-	**Retain**
9	*Eucalyptus amplifolia*	4	2	Fair	Fair	Juvenile	Low	Medium	Low	100	-	-	100	100	2.0	1.5	**Nil**	**0%**	-	**Retain**
10	*Eucalyptus amplifolia*	7	4	Fair	Poor	Semi-mature	Low	Short	Low	100	150	-	180	350	2.2	2.1	**Nil**	**0%**	Coppice regrowth	**Retain**
11	*Eucalyptus tereticornis*	12	4	Fair	Fair	Mature	Medium	Medium	Medium	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
12	*Eucalyptus tereticornis*	12	4	Fair	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Nil**	**0%**	-	**Retain**
13	*Eucalyptus microcorys*	7	5	Fair	Fair	Semi-mature	Low	Medium	Low	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
14	*Eucalyptus microcorys*	8	5	Good	Fair	Semi-mature	Medium	Medium	Medium	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
15	*Eucalyptus tereticornis*	14	7	Fair	Fair	Mature	Medium	Medium	Medium	250	250	-	350	400	4.2	2.3	**Nil**	**0%**	-	**Retain**
16	*Magnolia grandiflora*	5	4	Fair	Fair	Mature	Low	Medium	Low	200	150	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
17	*Magnolia grandiflora*	6	5	Fair	Fair	Mature	Medium	Medium	Medium	200	-	-	200	250	2.4	1.8	**Nil**	**0%**	-	**Retain**
18	*Melaleuca quinquenervia*	9	6	Good	Good	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Nil**	**0%**	-	**Retain**
19	*Livistona australis*	8	4	Good	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Nil**	**0%**	-	**Retain**
20	*Livistona australis*	9	4	Good	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Nil**	**0%**	-	**Retain**
21	*Livistona australis*	8	4	Good	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Major**	**17%**	Encroachment comprises low impact pavement works.	**Retain**
22	*Livistona australis*	10	4	Good	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Minor**	**8%**	-	**Retain**
23	*Melaleuca quinquenervia*	12	7	Good	Fair	Mature	Medium	Medium	Medium	450	-	-	450	500	5.4	2.5	**Major**	**24%**	Encroachment comprises low impact pavement works.	**Retain**
24	*Melaleuca quinquenervia*	9	6	Good	Fair	Mature	Medium	Medium	Medium	450	-	-	450	500	5.4	2.5	**Major**	**28%**	Encroachment comprises low impact pavement works.	**Retain**
25	*Melaleuca quinquenervia*	12	6	Good	Fair	Mature	Medium	Medium	Medium	450	-	-	450	500	5.4	2.5	**Major**	**32%**	Encroachment comprises low impact pavement works.	**Retain**
26	*Eucalyptus tereticornis*	14	7	Fair	Fair	Mature	Medium	Medium	Medium	450	-	-	450	500	5.4	2.5	**Nil**	**0%**	-	**Retain**
27	*Eucalyptus tereticornis*	14	6	Good	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Nil**	**0%**	-	**Retain**
28	*Eucalyptus tereticornis*	7	4	Fair	Fair	Semi-mature	Low	Medium	Low	200	-	-	200	250	2.4	1.8	**Nil**	**0%**	-	**Retain**
29	*Eucalyptus tereticornis*	9	5	Fair	Fair	Mature	Medium	Short	Low	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	Suppressed canopy.	**Retain**
30	*Casuarina glauca*	8	6	Fair	Fair	Mature	Medium	Medium	Medium	300	200	150	390	450	4.7	2.4	**Nil**	**0%**	-	**Retain**
31	*Melaleuca quinquenervia*	10	6	Good	Fair	Mature	Medium	Medium	Medium	400	-	-	400	450	4.8	2.4	**Major**	**28%**	Encroachment comprises low impact pavement works.	**Retain**
32	*Magnolia grandiflora*	6	5	Good	Fair	Mature	Low	Medium	Low	200	-	-	200	250	2.4	1.8	**Minor**	**8%**	-	**Retain**
33	*Eucalyptus bosistoana*	12	6	Fair	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Minor**	**7%**	-	**Retain**
34	*Eucalyptus robusta*	1	2	Good	Poor	Juvenile	Low	Short	Low	100	-	-	100	100	2.0	1.5	**Nil**	**0%**	Coppice regrowth.	**Retain**
35	*Eucalyptus robusta*	7	7	Fair	Fair	Mature	Medium	Medium	Medium	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
36	*Casuarina glauca*	12	6	Good	Fair	Mature	Medium	Medium	Medium	450	-	-	450	500	5.4	2.5	**Major**	**46%**	Encroachment comprises low impact pavement works.	**Retain**

Id.	Botanical name	Height (metres)	Spread (metres diameter)	Health	Structure	Age class	Tree significance	Useful life expectancy	Priority for retention	DBH 1 (millimetres diameter)	DBH 2 (millimetres diameter)	DBH 3 (millimetres diameter)	DBH Combined (millimetres diameter)	DRB (millimetres diameter)	TPZ (metres radius)	SRZ (metres radius)	Encroachment	% Encroachment within TPZ	Other notes	Proposal
37	*Melaleuca quinquenervia*	5	4	Fair	Fair	Mature	Low	Short	Low	200	-	-	200	250	2.4	1.8	**Major**	**51%**	Severe trunk wounds. Unsuitable location.	**Remove**
38	*Brachychiton populneus*	7	3	Fair	Fair	Mature	Medium	Medium	Medium	250	-	-	250	350	3.0	2.1	**Nil**	**0%**	-	**Retain**
39	*Casuarina glauca*	10	6	Fair	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Minor**	**9%**	-	**Retain**
40	*Eucalyptus racemosa*	6	3	Fair	Poor	Mature	Low	Medium	Low	150	-	-	150	200	2.0	1.7	**Major**	**49%**	Tree is within the construction footprint. Unsuitable location.	**Remove**
41	*Eucalyptus fibrosa*	12	8	Fair	Fair	Mature	Medium	Medium	Medium	400	200	-	450	500	5.4	2.5	**Nil**	**0%**	-	**Retain**
42	*Casuarina glauca*	12	6	Good	Fair	Mature	Medium	Medium	Medium	450	-	-	450	500	5.4	2.5	**Major**	**42%**	Encroachment comprises low impact pavement works.	**Retain**
43	*Casuarina glauca*	10	5	Fair	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Nil**	**0%**	-	**Retain**
44	*Casuarina glauca*	10	6	Fair	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Nil**	**0%**	-	**Retain**
45	*Eucalyptus robusta*	7	8	Good	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Nil**	**0%**	-	**Retain**
46	*Eucalyptus robusta*	5	3	Fair	Fair	Semi-mature	Low	Short	Low	150	-	-	150	200	2.0	1.7	**Nil**	**0%**	Suppressed canopy.	**Retain**
47	*Eucalyptus robusta*	7	9	Good	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Nil**	**0%**	-	**Retain**
48	*Eucalyptus robusta*	6	4	Good	Fair	Semi-mature	Low	Medium	Low	150	-	-	150	200	2.0	1.7	**Nil**	**0%**	-	**Retain**
49	*Eucalyptus bosistoana*	10	6	Good	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Nil**	**0%**	Included bark junction.	**Retain**
50	*Eucalyptus bosistoana*	5	3	Fair	Fair	Juvenile	Low	Short	Low	150	-	-	150	200	2.0	1.7	**Nil**	**0%**	Suppressed canopy.	**Retain**
51	*Syncarpia glomulifera*	6	3	Good	Fair	Semi-mature	Low	Medium	Low	150	-	-	150	200	2.0	1.7	**Nil**	**0%**	-	**Retain**
52	*Eucalyptus bosistoana*	6	5	Fair	Fair	Semi-mature	Low	Medium	Low	200	-	-	200	250	2.4	1.8	**Nil**	**0%**	-	**Retain**
53	*Eucalyptus bosistoana*	9	5	Good	Fair	Mature	Medium	Medium	Medium	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
54	*Brachychiton populneus*	5	2	Fair	Fair	Semi-mature	Low	Medium	Low	150	-	-	150	200	2.0	1.7	**Nil**	**0%**	-	**Retain**
55	*Eucalyptus bosistoana*	10	5	Fair	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Minor**	**1%**	Included bark junction.	**Retain**
56	*Eucalyptus fibrosa*	9	3	Fair	Fair	Mature	Medium	Medium	Medium	200	-	-	200	250	2.4	1.8	**Nil**	**0%**	-	**Retain**
57	*Eucalyptus robusta*	6	8	Good	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Nil**	**0%**	-	**Retain**
58	*Eucalyptus robusta*	6	7	Fair	Fair	Semi-mature	Low	Medium	Low	200	200	-	280	350	3.4	2.1	**Nil**	**0%**	-	**Retain**
59	*Eucalyptus racemosa*	5	4	Fair	Fair	Semi-mature	Low	Medium	Low	150	-	-	150	200	2.0	1.7	**Nil**	**0%**	-	**Retain**
60	*Corymbia ficifolia*	8	7	Fair	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Minor**	**7%**	Internodal pruning.	**Retain**
61	*Eucalyptus racemosa*	6	3	Fair	Poor	Mature	Low	Medium	Low	150	-	-	150	200	2.0	1.7	**Nil**	**0%**	-	**Retain**
62	*Eucalyptus racemosa*	6	3	Fair	Fair	Mature	Medium	Medium	Medium	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
63	*Eucalyptus amplifolia*	10	7	Fair	Fair	Mature	Medium	Medium	Medium	350	-	-	350	400	4.2	2.3	**Nil**	**0%**	Trunk wounds.	**Retain**
64	*Eucalyptus amplifolia*	9	4	Fair	Fair	Semi-mature	Low	Medium	Low	200	-	-	200	250	2.4	1.8	**Nil**	**0%**	-	**Retain**
65	*Eucalyptus amplifolia*	10	5	Fair	Fair	Mature	Medium	Medium	Medium	250	-	-	250	300	3.0	2.0	**Nil**	**0%**	-	**Retain**
66	*Eucalyptus amplifolia*	9	7	Fair	Fair	Mature	Medium	Medium	Medium	300	-	-	300	350	3.6	2.1	**Nil**	**0%**	-	**Retain**
67	*Melaleuca quinquenervia*	5	0	Fair	Fair	Semi-mature	Low	Short	Low	100	100	150	210	250	2.5	1.8	**Major**	**15%**	Encroachment comprises low impact pavement works.	**Retain**
68	*Melaleuca quinquenervia*	6	4	Fair	Fair	Semi-mature	Low	Medium	Low	150	150	-	210	250	2.5	1.8	**Major**	**42%**	Tree is within the construction footprint. Unsuitable location.	**Remove**
69	*Melaleuca quinquenervia*	7	4	Fair	Fair	Mature	Medium	Short	Low	200	-	-	200	250	2.4	1.8	**Major**	**100%**	Suppressed canopy. Unsuitable location.	**Remove**

4 Discussion

4.1 Nil encroachment

A total of **51** trees will be subject to nil encroachment within the TPZ:

- **Retain:** A total of **51** trees are located outside of the proposed construction footprint. No impacts on these trees are foreseeable under the current proposal.
- **Remove:** No trees within the category of “nil encroachment” are proposed for removal.

4.2 Minor encroachment

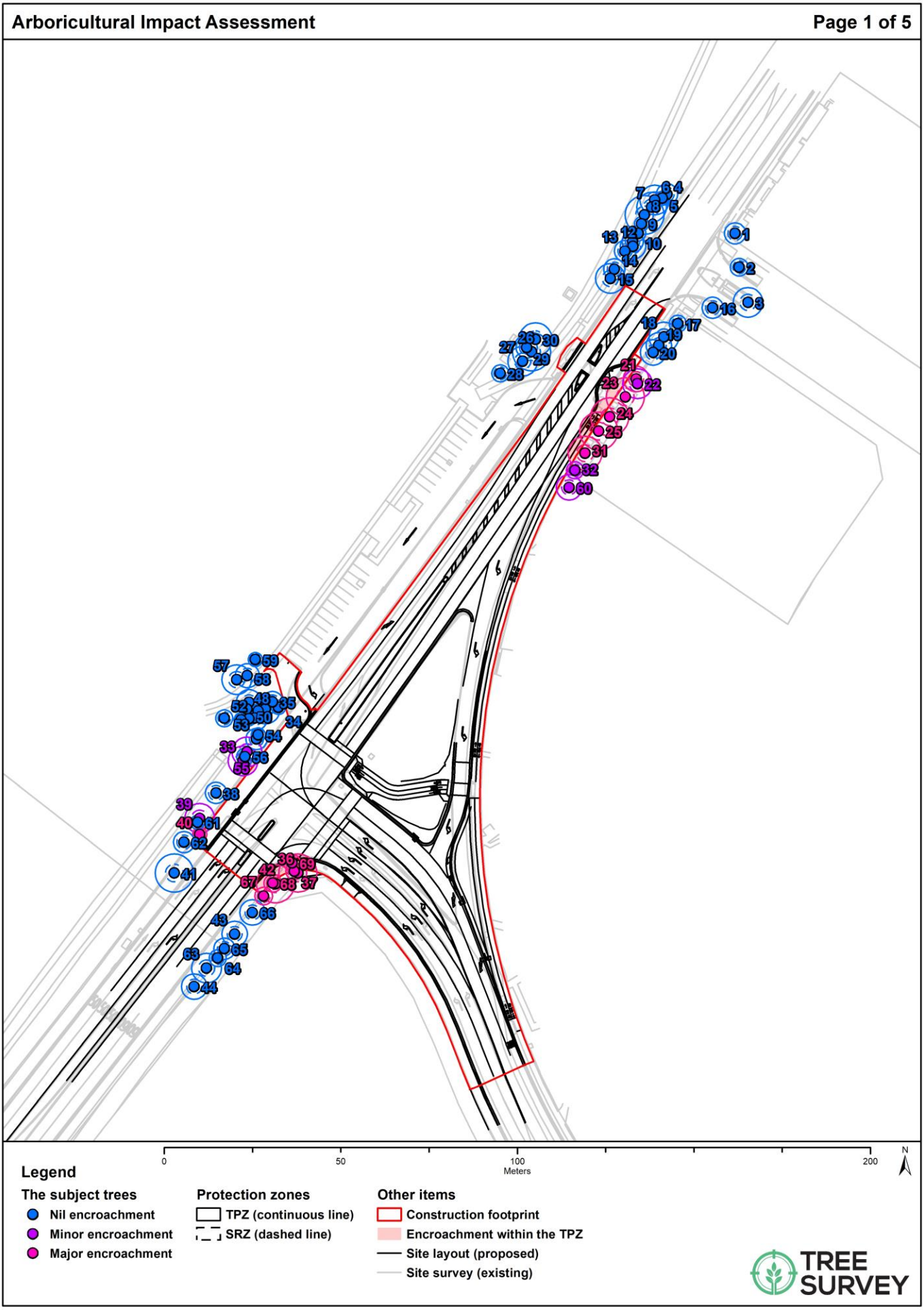
A total of **6** trees will be subject to a minor encroachment of less than 10% within the TPZ:

- **Retain:** A total of **6** trees will be subject to a minor encroachment of less than 10% within the TPZ. The encroachment will not impact the SRZ and is highly unlikely to impact the overall health or condition of these trees. Under the current proposal, these trees can be successfully retained.
- **Remove:** No trees within the category of “minor encroachment” are proposed for removal.

4.3 Major encroachment

A total of **12** trees will be subject to a major encroachment of greater than 10% within the TPZ:

- **Retain:** A total of **8** trees will be subject to a major encroachment within the TPZ. The encroachments primarily intersect the TPZ in areas of the existing roadway, road shoulder, and hard surfaces. These areas are not conducive to root growth. These encroachments are considered low impact and are unlikely to affect the overall health or condition of the subject trees. Several site-specific mitigations for these encroachments have been outlined in the Tree Protection Plan. Under the current proposal, these trees can be successfully retained.
- **Remove:** A total of **4** trees are located within, or directly adjacent to the proposed construction footprint and cannot be retained under the current proposal. These trees have been assessed as a low priority for retention and are recommended for removal.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The subject trees
Nil encroachment
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Major encroachment
Protection zones
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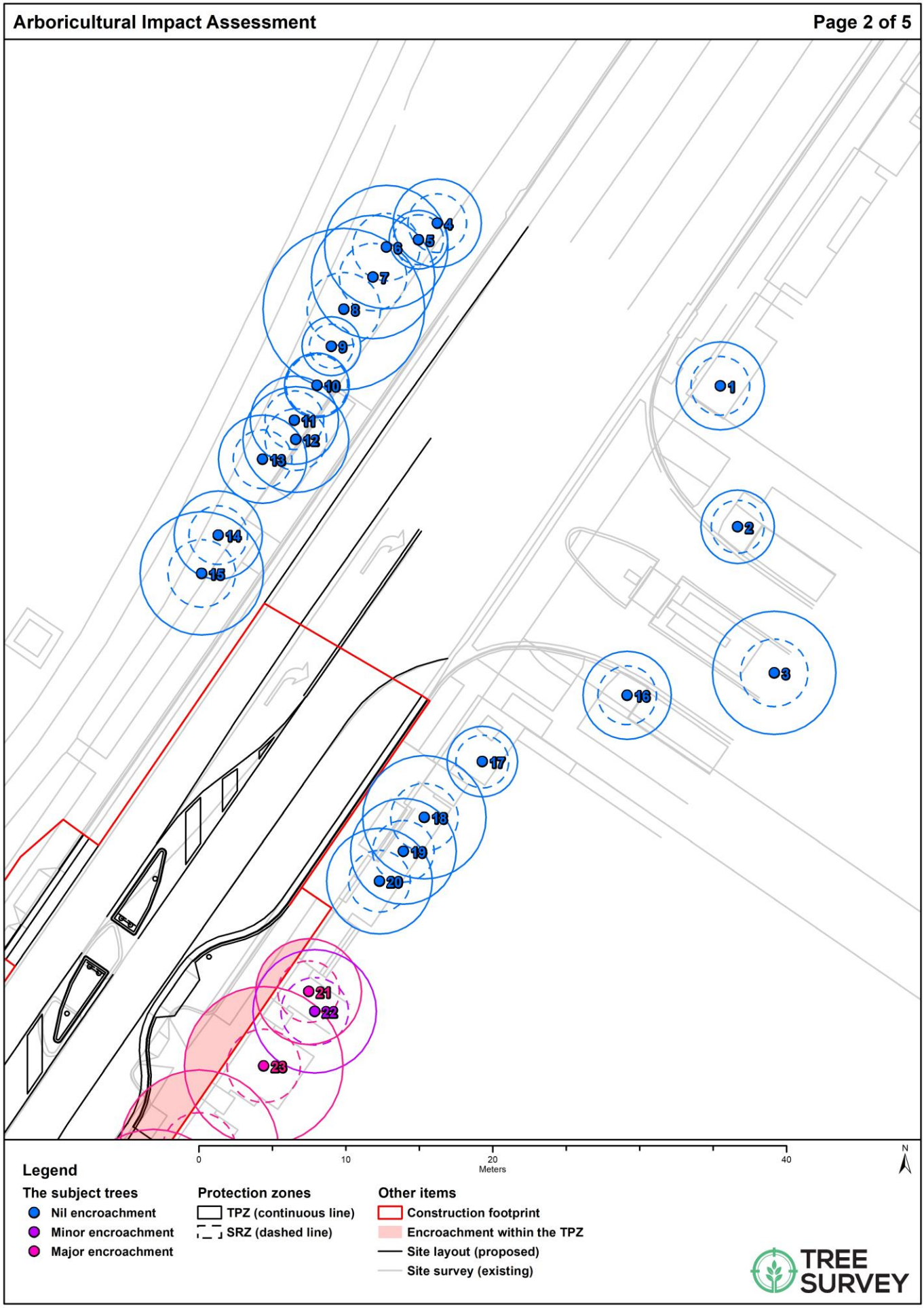
SRZ (dashed line)
Other items
Construction footprint
Encroachment within the TPZ
Site layout (proposed)
Site survey (existing)
TREE SURVEY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The subject trees
Nil encroachment
Minor encroachment
Major encroachment
Protection zones
TPZ (continuous line)
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Other items
Construction footprint
Encroachment within the TPZ
Site layout (proposed)
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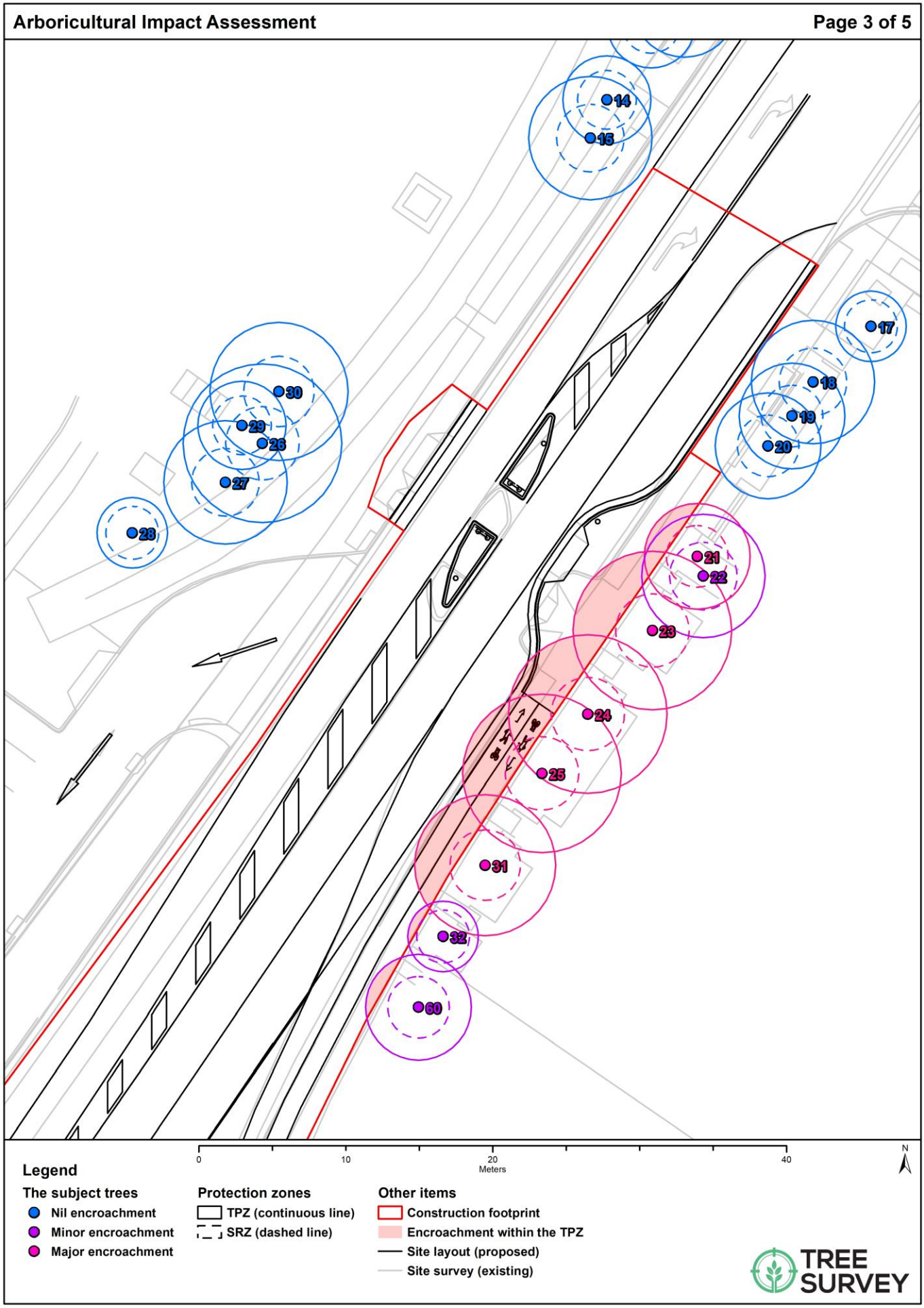
TREE SURVEY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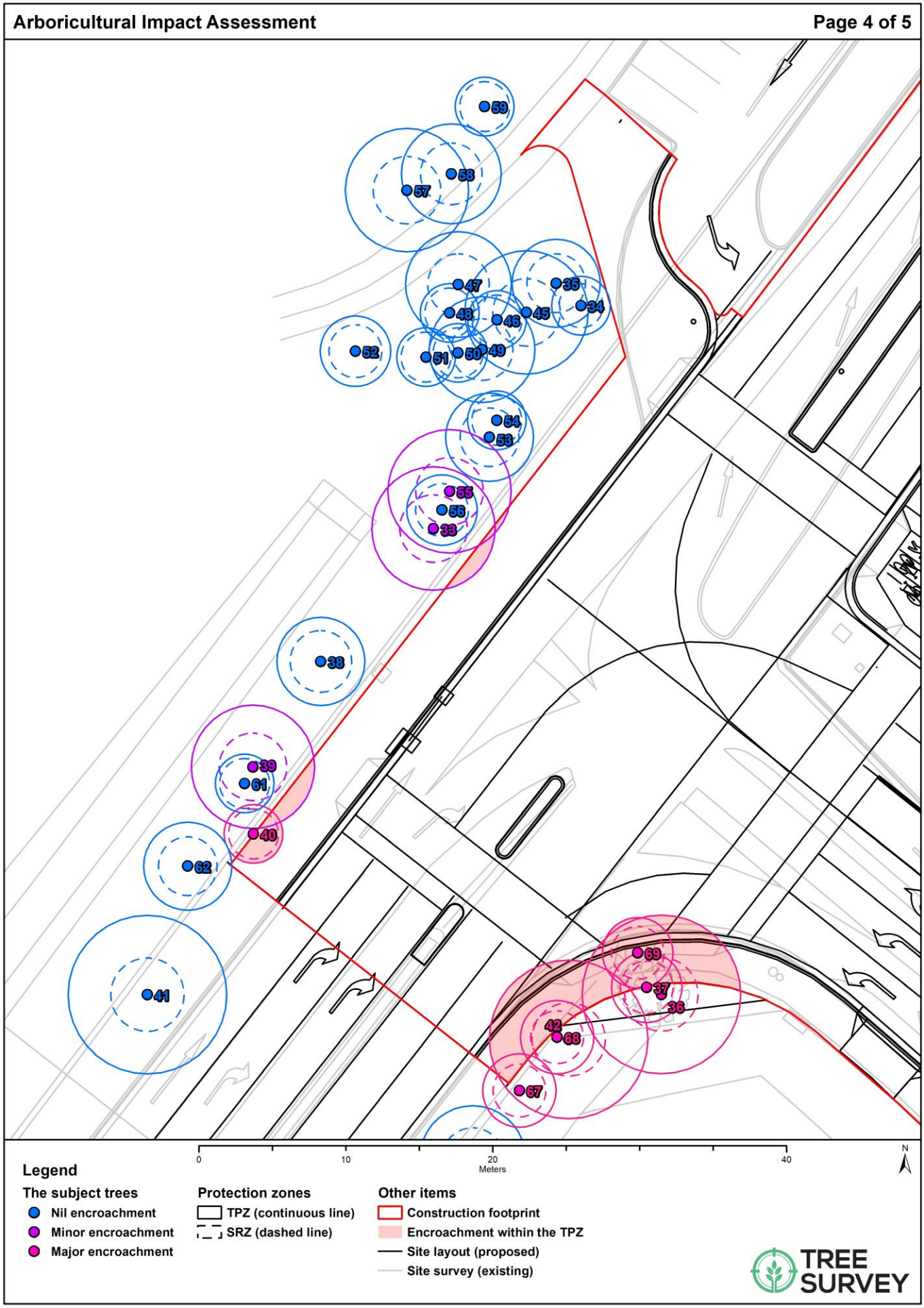
The subject trees
Nil encroachment
Minor encroachment
Major encroachment
Protection zones
TPZ (continuous line)
SRZ (dashed line)
Other items
Construction footprint
Encroachment within the TPZ
Site layout (proposed)
Site survey (existing)
TREE SURVEY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Nil encroachment
Minor encroachment
Major encroachment
Protection zones
TPZ (continuous line)
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Construction footprint
Encroachment within the TPZ
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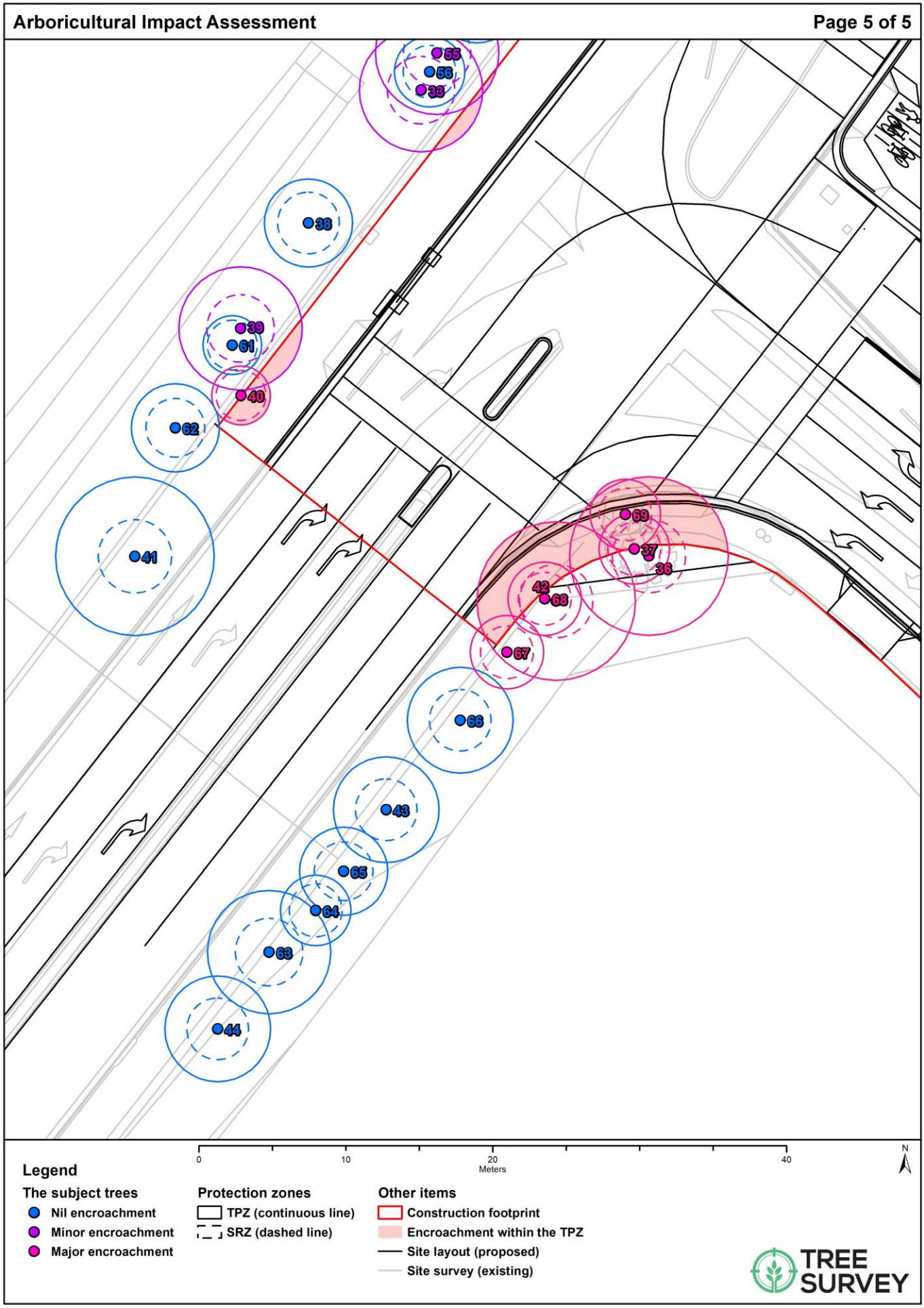
Site survey (existing)
TREE SURVEY


Arboricultural Impact Assessment
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Legend
The subject trees
Nil encroachment
Minor encroachment
Major encroachment
Protection zones
TPZ (continuous line)
SRZ (dashed line)
Other items
Construction footprint
Encroachment within the TPZ
Site layout (proposed)
Site survey (existing)
TREE SURVEY

5 Tree Protection Plan (TPP)

5.1 Tree removal and retention

A summary of the total proposed tree removals is outlined below :

- **Retain:** A total of **65** trees are proposed for retention.
- **Remove:** A total of **4** trees are proposed for removal.

5.2 Tree removal

All tree removal work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in accordance with Australian Standard AS4373-2007, Pruning of Amenity Trees (AS4373), the Work Health and Safety Act 2011, and Work Health and Safety Regulations 2017.

5.3 Tree pruning

Minor vegetation trimming may be required to accommodate construction clearances. Standard pruning specifications are outlined below:

- Pruning must not exceed 10% of the overall canopy volume.
- No limbs greater than 100mm in diameter are to be removed.
- The final pruning cut shall be at the branch collar or growth point in accordance with AS4373.
- All tree pruning work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in accordance with AS4373 and the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998).

If proposed vegetation trimming does not meet the specifications outlined above, the project arborist must undertake an assessment of impacts on a case-by-case basis.

5.4 Restricted activities within the TPZ

The TPZ is an area that is isolated from the work zone to ensure no disturbance or encroachment occurs in this zone. Activities generally excluded from the TPZ (unless otherwise approved under the development consent) include, but are not limited to:

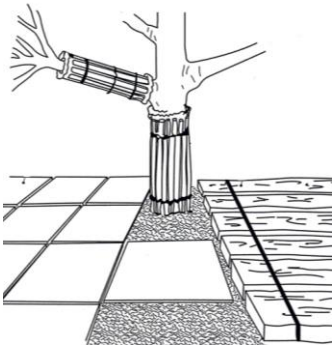
- Machine excavation and trenching.
- Ripping or cultivation of the soil.
- Storage of building materials, waste, and waste receptacles.
- Disposal of waste materials and chemicals including paint, solvents, cement slurry, fuel, oil, and other toxic liquids.
- Movement and storage of plant, equipment, and vehicles.
- Soil level changes, including the placement of fill material.
- Mechanical removal of vegetation.
- Affixing of signage or hoardings to trees.
- Other physical damage to the trunk or root system.
- Any other activity that is likely to cause damage to the tree.

5.5 Trunk protection

Trunk protection must be installed at the locations shown in the TPP.

Specifications for trunk protection are as follows:

- A thick layer of carpet underfelt, geotextile fabric, or similar wrapped around the trunk to a minimum height of 2m.
- 1.8m lengths of softwood timbers aligned vertically and spaced evenly around the trunk (with a small gap of approximately 50mm between the timbers).
- The timbers must be secured using galvanised hoop strap (aluminium strapping).



The timbers shall be wrapped around the trunk but not fixed to the tree, as this will cause injury/damage to the tree.

5.6 Ground protection

If temporary access for vehicle, plant, or machinery is required within the TPZ ground protection shall be installed. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Where possible, areas of the existing pavement shall be used as ground protection.

Specifications for light traffic access (<3.5 tonne) are as follows:

- Permeable membrane such as geotextile fabric.
- A layer of mulch or crushed rock (at a minimum depth of 100mm)

Specifications for heavy traffic access (>3.5 tonne) are as follows:

- Permeable membrane such as geotextile fabric.
- A layer of lightly compacted road base (at a minimum depth of 200mm)
- Geotextile fabric shall extend a minimum of 300mm beyond the edge of the road base.
- Heavy vehicle track mats, road plates, access mats, or similar.

Pedestrian, vehicular, and machinery access within the TPZ shall be restricted solely to areas where ground protection has been installed.

5.7 Mulch

The area within the TPZ should be mulched with good quality composted wood chip/leaf mulch and should be maintained at a depth of 150mm-200mm. Mulching around the base of the tree will provide nutrients and organic matter to the soil as it breaks down, improving and maintaining the overall health of the trees.

5.8 Demolition

The demolition of all existing structures inside or directly adjacent to the TPZ of trees to be retained must be undertaken in consultation with the project arborist. Any machinery is to work from inside the footprint of the existing structures or outside the TPZ, to minimise soil disturbance and compaction. If it is not feasible to locate demolition machinery outside the TPZ of trees to be retained, ground protection will be required. The demolition should be undertaken inwards into the footprint of the existing structures, sometimes referred to as the ‘top-down, pull back’ method.

5.9 Excavations

The project arborist must supervise and certify that all excavations and root pruning are in accordance with AS4373 and AS4970. All excavations (including root investigations) within the TPZ must be carried out using tree-sensitive methods under the supervision of the project arborist (see **Tree Protection Plan**). These methods may include:

- **Manual excavation:** Use of hand tools such as spades, trowels, and brushes.
- **Air spade:** Use of a pressurised air device that blows the soil away and leaves roots intact.
- **Hydro-vacuum excavation:** Use of pressurised water to remove soil from around roots.

The recommended techniques for common types of excavations have been outlined below:

- **Continuous strip footings:** Manual excavation, air spade, or hydro-vacuum is utilised excavation lines within the TPZ prior to the commencement of mechanical excavation. Excavation should be a depth of 1 metre (or to unfavourable root growth conditions such as bedrock or heavy clay, if agreed by the project arborist). Any conflicting roots shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning must be documented and carried out by the project arborist. After all root pruning is completed, machine excavation is permitted within the footprint of the structure.
- **Post or pier footings:** Manual excavation, air spade, or hydro-vacuum is utilised at the location of pier footings within the TPZ. Any conflicting roots shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning must be documented and carried out by the project arborist. After all root pruning is completed, machine excavation is permitted within the footprint of the structure.

No over-excavation, battering, or benching shall be undertaken beyond the footprint of any structure unless approved by the project arborist.

5.10 Underground services

Where possible, underground services should be routed outside of the TPZ. If underground services need to be installed within the TPZ, they must be installed using tree-sensitive excavation methods under the supervision of the project arborist. Alternatively, boring methods such as horizontal directional drilling (HDD) may be used for underground service installation, providing the installation is at a minimum depth of 800mm below grade. Excavations for entry/exit pits must be located outside the TPZ.

5.11 Root pruning

Any conflicting roots greater than 50mm in diameter identified during the supervised excavations shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning (>50mm) must be documented and carried out by the project arborist.

5.12 Site inspections

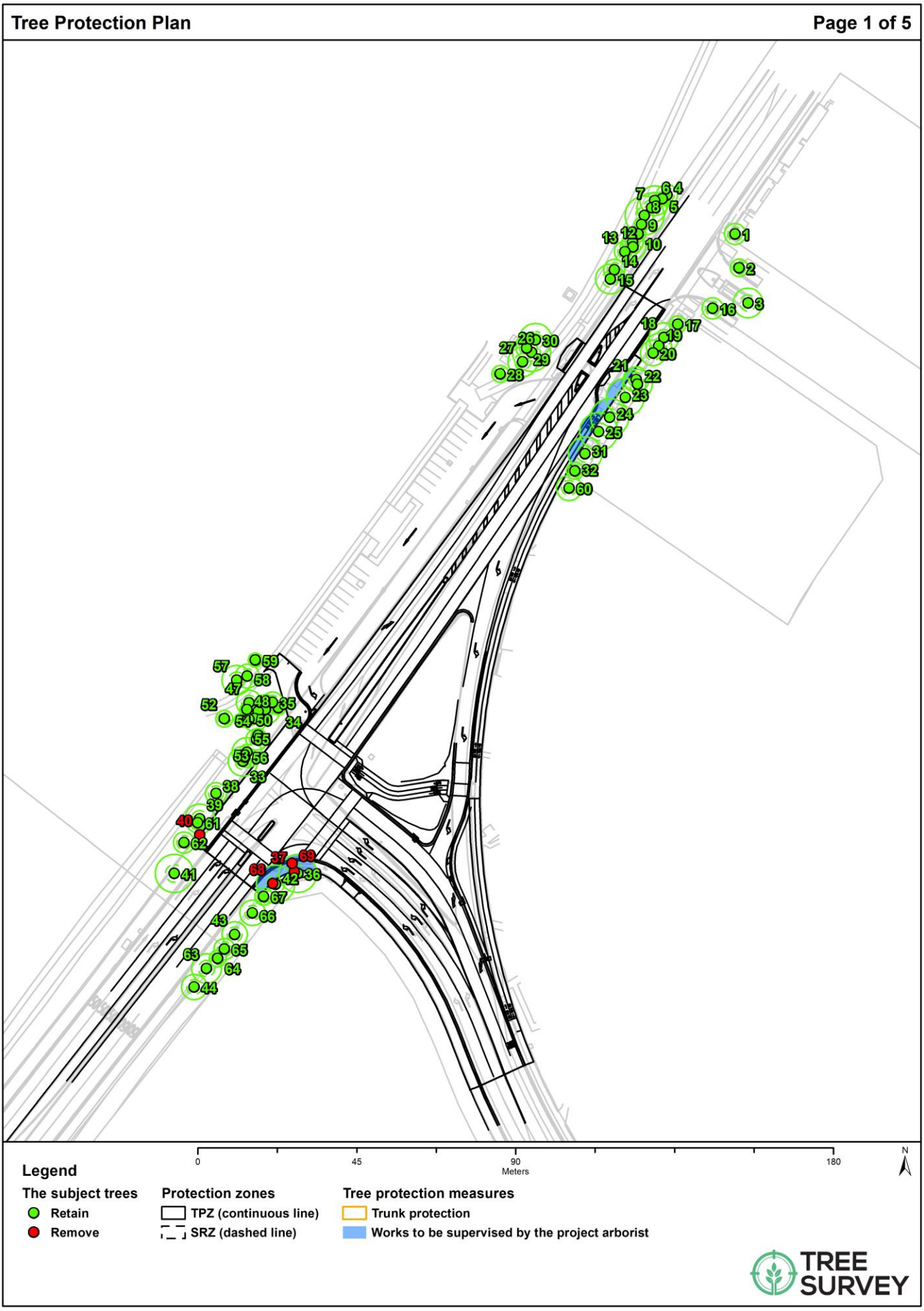
In accordance with AS4970, inspections must be conducted by the project arborist at the following key project stages:

- Prior to any work commencing on-site (including demolition, earthworks, or site clearing) and following the installation of tree protection.
- During any excavations, building works, and any other activities carried out within the TPZ of any tree to be retained & protected.
- A minimum of once per 12 weeks (every 3 months) during the construction phase for trees with a major encroachment within the TPZ.
- After all major construction has ceased, following the removal of tree protection.

It shall be the responsibility of the project manager to notify the project arborist prior to any works within the TPZ of any protected tree at a minimum of 48 hours' notice. To ensure the tree protection plan is implemented, hold points have been specified in the schedule of work (**Table 4**).

Table 4: Schedule of work

Construction stage	Hold point	Description
Pre-construction	1	Tree protection (for trees that will be retained) shall be installed prior to demolition and site establishment. This may include the mulching of areas within the TPZ. The project arborist shall inspect and certify tree protection.
During Construction	2	Project arborist to supervise and document any significant works carried out within the TPZ of trees to be retained.
	3	Scheduled inspection of trees by the project arborist should be undertaken approximately every 12 weeks (3 months) during the construction period.
Post Construction	4	Final inspection of trees by project arborist.


Tree Protection Plan
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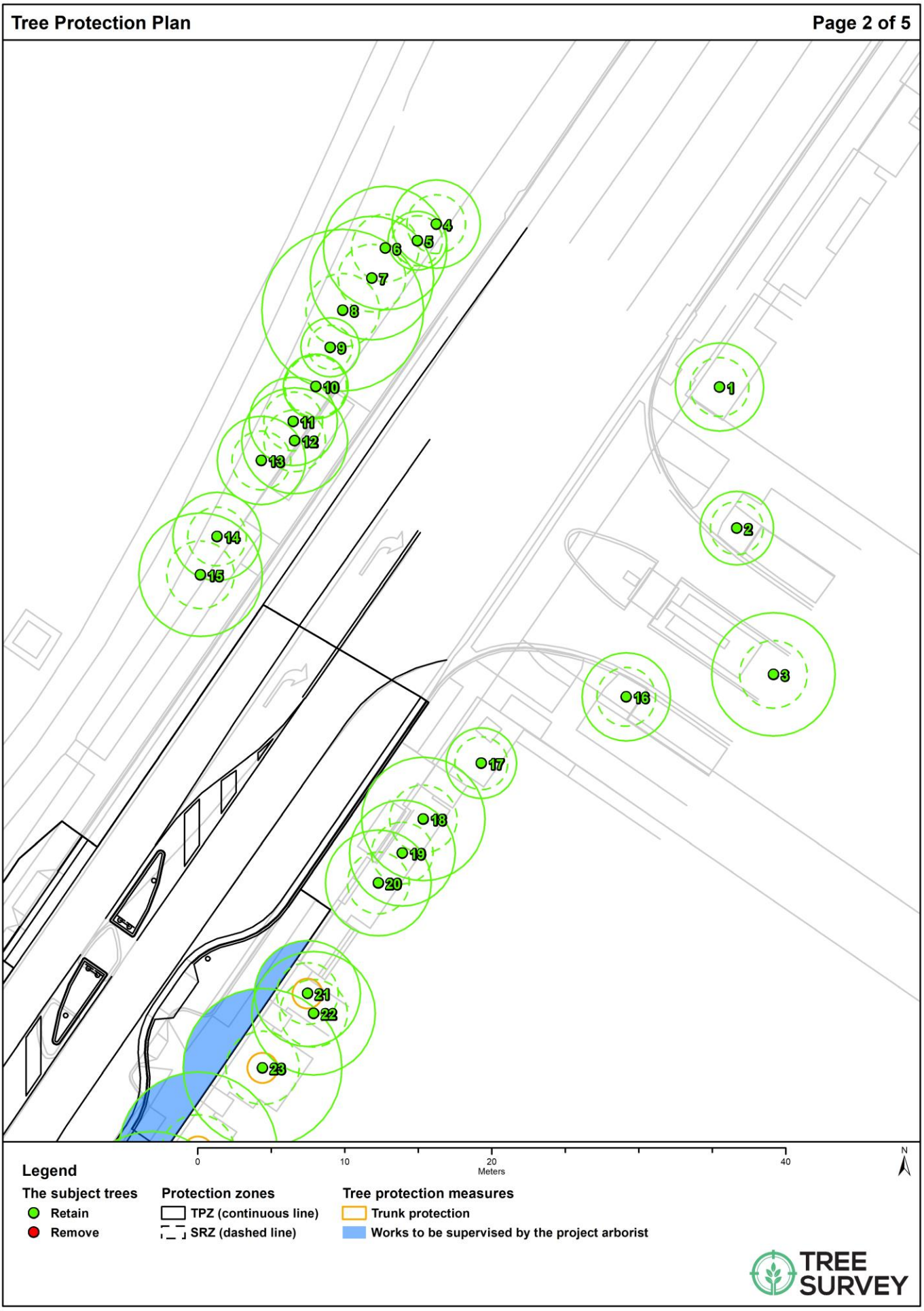
Tree protection measures
Trunk protection
Works to be supervised by the project arborist
TREE SURVEY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Tree protection measures
Trunk protection
Works to be supervised by the project arborist
TREE SURVEY


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Protection zones
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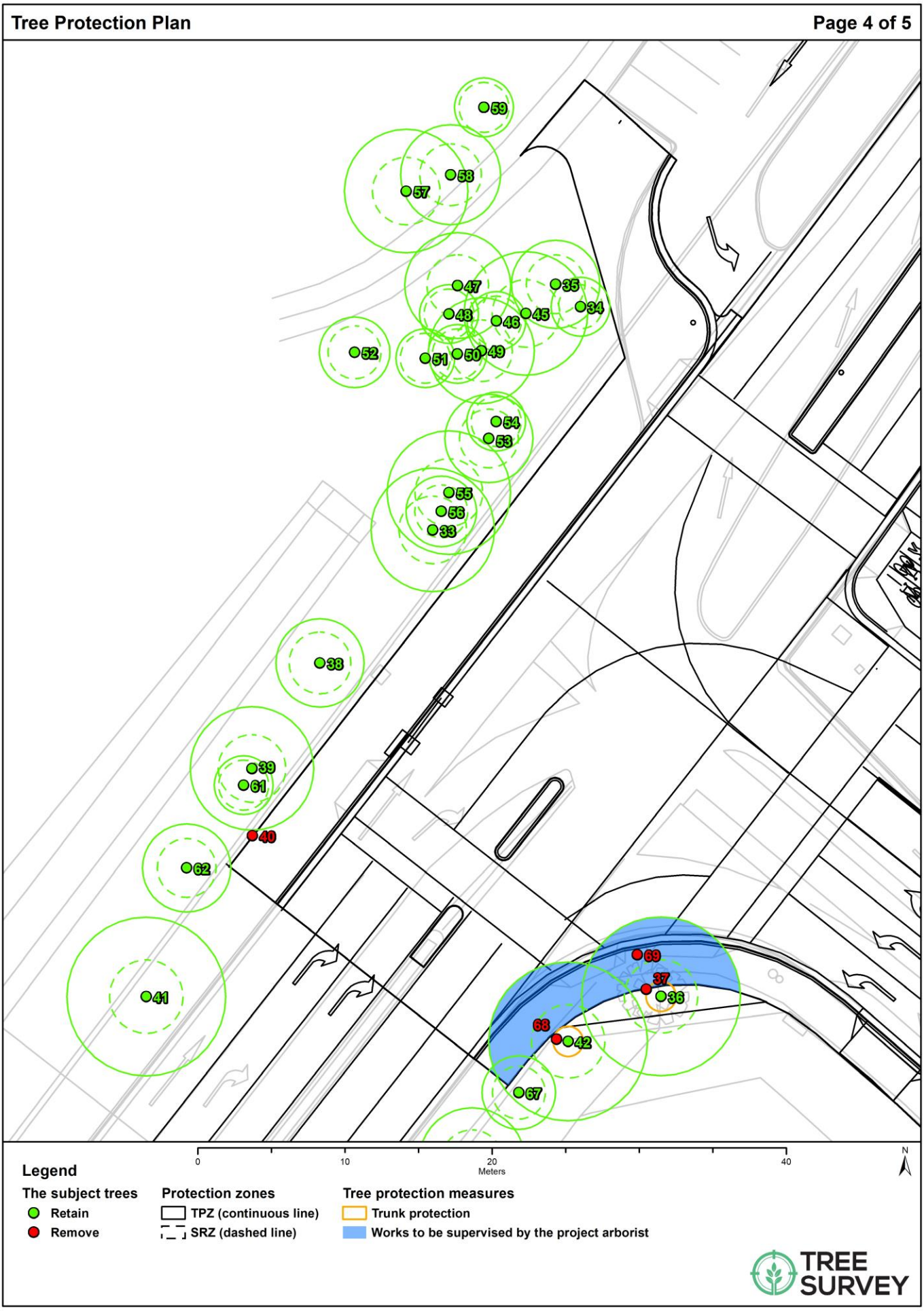
Tree protection measures
Trunk protection
Works to be supervised by the project arborist
TREE SURVEY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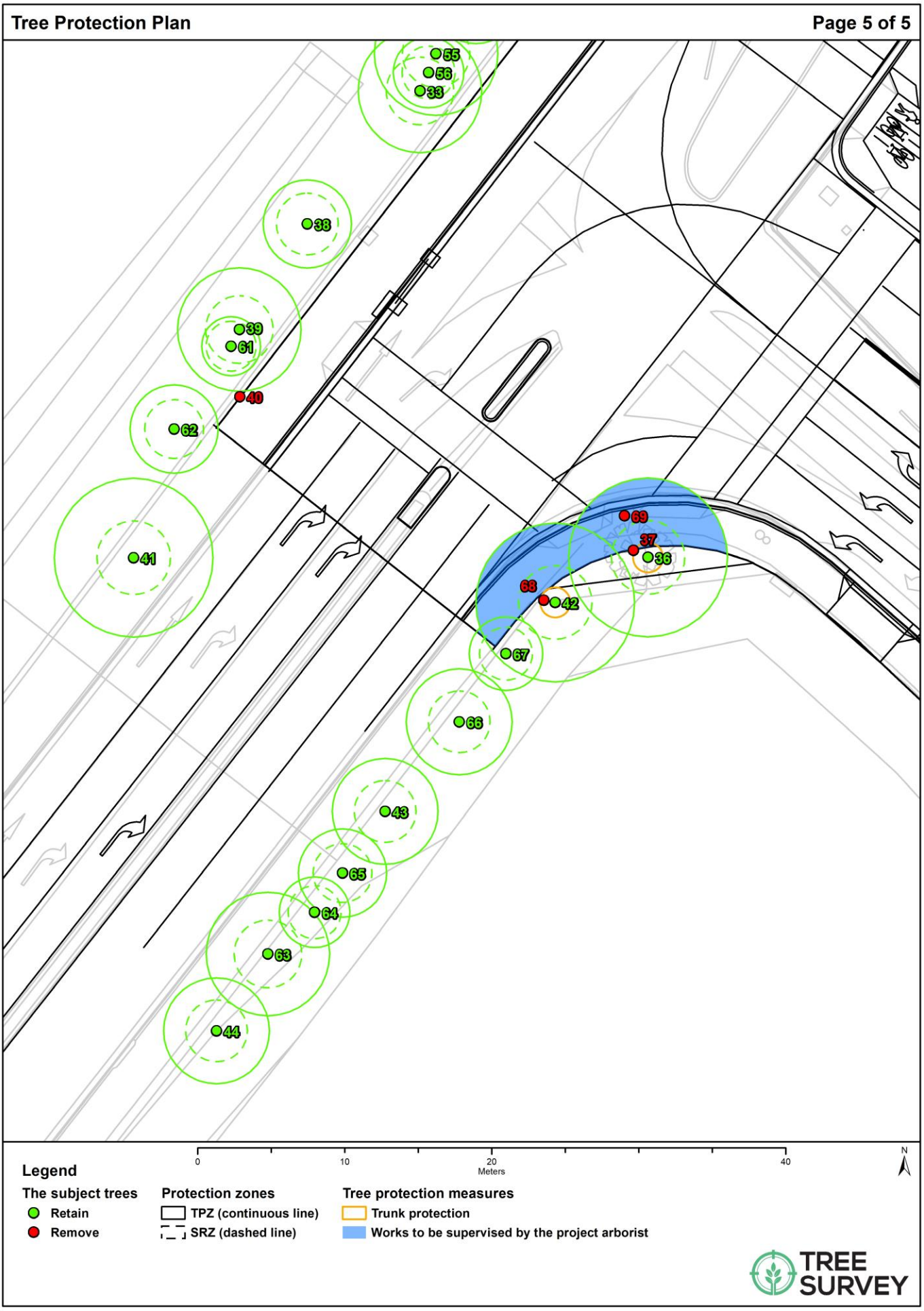
Tree protection measures
Trunk protection
Works to be supervised by the project arborist
TREE SURVEY


Tree Protection Plan
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The subject trees
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Protection zones
TPZ (continuous line)
SRZ (dashed line)
Tree protection measures
Trunk protection
Works to be supervised by the project arborist
TREE SURVEY

6 References

Australian Standard, AS 4970-2009, Protection of Trees on Development Sites

Australian Standard, AS 4373-2007, Pruning of Amenity Trees.

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Mattheck, C., Lonsdale, D. and Breloer, H. (1994). The body language of trees. London: H.M.S.O.

Roberts, J., Jackson, N. and Smith, D. (2006). Tree roots in the built environment.

Appendix I **- STARS© assessment matrix**

The retention value of a tree or group of trees is determined using a combination of environmental, cultural, physical, and social values.

- **Low:** These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
- **Medium:** These trees are moderately important for retention. Their removal should only be considered if adversely affecting the proposed building/works, and all other alternatives have been considered and exhausted.
- **High:** These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by Australian Standard, AS4970-2009 Protection of trees on development sites.

This tree retention assessment has been undertaken in accordance with the Institute of Australian Consulting Aboriculturalists (IACA) Significance of a Tree, Assessment Rating System (STARS). The system uses a scale of High, Medium, and Low significance in the landscape. Once the landscape significance of a tree has been defined, the retention value can be determined. Each tree must meet a minimum of three (3) assessment criteria to be classified within a category.

Tree Significance - Assessment Criteria

Low Significance	Medium Significance	High Significance
The tree is in fair-poor condition and good or low vigour. The tree has form atypical of the species The tree is not visible or is partly visible from the surrounding properties or obstructed by other vegetation or buildings The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area The tree is a young specimen which may or may not have reached dimensions to be protected by local Tree Preservation Orders or similar protection mechanisms and can easily be replaced with a suitable specimen The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa in situ – tree is inappropriate to the site conditions The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms The tree has a wound or defect that has the potential to become structurally unsound.	The tree is in fair to good condition The tree has form typical or atypical of the species The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street The tree provides a fair contribution to the visual character and amenity of the local area The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ	The tree is in good condition and good vigour The tree has a form typical for the species The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age. The tree is listed as a heritage item, threatened species or part of an endangered ecological community or listed on council's significant tree register The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity. The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group, or has commemorative values. The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ – tree is appropriate to the site conditions.
Environmental Pest / Noxious Weed		
The tree is an environmental pest species due to its invasiveness or poisonous/allergenic properties. The tree is a declared noxious weed by legislation		
Hazardous / Irreversible Decline		
The tree is structurally unsound and/or unstable and is considered potentially dangerous. The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.		

Useful Life Expectancy - Assessment Criteria			
Remove	**Short**	**Medium**	**Long**
Trees with a high level of risk that would need removing within the next 5 years. Dead trees. Trees that should be removed within the next 5 years. Dying or suppressed or declining trees through disease or inhospitable conditions. Dangerous trees through instability or recent loss of adjacent trees. Dangerous trees through structural defects, including cavities, decay, included bark, wounds, or poor form. Damaged trees that considered unsafe to retain. Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. Trees that will become dangerous after removal of other trees for the reasons.	Trees that appear to be retainable with an acceptable level of risk for 5-15 years. Trees that may only live between 5 and 15 more years. Trees that may live for more than 15 years but would be removed to allow the safe development of more suitable individuals. Trees that may live for more than 15 years but would be removed during the course of normal management for safety or nuisance reasons. Storm damaged or defective trees that require substantial remedial work to make safe and are only suitable for retention in the short term.	Trees that appear to be retainable with an acceptable level of risk for 15-40 years. Trees that may only live between 15 and 40 more years. Trees that may live for more than 40 years but would be removed to allow the safe development of more suitable individuals. Trees that may live for more than 40 years but would be removed during the course of normal management for safety or nuisance reasons. Storm damaged or defective trees that require substantial remedial work to make safe and are only suitable for retention in the short term.	Trees that appear to be retainable with an acceptable level of risk for more than 40 years. Structurally sound trees located in positions that can accommodate future growth. Storm damaged or defective trees that could be made suitable for retention in the long term by remedial tree surgery. Trees of special significance for historical, commemorative, or rarity reasons that would warrant extraordinary efforts to secure their long-term retention.

Tree Significance

Useful Life Expectancy	High Significance	Medium Significance	Low Significance	Environmental Pest / Noxious Weed	Hazardous / Irreversible Decline
Long >40 years					
Medium 15-40 years					
Short <1-15 years					
Dead					

Legend for Matrix Assessment

	Priority for retention (High): These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 Protection of trees on development sites. Tree sensitive construction measures must be implemented if works are to proceed within the Tree Protection Zone.
	Consider for retention (Medium): These trees may be retained and protected. These are considered less critical; however, their retention should remain priority with the removal considered only if adversely affecting the proposed building/works, and all other alternatives have been considered and exhausted.
	Consider for removal (Low): These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	Priority for removal (Low): These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.

Reference

IACA, 2010, IACA Significance of a Tree, Assessment Rating System (STARS)
Institute of Australian Consulting Arboriculturists
Australia, www.iaca.org.au

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environmental

Eastern Sydney Office
2/8 Apollo Street
Warriewood
NSW 2102
Ph: 02 9986 1295

Western Sydney Office
7 Twentyfifth Avenue
West Hoxton
NSW 2171

Hunter Valley Office
10/103 Glenwood Drive
Thornton
NSW 2322

www.narla.com.au