



The Cooks to Cove GreenWay (In-Corridor Works) – Review of Environmental Factors

Inner West Council

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Contents

1. Introduction	1
1.1 Project Description and Background	1
1.2 Project Location and Context	2
1.3 Land Use and Ownership	4
2. The Project	8
2.1 Scope of Works	8
2.2 Detailed Scope of Works and Preliminary Construction Methodology.....	10
2.3 Machinery, Equipment, Access, and Ancillary Works	18
2.4 Duration and Working Hours	19
3. Project Justification and Consideration of Alternatives	21
3.1 Eastern City District Plan.....	21
3.2 Our Place Inner West – Local Strategic Planning Statement	21
3.3 Alternative Options.....	22
4. Statutory and Planning Context	26
4.1 NSW Planning and Approvals Process	30
5. Existing Environment and Impact Assessment	33
5.1 Landform, Geology, Soils and Geotechnical Considerations.....	33
5.2 Contamination	37
5.3 Flooding, Waterways and Aquatic Habitat	48
5.4 Biodiversity	53
5.5 Arboriculture	75
5.6 Aboriginal Heritage	79
5.7 Historic Heritage	82
5.8 Noise and Vibration	87
5.9 Landscape and Visual Amenity	95
5.10 Traffic and Transport	113
5.11 Infrastructure.....	118
5.12 Air Quality.....	123
5.13 Waste Management	126
5.14 Socio-Economic Considerations.....	128
5.15 Cumulative Impacts	131
5.16 Matters of National Environmental Significance	133
5.17 Clause 228 of the Environmental Planning and Assessment Act 1979	133
6. Stakeholder Consultation.....	136
6.1 State Environmental Planning Policy (Infrastructure) 2007	136

6.2 Government Agency and Utility Consultation	138
6.3 Community Consultation	139
7. Mitigation Measures.....	145
8. Conclusion.....	162
8.1 Assessor Declaration.....	163
9. References	164

Appendix A Concept Design Drawings (McGregor Coxall, 2020)

Appendix B Geotechnical Investigation (GHD, 2020)

Appendix C Soils and Contamination Report (GHD, 2020)

Appendix D Flood Impact Assessment (WMA Water, 2020)

Appendix E Flora and Fauna Assessment (ELA, 2021)

Appendix F Biodiversity Development Assessment Report (ELA, 2021)

Appendix G Arboricultural Impact Assessment (ELA, 2021)

Appendix H Aboriginal Due Diligence Assessment (ELA, 2020)

Appendix I Statement of Heritage Impact (ELA, 2021)

Appendix J Noise and Vibration Impact Assessment (Marshall Day Acoustics, 2021)

Appendix K Landscape and Visual Impact Assessment (MODE Design, 2021)

Appendix L Community Engagement Report (Inner West Council, 2021)

List of Figures

Figure 1-1: Location of In-Corridor Works study area.....	3
Figure 1-2: Land zoning within the In-Corridor Works study area (Marrickville LEP 2011)	7
Figure 4-1 Terrestrial biodiversity within the study area (Marrickville LEP 2011)	32
Figure 5-1: Mapped watercourses (Strahler stream order) within the study area.....	50
Figure 5-2: Previously mapped vegetation communities within the study area (OEH, 2016).....	54
Figure 5-3: Validated vegetation communities within the study area (1 of 5) (ELA, 2020)	56
Figure 5-4: Validated vegetation communities within the study area (2 of 5) (ELA, 2020)	57
Figure 5-5: Validated vegetation communities within the study area (3 of 5) (ELA, 2020)	58
Figure 5-6: Validated vegetation communities within the study area (4 of 5) (ELA, 2020)	59
Figure 5-7: Validated vegetation communities within the study area (5 of 5) (ELA, 2020)	60
Figure 5-8: Previously recorded threatened species within the study area	65

Figure 5-9: AHIMS sites in proximity to the study area80
 Figure 5-10: State and locally listed heritage items within the study area.....83
 Figure 6-1: Suburbs where engaged users reside141
 Figure 6-2: Summary of the engagement results.....141
 Figure 6-3: Main themes identified from engagement results142

List of Tables

Table 1-1 Land ownership within the In-Corridor works study area5
 Table 2-1: Summary of proposed access requirements for construction activities18
 Table 2-2: Summary of proposed working hours for construction activities.....19
 Table 3-1: Alternative options considered (Inner West Council, 2020).....23
 Table 4-1 Legislative Context26
 Table 5-1: Geological Landscape of the study area (amended from GHD, 2020).....33
 Table 5-2: Topography and Drainage (from GHD, 2020)34
 Table 5-3: Soil characteristics of the study area (from GHD, 2020).....34
 Table 5-4: On-site groundwater conditions (from GHD, 2020).....35
 Table 5-5: Mitigation measures for soils and landform35
 Table 5-6 Site conditions related to contamination (GHD, 2020 (1))37
 Table 5-7: Area 2 Contamination Risk Discussion (GHD, 2020 (1))40
 Table 5-8: Area 3 Contamination Risk Discussion (GHD, 2020 (1))43
 Table 5-9: Area 4 Contamination Risk Discussion (GHD, 2020 (1))45
 Table 5-10: Mitigation measures for contamination47
 Table 5-11: Mitigation measures for flooding and waterways52
 Table 5-12: Summary of vegetation zones recorded within the study area.....55
 Table 5-13: Threatened Ecological Communities.....61
 Table 5-14: State level determined priority weeds and other weeds of concern present63
 Table 5-15: Results of targeted survey and credit requirements.67
 Table 5-16: Assessment of the vegetation impacted within the study area68
 Table 5-17: Ecosystem credits required for native vegetation impacts69
 Table 5-18: Mitigation measures for biodiversity.....72
 Table 5-19: Summary of retention values and removal percentages.....76
 Table 5-20: Summary of removal percentages of native trees, unhealthy/dead trees and weeds/undesirable species77
 Table 5-21: Mitigation measures for trees.....77
 Table 5-22: Mitigation measures for Aboriginal heritage81
 Table 5-23 Potential impacts to heritage items (from SoHI, ELA 2020).....84
 Table 5-24: Mitigation measures for historic heritage85
 Table 5-25: measured average background and ambient noise levels (Marshall Day Acoustics, 2021) .87
 Table 5-26: Residential Construction NMLs applicable to receivers near compound Sites [CS-01 - CS-07],
 LAeq dB (From Marshall Day Acoustics 2021)88
 Table 5-27: Road Traffic Noise Criteria (from Marshall Day Acoustics 2021)88
 Table 5-28: Vibration limits according to DIN 4150: Peak Particle Velocity mm/s89

Table 5-29: Predicted noise levels during works at Compound Sites [CS-01 – CS-07], LAeq, 15min (dB) (Marshall Day Acoustics 2021)90

Table 5-30: Predicted noise levels during ‘Fencing Works’ [FW], LAeq, 15min (dB)90

Table 5-31: Predicted noise levels during works at each work site, LAeq, 15min (dB).....90

Table 5-32: Summary of potential construction noise impact at receivers near proposed construction sites based on land uses (from Marshall Day Acoustics, 2021)91

Table 5-33: Safe working distance – cosmetic damage (Marshall Day Acoustics, 2021).....92

Table 5-34: Mitigation measures for noise and vibration.....93

Table 5-35: Landscape elements contributing to the overall landscape character of the study area (MODE, 2021).....95

Table 5-36 Overall impacts to landscape character for different landscape zones within the study area.98

Table 5-37: Visual impact of the works resulting from the Project (Mode, 2021)102

Table 5-38: Mitigation measures for visual and landscape112

Table 5-39: Road Classification and indicative AADT traffic volumes (Inner West Council).....113

Table 5-40: Proposed Construction Timeline.....114

Table 5-41: Assumed compound sites for each stage of works.....115

Table 5-42: Construction heavy vehicle trips for project.....116

Table 5-43: Mitigation measures for traffic.....117

Table 5-44: Service locations, details and potential issues (from Concept Design Technical Report, 2020)119

Table 5-45: Mitigation measures for infrastructure122

Table 5-46: Mitigation measures for air quality.....125

Table 5-47: Mitigation measures for waste management.....126

Table 5-48: Mitigation measures for socio-economic considerations.....130

Table 5-49: Mitigation measures for cumulative impacts132

Table 5-50 Consideration of Matters of National Environmental Significance.....133

Table 5-51 Clause 228 Factors.....133

Table 6-1 Infrastructure SEPP consultation requirements.....136

Table 7-1 Recommended mitigation measures for the proposed works145

Abbreviations

Abbreviation	Description
(B(a)P)	benzo(a)pyrene
AADT	Annual Average Daily Traffic
ACM	asbestos containing material
AEP	Average Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AIA	Arborist Impact Assessment
AMDP	Adaptive Microbat Design Plan
AQF	Australian Qualifications Framework
ARI	Average Recurrence Interval
As	Arsenic
ASS	Acid Sulfate Sulphate Soils
BAM	Biodiversity Assessment Method
BC Act	<i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
BGL	Below Ground Level
CAA	Controlled Activity Approval
CBD	Central Business District
CICL	Cast Iron Cement Lined
CICL	Cast Iron Cement Lined
CMMP	Construction Microbat Management Plan
Cu	Copper
DECC	Department of Environment and Climate Change
DGB	Dense Graded Base
EIL	Ecological Investigation Level
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
ESL	Ecological Screening Level
FM Act	<i>Fisheries Management Act 1994</i>
GSW	General Solid Waste
HW	Hazardous Solid Waste
IACA	Institute of Consulting Arborists
Infrastructure SEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>

Abbreviation	Description
IWLR	Inner West Light Rail
KFH	Key Fish Habitat
Koala Habitat Protection SEPP	<i>State Environmental Planning Policy (Koala Habitat Protection) 2019</i>
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
MMP	Microbat Management Plan
NML	Noise Management Levels
NP&W Act	<i>National Parks and Wildlife Act 1974</i>
NRAR	Natural Resources Access Regulator
NSW	New South Wales
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCT	Plant Community Type
REF	Review of Environmental Factors
RL	Reduced Level
RSW	Restricted Solid Waste
SEPP 55	<i>State Environmental Planning Policy 55 – Remediation of Land</i>
SHR	State Heritage Register
SIS	Species Impact Statement
SLRE	Sydney Light Rail Extension
SOHI	Statement of Heritage Impact
SRZ	Structural Root Zone
TCLP	Toxicity characteristic leaching procedure
TEQTEQ	Toxic Equivalency Quotient
TfNSW	Transport for NSW
TPZ	Tree Protection Zone
TRH	total recoverable hydrocarbons
ULE	Useful Life Expectancy
WM Act	<i>Water Management Act 2000</i>
Zn	Zinc

Executive Summary

INTRODUCTION

Eco Logical Australia Pty Ltd (ELA) was engaged by Inner West Council (Council) to prepare a Review of Environmental Factors (REF) for the proposed delivery of the In-corridor Works Package for the GreenWay. The overall objective of the GreenWay is to provide positive impacts for local residents in the area and help to support an active lifestyle for a growing population.

PROJECT OUTLINE

The Cooks to Cove GreenWay is a 5.8 km urban environmental corridor linking the Parramatta River at Iron Cove with the Cooks River at Earlwood. The GreenWay follows the route of the Inner West Light Rail and Hawthorne Canal and features bike paths, foreshore pedestrian pathways, cultural and historical sites, cafes, native bushland areas and a range of parks, playgrounds and sporting facilities.

Generally, the works proposed will consist of:

- Completing the major ‘Missing Links’ in the shared path, which include the ‘Central Links’ between Parramatta Road and Old Canterbury Road, and the ‘Southern Links’ between Old Canterbury Road and the Cooks River
- Creating new public spaces along the light rail corridor, including significant spaces at Lewisham West and Dulwich Hill
- Integrating ecological restoration, public art and community infrastructure within the proposed works.

PROJECT JUSTIFICATION

The *Eastern City District Plan* (Greater Sydney Commission 2018) contains a number of objectives with four main goals in mind. These are to promote infrastructure and collaboration, to increase liveability, to improve productivity and to promote sustainability. The design of the GreenWay is intrinsically linked to these goals, as it will create a sequence of connected open spaces that will provide enhanced open space to growing communities along the light rail.

Our Place Inner West – Local Strategic Planning Statement (Inner West Council, 2020) sets out the vision for the area in 2036 and the actions that will be taken to achieve this vision. The GreenWay is recognised as a key regional active transport route, which is currently disjointed and incomplete, resulting in low usage rates. Therefore, the creation of a continuous pathway will aid in achieving the strategic sustainable transport objectives within the Local Government Area (LGA).

The *Eastern City District Plan* also recognises that trees and other layers of vegetation are important urban assets, providing many economic, environmental and social benefits and have therefore set out a target of 40% tree canopy cover for each LGA. The Inner West LGA currently consists of approximately 16% tree canopy cover. The GreenWay is therefore vital in helping to achieve this target through protecting the LGAs biodiversity, liveability and resilience.

The GreenWay is also a priority blue/green link within the Inner West LGA, which will create a network of vital connections across the landscape and provide numerous benefits such as an increase in recreational open space area, expanding the urban forest, reducing urban heat and providing shade.

STATUTORY CONTEXT

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of proposals. The proposal comprises of the construction of fences, tunnels, bridges and pedestrian and cycleway facilities to form the GreenWay corridor. These works fall under the definition in Clause 1.5.1(d) of the EP&A Act and further categorised under Clause 1.5.3(c) of the Act as ‘*development that is an activity requiring environmental assessment under Division 5.1 before it is carried out by a public authority or before a public authority gives approval for the carrying out of the activity*’.

In this case, as detailed above, one environmental planning instrument, namely the *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP), addresses the type of work proposed and it is agreed that this type of development may be carried out without the need for development consent.

Clause 79(1) of the Infrastructure SEPP states that development for the purpose of a railway or rail infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land. Rail infrastructure facilities are defined in Clause 78 of the Infrastructure SEPP and include:

railway tracks, associated track structures, cuttings, drainage systems, fences, tunnels, ventilation shafts, emergency accessways, bridges, embankments, level crossings and roads, pedestrian and cycleway facilities

Part 5 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by or on behalf of public authorities that are permissible without development consent.

It is therefore concluded that Part 5 is the appropriate approval pathway.

ENVIRONMENTAL ASSESSMENT

Landform, Geology Soils and Geotechnical Considerations

A Geotechnical and Contamination Report was prepared by GHD (2020), which involved a targeted field and laboratory-testing program and extended from October 2019 to January 2020. Construction of the proposal will involve disturbing the ground surface and subsurface. The potential impacts include erosion of soils and stockpiled materials, dust generation and increased sediment loads in waterways. However, these impacts are considered to be minimal, temporary and short term. Impacts on adjoining properties and structures will also be minimised through implementation of strict mitigation measures in line with the Geotechnical Report.

Contamination

Some areas across the GreenWay are considered to be environmentally sensitive, including the Cadigal Reserve and bushcare sites along the study area. For the Cadigal Reserve, there is a risk of exposure to ecological receptors where heavy metals and other analyte exceedances are found. However, a dust control plan written alongside the Construction Environmental Management Plan (CEMP) will likely be sufficient for control of these risks.

Asbestos Management Reports were also written by CONSARA in 2016 for the remediation of asbestos in four bushcare sites along the Inner West Light Rail Extension Corridor. Specific measures will be

adopted to ensure that asbestos is managed in a way that will not result in environmental harm. Dust suppression measures will also be strongly considered through delivery of the works package.

Flooding, Waterways and Aquatic Habitat

Two alternative structures were put forward for the shared path crossing of the open channel on Parramatta Road, with slight differences to changes in flood regimes being provided by each. These options were referred to as option 1 and 2 and included the construction of piers and construction of a suspended cantilever structure, respectively. The suspended cantilever structure was deemed as the more viable of the two options, as minor flood level reductions are greater when compared to the impacts that the piers would have on flood regimes.

Minor stormwater drainage works are proposed at the bottom of Terry Road, Dulwich Hill to ameliorate flooding in this location. Minor improvements to the stormwater channel are also proposed in the light rail corridor behind Hercules Street, Dulwich Hill, to ameliorate flooding. This is likely to reduce flooding in small storm events but will have negligible effect in larger storm events due to the constraints in the downstream storm water system.

The proposed design has been optimized to ensure that flooding outcomes have been improved and impacts to waterways and fish habitat will be minimised and avoided where possible in line with the recommendation of WMA Water (2020).

Biodiversity

A Flora and Fauna Assessment was also undertaken by ELA (2021) to provide an assessment of the works on biodiversity values within the study area. It concluded that the proposed works may result in a significant impact upon the lifecycle of *Miniopterus orianae oceanensis* (Large Bent-winged Bat). Construction of the pedestrian pathway will be located within 10 - 15 m of the entrance to a known roost site for this species, which may lead to abandonment of the roost due to impacts from lighting, noise, restriction to flight path and increased exposure to predators and other stressors. As the number of known roost sites for this species has declined over the last 40 years, and populations have decreased, the abandonment of this roost will likely lead to a significant increase in pressure on remaining roosts within the Sydney Area which may be unsustainable for the local population over the medium to long term. Therefore, in accordance with Section 7.8(3) of the *Biodiversity Conservation Act 2013* (BC Act), the preparation of a Biodiversity Development Assessment Report (BDAR) has been undertaken to further assess potential impacts to the Large Bent-winged Bat.

The BDAR concluded that ecosystem credits are required for the removal of native vegetation within the proposed works area (refer to the table below).

Ecosystem Credits Required

Veg zone	PCT ID	PCT name	Trading Group			Direct impacts (ha)	Credits required
1	1232	Coastal Forest	Freshwater	Swamp	Coastal Swamp Forests ≥ 90% cleared group (including Tier 1 or higher threat status)	0.04	1

Veg zone	PCT ID	PCT name	Trading Group	Direct impacts (ha)	Credits required
2	1281	Sydney Turpentine-Ironbark Forest	Northern Hinterland Wet Sclerophyll Forests ≥ cleared group (including Tier 1 or higher threat status)	0.23	8

No threatened flora species were recorded within the study area or were considered likely to occur based on literature review, field habitat assessment and targeted surveys.

Three threatened fauna species were recorded during initial field surveys:

- *Miniopterus australis* (Little Bent-winged Bat) – listed as vulnerable under the BC Act
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat) – listed as vulnerable under the BC Act
- *Pteropus poliocephalus* (Grey-headed Flying-fox) – listed as vulnerable under the BC Act and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Additional targeted surveys were conducted for two species credit species, Little Bent-winged Bat and Large Bent-winged Bat, to determine if breeding habitat occurs within the study area. Both of these species are listed as species credit species for breeding habitat only. Breeding habitat is defined within the ‘Species credit’ threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (OEH 2018) as sites where female bats give birth and form nursery colonies. The results from visual inspections and emergence surveys of the microbat roosting habitat present on site and ultrasonic recording of microbat calls indicate that neither species is using the microbat roosting habitat as maternity roosting habitat (breeding habitat) within the proposed works area. Both species are utilising the site as foraging habitat and the Large Bent-winged Bat is using the site as winter roosting habitat. Therefore, no breeding habitat was recorded for these species and no species credit species were generated for the proposed works.

In accordance with Section 8.3 of the BAM 2020, the assessor must take into consideration Prescribed Impacts which includes human-made structures such as culverts and bridges. The threatened Large Bent-winged Bat is known to use a human-made structure within the development site as winter-roosting habitat. The threatened Little Bent-winged Bat was recorded foraging on site and there is potential for this species to use human made structures on site as winter roosting habitat. Human made structures within the development site which provide microbat roosting habitat have been assessed as part of Prescribed Impacts. To address prescribed impacts, an adaptive microbat design plan and microbat management plan which will follow a similar methodology to an Adaptive Management Plan as specified in Section 8.5 of the BAM 2020, will be implemented. These plans will include details the of baseline studies required, mitigation and monitoring measures to be applied prior to and during the construction / operational phases of the proposed development and any additional conservation measures to minimise impacts and benefit these species. The retirement of credits for Prescribed Impacts on artificial structures has not been proposed.

One Matters of National Environmental Significance (MNES) has potential to be affected by the proposed works, being Grey-headed Flying-Fox. An assessment of the Commonwealth Significant

Impact Criteria under the EPBC Act was undertaken for this entity and concluded the works are unlikely to have a significant impact on MNES.

Arboriculture

An Arboricultural Impact Assessment (AIA) was prepared by ELA (2021) which included a visual assessment of 372 trees. An additional number of trees were previously assessed by Council in 2018 and Birds Tree Consulting in 2019. They assessed 59 and 303 trees respectively. ELA's report also included the results from these previous assessments in order to assess the impacts of the proposed works to trees within the study area.

The AIA indicated that a total of 232 trees are proposed for removal, which is equivalent to approximately 31% of the total tree present within the study area. An additional 106 trees are proposed to be retained if possible. Such trees may be potentially impacted by minor works such as the construction of the on-grade path and lighting. The remaining 396 trees will be retained, which is equivalent to approximately 54% of the total trees present within the study area.

Where possible, trees were retained based off level of encroachment, assessment of tree health and determination of tree species. Significant landscaping works will also be undertaken to ensure that trees are replaced with native species where possible.

Aboriginal Heritage

An assessment of Aboriginal heritage was undertaken in accordance with the due diligence Code of Practice as set out in the Office of Environment and Heritage's *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010). No recorded Aboriginal sites or objects or areas with archaeological potential were identified within the study area. Therefore, no further assessment, in the form of an Aboriginal Cultural Heritage Assessment (ACHA), is recommended.

Historic Heritage

A Statement of Heritage Impact (SoHI) for a number of heritage items located in or near the study area was undertaken. The assessment determined that the proposed works would result in negligible impacts to the heritage significance of listed items within the study area.

Noise and Vibration

There is potential for noise impacts along most of the corridor that will need to be managed during construction. Based on the high-level construction noise impact assessment undertaken as part of the Noise and Vibration Impact Assessment (NVIA) by Marshall Day Acoustics (2021), it is unlikely that the project will generate traffic noise on local roads greater than 2dB above the existing traffic noise during the Daytime period and is not anticipated to generate significant traffic noise impacts as a result of daytime works. However, a detailed traffic noise impact assessment will be required later to be prepared in the detailed design phase once detailed construction traffic assessment is available.

Since some construction works would be required during the Night-time period, potential sleep disturbance is required to be assessed regarding the construction traffic associated with the project. For

residential receivers, the screening level of 46 dB LA1(60 sec) is expected to be exceeded, and sleep awakening is probable pending further assessment.

Additionally, based on the assumed plant and equipment summarised the NVIA report, the use of some vibration intensive activities may potentially exceed the applicable human comfort guidelines. However, a number of mitigation measures have been recommended to ensure that these potential impacts are minimised.

Landscape and Visual Amenity

A Landscape and Visual Impact Assessment (LVIA) was undertaken by MODE (2021), which concluded that the proposed works will infer varying levels of impact on the visual and landscape character of the study area, depending on the sensitivity of individual locations near the works and their sensitivity to change. The highest expected visual impacts are predominantly felt by residential buildings, where there is minimal vegetation screening to the proposed GreenWay. Minimising the amount of vegetation removal and ensuring that replanting works are undertaken will reduce the potential visual impacts on sensitive receivers in and near the study area.

Traffic and Transport

Construction traffic would likely access the compounds and works areas within the Central Links works area from Grovesnor Crescent, Malthouse Way, Old Canterbury Road and Hudson Street. For the Southern Links works areas and compounds, construction traffic will likely access the compounds and works area from Weston Street, Davis Street, Terry Road, Constitution Road, New Canterbury Road and Hercules Street.

It has been assumed that the construction works for the GreenWay will require approximately:

- 970m³ or 2,330 T of concrete
- 1,450 m³ or 1,880 T of soil/aggregate
- 290 T of steel
- Removal of 2,260 m³ of spoil or 2,940 T.

It is assumed that a 10 T truck will be utilised for haulage, the amount of heavy vehicle trips required for the project is assumed to be 5.2 per day.

It is recommended that a Traffic Management Plan be implemented prior to the commencement of any construction works. Appropriate signage should be erected to notify commuters of detours and road closures, and consultation with the relevant road authority (including Council and Transport for NSW for proposed road closures on Parramatta Road, Old Canterbury Road and New Canterbury Road) should be undertaken to develop this Traffic Management Plan.

Infrastructure

Council Developed a Draft Operational Management Plan in June 2020, which describes, at a high level, the proposed operational management for the GreenWay which will come into effect between 2021 and 2023. Land within the GreenWay corridor is owned and managed by a number of government agencies. Assets of respective agencies would continue to be managed by the respective agencies.

In most cases, it is likely that service conflicts can be avoided, however buried services will need to be located to confirm locations and depths so that detailed design can work around existing infrastructure. At Parramatta Road relocation of one water main, modification of another water main and modification of a gas main will be required. Modifications to the Hawthorne Canal will also be required north and south of Parramatta Road. Consultation with the relevant asset owners is currently being undertaken where services are potentially at risk of being impacted by excavation works associated with the GreenWay. Outcomes of this consultation will be included within the detailed design of the proposed works.

Air Quality

The works area is located within areas that are primarily utilised for residential activities. Existing air quality is considered to be typical of a Sydney suburban area. Potentially affected receivers near the project include residential properties, childcare centres, aged care facilities and schools. A number of residences and businesses are located in close proximity to the study area.

Anticipated sources of dust and dust-generating activities from the project include:

- Operation of bulldozers, scrapers, graders, loaders and excavators across the entire project area
- Dust loading and transfers from aggregate material on trucks, loaders and excavators
- Emissions of dust from the movement of vehicles on unsealed roads
- Wind erosion from exposed surfaces at disturbed areas.

Where earthworks are proposed, and within project compound areas, a number of dust suppression methods will be required to ensure that the potential for dust generation is mitigated and negative impacts to sensitive receivers located within 100 m of the proposed works are minimised. These methods include utilising fencing with shade cloth, wetting down of stockpiled material, staging excavation works and water cart rotations or the application of misting systems.

Waste Management

The project has the potential to utilise a range of different resources and generate a number of different types of waste throughout its construction and operational phases. The construction of the project would require the use of resources such as electricity, water, fuel, concrete and paving materials. Other resources would be required for infrastructure such as signage, landscaping and retaining walls.

Waste may be generated from excess spoil from earthworks, vegetation clearing, drainage works, demolition, equipment maintenance, road infrastructure upgrades, waste concrete, wood and metal, materials packaging and as general waste from staff and contractors.

Any excess spoil from earthworks is proposed to be classified in accordance with Waste Classification guidelines (EPA, 2014) and disposed of at an appropriately licenced waste facility. No waste is to be imported into the site.

Hazardous waste arising from the construction phase of the project would also be removed and disposed of in accordance with the relevant guidelines, including the DECCW Environmental Guidelines:

Assessment, Classification and Management of Liquid and Nonliquid Wastes (Environment Protection Authority 1999).

Socio-Economic

The GreenWay will ultimately provide a number of socioeconomic impacts within the local area, these will primarily be positive in the longer term, but may have some small short-term negative impacts including decrease in trade/demand for services due to noise, vibration, access and visual amenity, congestion and road closures.

In the longer term, major public investment would benefit private production and the economy, the visual amenity of the area would be improved, and the GreenWay will encourage healthy lifestyle choices for the growing local community.

Cumulative Impacts

The projects likely to present the largest cumulative impact in conjunction with the GreenWay In-Corridor Works are those associated with the Sydenham to Bankstown Metro Project. It is unlikely that the construction timeline of the GreenWay will match any major projects in the area, however there is potential for cumulative impacts on residents exposed to longer periods of construction.

Works in Hercules street should consider staging of works in consultation with the Metro project team to limit any cumulative impact.

Stakeholder Consultation

Extensive community engagement informed the development of the Greenway Master Plan. During October and November 2017 Council undertook community engagement with residents and stakeholders across the Inner West area.

Overall, the community response to the project was overwhelmingly positive, with the community supporting the draft plans for the GreenWay or supporting it with proposed changes. Following several rounds of consultation in regard to draft concept plans and consultation within Council, a revised concept for the GreenWay was finalised in July 2020, which included local changes around Longport Street to reduce potential impacts on the Large Bent-wing Bat colony, reduce impacts on water infrastructure and improve constructability.

The REF was put on public exhibition from 15 February to 15 March 2021 and sent to relevant agencies and community groups. Thirty-four (34) responses were received on the Draft REF, including three (3) responses received after the close of the public exhibition. All responses, including late responses, were considered. No significant changes to the REF or concept plans were warranted.

Conclusion

Overall, the identified potential environmental impacts associated with the proposed works can be adequately managed provided the design recommendations and mitigation measures outlined within this REF are adhered to.

1. Introduction

1.1 Project Description and Background

1.1.1 The Cooks to Cove GreenWay

The Cooks to Cove GreenWay ('the GreenWay') is a 5.8 km urban environmental corridor linking the Parramatta River at Iron Cove with the Cooks River at Earlwood. The GreenWay follows the route of the Inner West Light Rail and Hawthorne Canal and features bike paths, foreshore pedestrian pathways, cultural and historical sites, cafes, native bushland areas and a range of parks, playgrounds and sporting facilities.

The Cooks to Cove GreenWay has regional significance as a recreational and active transport route, an ecological corridor and a place of cultural significance. A Masterplan was adopted by Inner West Council (herein referred to as 'Council') on 14 August 2018. The Masterplan includes works that have been organised into six precincts along the GreenWay, and aims to achieve the following four main outcomes:

- A connected ecological corridor, supporting diverse locally native species and links to the surrounding neighbourhoods
- A connected active transport corridor, with a main spine between the Cooks River and Iron Cove, and links into the surrounding neighbourhood
- Diverse recreation opportunities, including the opportunity to connect with nature
- An engaging cultural experience, which integrates public art and facilitates education and engagement with local stories.

The highest priority works have current funding available and are focussed on:

- Completing the major 'Missing Links' in the shared path, which include the 'Central Links' between Parramatta Road and Old Canterbury Road, and the 'Southern Links' between Old Canterbury Road and the Cooks River
- Creating the new public spaces along the light rail corridor, including significant spaces at Lewisham West and Dulwich Hill
- Integrating ecological restoration, public art and community infrastructure with proposed works.

A number of additional works are proposed, which involve:

- Improved path connections across roads throughout the corridor, including grade-separated crossings where possible, and improved at grade crossings elsewhere
- A major upgrade of the Hawthorne Canal Parks, including Richard Murden and Hawthorne Reserves.
- Major Renewal in the precinct where the GreenWay meets the Cooks River – with plans for this area to be integrated with planning also underway for the Marrickville Golf Course and Ewen Park.

1.1.2 The In-Corridor Works Package

The In-corridor Works package considers the construction of a shared path, lighting and landscaping within the Inner West Light Rail Corridor and adjacent land. The In-Corridor Package consists of two discrete areas known as the Central Links and the Southern Links, with the central extending from north of Parramatta Road to the south of Old Canterbury Road while the southern extends from Weston Street to Hercules Street.

Concurrent with development of the Masterplan, Council prepared detailed designs and in 2018 submitted a Development Application (DA) for the GreenWay Central Links Shared Path, however due to potential impacts on microbat species as well as impacts on water infrastructure and constructability identified during the assessment process, the DA was withdrawn.

An updated concept design for the GreenWay was completed in June 2020 to mitigate these potential issues. The updated concept realigned the path through Cadigal Reserve and Lewisham West. Minor amendments were also made in the Hercules Street Parklands based on water infrastructure. For consistency the Masterplan was also updated at the same time.

1.2 Project Location and Context

The GreenWay travels through the suburbs of Earlwood, Dulwich Hill, Lewisham, Summer Hill, Haberfield and Leichhardt and traverses the Inner West Local Government Area (LGA) into Canterbury-Bankstown. The corridor is intersected by several major arterial roads, including New Canterbury Road, Old Canterbury Road, Parramatta Road and the City West Link.

The Central Links extends from north of Parramatta Road to south of Old Canterbury Road while the Southern Links extends from Weston Street to Hercules Street (Figure 1-1).

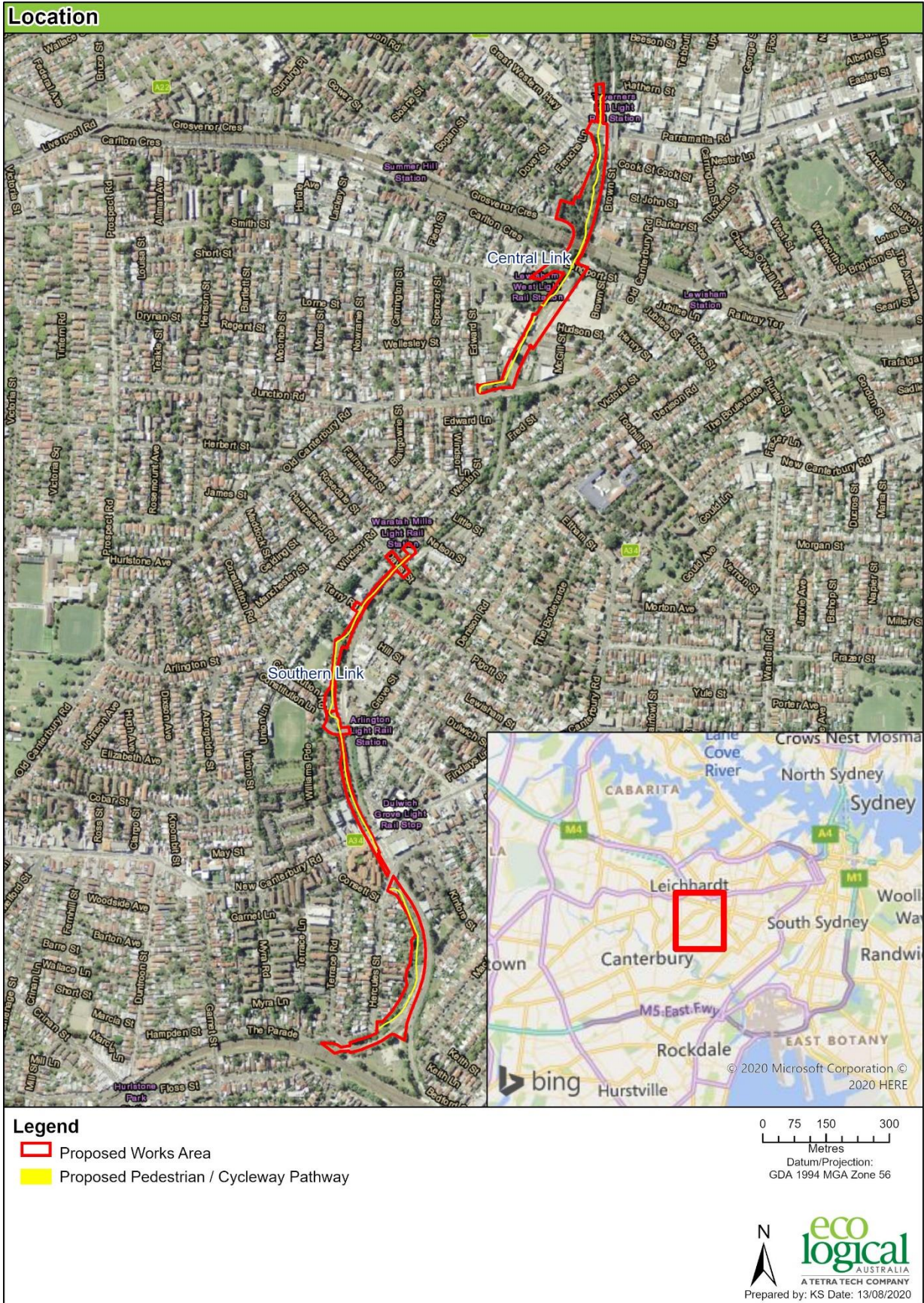


Figure 1-1: Location of In-Corridor Works study area

1.3 Land Use and Ownership

1.3.1 Land Use

The majority of the project area is zoned under the Marrickville Local Environmental Plan (LEP) 2011. Within this LEP, the study area crosses several zoning types. These zones, and their associated objectives are:

SP2: Infrastructure

- *To provide for infrastructure and related uses.*
- *To prevent development that is not compatible with or that may detract from the provision of infrastructure.*
- *To protect and provide for land used for community purposes*

B4: Mixed Use

- *To provide a mixture of compatible land uses.*
- *To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling.*
- *To support the renewal of specific areas by providing for a broad range of services and employment uses in development which display good design.*
- *To promote commercial uses by limiting housing.*
- *To enable a purpose built dwelling house to be used in certain circumstances as a dwelling house.*
- *To constrain parking and restrict car use.*

RE1: Public Recreation

- *To enable land to be used for public open space or recreational purposes.*
- *To provide a range of recreational settings and activities and compatible land uses.*
- *To protect and enhance the natural environment for recreational purposes.*
- *To provide for a range of community facilities, services and compatible land uses.*

IN2: Light Industrial

- *To provide a wide range of light industrial, warehouse and related land uses.*
- *To encourage employment opportunities and to support the viability of centres.*
- *To minimise any adverse effect of industry on other land uses.*
- *To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area.*
- *To support and protect industrial land for industrial uses.*
- *To provide business and office premises for the purposes of certain art, technology, production and design sectors.*
- *To enable a purpose-built dwelling house to be used in certain circumstances as a dwelling house.*

R1: General Residential

- *To provide for the housing needs of the community.*
- *To provide for a variety of housing types and densities.*

- To enable other land uses that provide facilities or services to meet the day to day needs of residents.
- To provide for retail premises in existing buildings designed and constructed for commercial purposes.
- To provide for office premises in existing buildings designed and constructed for commercial purposes or as part of the conversion of existing industrial or warehouse buildings.

However, small sections of the project area are covered under the Leichardt LEP 2013 and Ashfield LEP 2013. This zoning is further explained in Section 4.

1.3.2 Ownership

Land within the In-Corridor Works area is owned and managed by a number of government agencies, including Council, Sydney Water and Railcorp NSW.

Table 1-1 Land ownership within the In-Corridor works study area

Lot / DP	Land Zoning	Ownership
1//DP1003675	Infrastructure - SP2	Rail Corporation New South Wales
1//DP1065311 1//DP1065311	Infrastructure - SP2	State Rail Authority of New South Wales
1//DP1140417	Public Recreation - RE1 Enterprise Corridor - B6	Sydney Water Corporation
1//DP117359	Public Recreation - RE1	Inner West Council
1//DP185291	Low Density Residential - R2	Private ¹
1//DP962909	Public Recreation - RE1	Sydney Water Corporation
18//DP1223949	General Residential - R1 Public Recreation - RE1 Infrastructure - SP2 Low Density Residential - R2	Rail Corporation NSW
19//DP1220375	High Density Residential - R4 Light Industrial - IN2 Infrastructure - SP2 Public Recreation - RE1 Natural Waterways - W1	Rail Corporation NSW
2//DP117359	Public Recreation - RE1	Inner West Council

¹ Inner West Council in process of acquiring.

Lot / DP	Land Zoning	Ownership
2//DP962909	Public Recreation - RE1	Sydney Water Corporation
20//DP1217284	Infrastructure - SP2 Public Recreation - RE1	Rail Corporation NSW
20//DP658151	Public Recreation - RE1	Inner West Council
24//DP4182	Public Recreation - RE1	Inner West Council
292//DP1093021	Low Density Residential - R2	Private ¹
555//DP1221573	Infrastructure - SP2 Public Recreation - RE1 Low Density Residential - R2 Natural Waterways - W1	Rail Corporation NSW
A//DP322679	Public Recreation - RE1	Sydney Water Corporation
A//DP323197	Public Recreation - RE1	Cadigal Reserve Sydney Water Corporation
A//DP341485	Public Recreation - RE1	Inner West Council
B//DP323197	Public Recreation - RE1	Cadigal Reserve Inner West Council
B//DP341485	Public Recreation - RE1	Inner West Council
C//DP944563	Public Recreation - RE1	Inner West Council
D//DP944563	Infrastructure - SP2	Inner West Council

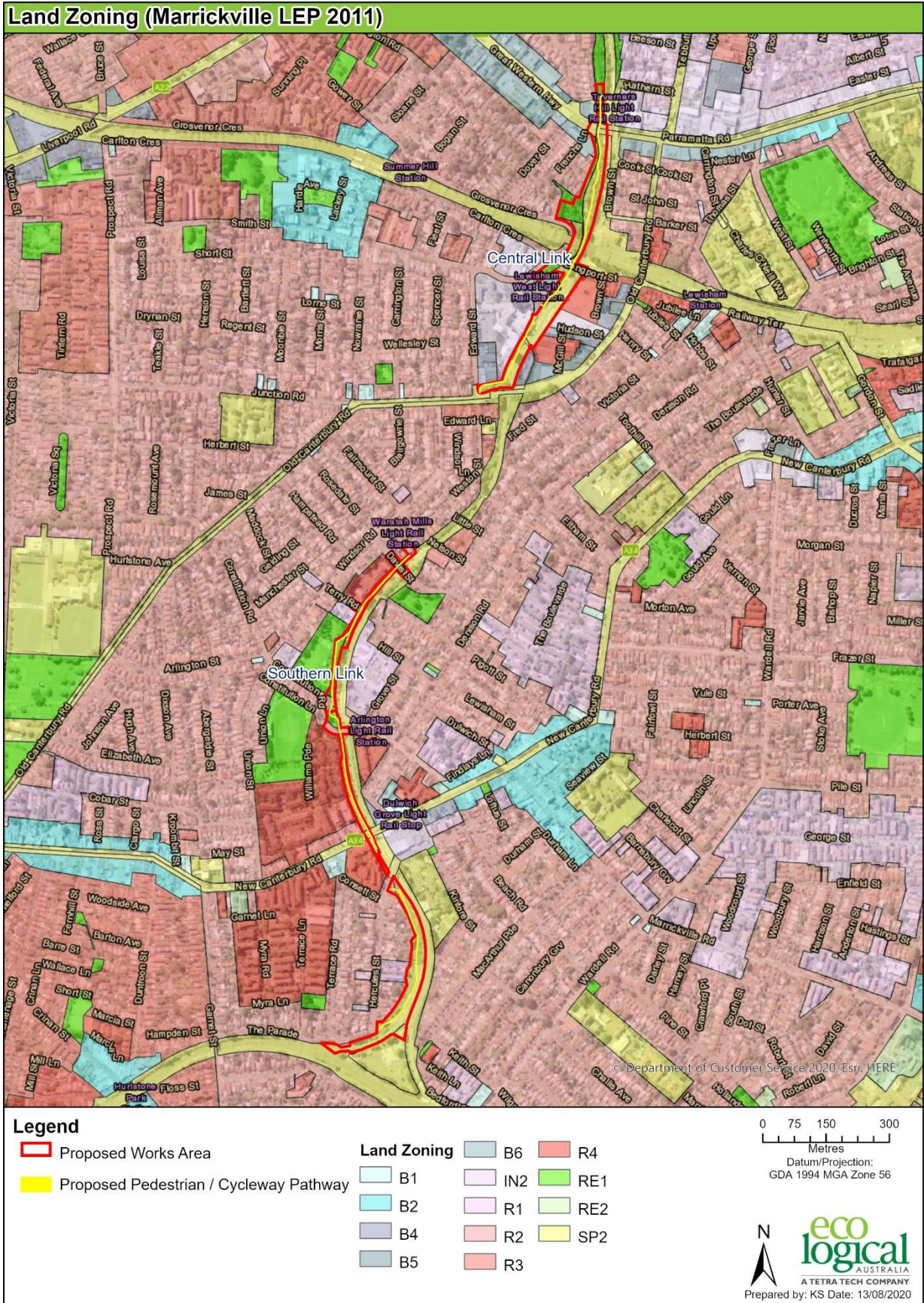


Figure 1-2: Land zoning within the In-Corridor Works study area (Marrickville LEP 2011)

2. The Project

2.1 Scope of Works

A summary of the proposed scope of works is provided below. Detailed concept designs can be found in Appendix A.

Note that between the Southern and Central Links are sections along local roads being delivered by Council under a separate approval, and a new set of traffic signals at Edward Street and Old Canterbury Road being delivered by others. In addition, realignment of a high voltage electricity feeder within the light rail corridor is being delivered by Council under a separate approval. These works are all outside the scope of this Review of Environmental Factors (REF).

The Project is intended to be delivered under a Design and Construct contract arrangement. As such the final design and geometry of the works may differ. This REF has therefore assessed a study area likely larger than what will be utilised, as a worse-case scenario.

2.1.1 Central Links

The Central Links works will include the construction of the following:

- An elevated path, north of Parramatta Road, cantilevered over the Hawthorne Canal (owned by Sydney Water) on the eastern side, with footings integral with the Canal wall
- A suspended path under Parramatta Road (a state road managed by Transport for NSW) over the Hawthorne Canal, suspended from beams supported from the road bridge abutments
- An elevated path, south of Parramatta Road, cantilevered over the Hawthorne Canal on the eastern side, with footings integral with the Canal wall
- Realignment of a length of a 500 mm water main and modification to another existing water main, plus sewer and disused gas main near and under Parramatta Road
- Stairs linking from the GreenWay path to the southern side of Parramatta Road and Light Rail lift east of the Canal
- An on-grade path on the eastern side of the Hawthorne Canal (on land owned by Rail Corp NSW currently under control of Council), within Cadigal Reserve
- Channel access ramp and bridge construction in Cadigal Reserve to facilitate construction and maintenance
- Ecological restoration, a rest/nature play area on the eastern side and a separate observation area on the western side of Cadigal Reserve
- An elevated path under the main western rail line and whipple truss (on land owned by Rail Corp NSW)
- A jacked box culvert tunnel under Longport Street (a regional road managed by Council)
- A path through the light rail corridor (owned by Rail Corp NSW and operated by Transdev) west of the light rail tracks from Longport Street to Old Canterbury Road, connecting to the Summer Hill Flour Mills near Lewisham West light rail, and inclusive of rest areas
- Dog off leash area on the eastern side of the light rail tracks and north of Lewisham West Light Rail Stop
- A wetland on the eastern side of the light rail tracks and south of Lewisham West Light Rail Stop

- A path linking from the light rail corridor to Old Canterbury Road in the road reserve on the northern side of Old Canterbury Road
- Lighting and electrical work for all sections, including ecological sensitive lighting in Cadigal Reserve
- Associated fencing, landscaping, ecological restoration, signage and ancillary works.

2.1.2 Southern Links

The Southern Links works will include the construction of the following:

- A cut and cover tunnel (or jacked culvert) under Davis Street
- A low-level boardwalk from Davis Street to Jack Shanahan Reserve, inclusive of stormwater drainage works near Terry Road
- Upgrade of the path through Jack Shanahan Reserve including modification to the existing playground and surrounds
- A cut and cover tunnel (or jacked culvert) under Constitution Road, including retaining walls on the northern approach and a secant pile wall on southern approach, in close proximity to private property
- Protection and/or diversion of existing water and gas mains in Constitution Road during tunnel construction
- An elevated path from south of Constitution Road to south of New Canterbury Road, including through the back span under the New Canterbury Road bridge and connecting to the existing path south of New Canterbury Road
- A new on-grade path from Hercules Street near Consett Street to Jack Shanahan Reserve and Hercules Street near Terrace Road
- Creation of new parklands and ecological restoration area Hercules Street near Consett Street to Jack Shanahan Reserve and Hercules Street near Terrace Road, including earthworks and stormwater drainage improvements
- Lighting and electrical work for all sections, including ecological sensitive lighting in Cadigal Reserve
- Associated fencing, landscaping, ecological restoration, signage and ancillary works.

2.2 Detailed Scope of Works and Preliminary Construction Methodology

This section provides one possible construction method and is used as a guide to assess the impacts of the works. The actual construction methods and timing will be determined by the Contractor.

2.2.1 Site Compounds and Construction Access

Site compounds would be established prior to the commencement of site works at multiple locations and would be retained in place for parts of or throughout the works period.

2.2.1.1 Central Links

Site compounds for the Central Links would likely be established:

- within the light rail corridor at Lewisham West (both sides)
- the carpark in Cadigal Reserve
- on the western side of Cadigal Reserve in the existing dog off leash area.

A further site compound may be required in private property either north or south of Parramatta Road if available.

Construction traffic would likely access the compounds and works areas from Grovesnor Crescent, Malthouse Way (a private road with a public access easement), Old Canterbury Road and Hudson Street.

2.2.1.2 Southern Links

Site compounds for the Southern Links would likely be established:

- at the southern end of Weston Street and in the roadway on Davis Street
- in the southern part of Johnson Park and in the roadway on Constitution Road and/or Williams Parade
- within the light rail corridor between Constitution Road and New Canterbury Road
- within the light rail corridor behind Hercules Street.

Construction traffic would likely access the compounds and works areas from Weston and Davis Streets, Terry Road, Constitution Road, New Canterbury Road and Hercules Street.

2.2.2 Fencing

Prior to commencement of civil works, permanent fencing of the 'active' light rail corridor within the dedicated corridor would be installed between Longport Street and Old Canterbury Road on both sides of the light rail tracks, and between Constitution Road and New Canterbury Road on the western side to form a 'non active' corridor.

The type and alignment of the fencing would be agreed in consultation with Transport for NSW, but would seek to utilise a 1.8 m black PVC coated chain wire fence as standard and/or mid-level fencing as per fences installed along the Central Business District (CBD) and South East Light Rail adjacent to Moore Park and Centennial Parklands. Fencing would typically be located 3 to 4 m from the centre of the tracks.

Fencing would be installed using small hand operated plant. These works could largely be undertaken during the day with track occupations, although some works may require night-time works and/or track possessions.

2.2.3 Cadigal Reserve Preliminary Works

Works would be undertaken to facilitate access through Cadigal Reserve for the construction of Parramatta Road southern approach and Longport Street northern approach. Cadigal Reserve would be closed, and diversions put in place. Preliminary works within Cadigal Reserve would include:

- Construction of a new concrete bridge over the Hawthorne Canal north of the existing pedestrian bridge. An excavator or drill rig would bore piles either side of the Canal, formwork and reinforcement placed, and concrete pumped using a ground line pump from the Cadigal Reserve Carpark
- Excavation on the eastern side of the Hawthorne Canal with an excavator to create a vehicle access into the Hawthorne Canal, including concrete sawing and breaking out a length of the Hawthorne Canal. This vehicle access would later be 'naturalised' and retained for maintenance access
- Installation of low temporary weirs and a low flow pipe in the channel to stop low flows from upstream and tidal back watering from downstream
- Installation of trackmats along the Canal to protect the base
- Demolition of the existing pedestrian bridge.

Small plant would be lifted by franna crane in/out of the Hawthorne Canal from Haig Avenue as required. It is anticipated these works could be undertaken during the day.

2.2.4 Parramatta Road under Bridge and Approaches

It is likely that the suspended, cantilevered pathway north and south of Parramatta Road will be constructed from bored concrete pile foundations with a steel and/or aluminium and/or fibre composite superstructure. Other construction methods and materials may be used. To construct this section of the pathway, the following is proposed:

- Installation of a temporary pumped diversion of the sewer just south of Parramatta Road
- Cutting out of short segments of the channel wall and floor on the eastern side at approximately 5 m intervals, using a concrete saw. An excavator would work from within the channel in the north of Cadigal Reserve and north of Parramatta Road to break out the concrete and then excavate bored piles to support the cantilevered path
- Removal of spoil by a mini site dumper and stockpiled in Cadigal Reserve carpark
- Clearing and grubbing either side of the Canal close to Parramatta Road by an excavator to facilitate stair construction and water main diversion
- Construction of footings for stairs to Parramatta Road by an excavator. Concrete for footings and retaining wall would be pumped from Parramatta Road near Frenches Lane with a boom pump
- Diversion of 500 mm watermain. Concrete for footings and retaining wall would be pumped using a boom pump from Parramatta Road near Frenches Lane
- Formation of the piles and piers integrally with the channel wall and floor and poured to support the cantilevered path. Concrete would be pumped from Haig Avenue, or Parramatta Road near Frenches Lane, or Parramatta Road using a boom pump. A ground line pump may be needed in some areas. Where pumped from Parramatta Road this may require part closure of Parramatta Road

- Modifications to the 375 mm water main and 900 mm disused gas main below Parramatta Road bridge from within the Canal
- Installation of support beams for suspended walkway below Parramatta Road bridge from within the Canal using a beam lifter and/or scissor lift
- The suspended path segments are anticipated to be prefabricated and transported to site. The sections would likely be craned into the Canal from either Haig Avenue or Parramatta Road, traversed along the Canal, and sequentially lifted and fixed to the pier supports. Where craned from Parramatta Road this may require part closure of Parramatta Road and night works.

2.2.5 Longport Street Northern Approach

It is likely that the elevated path north of Longport Street will be constructed from bored concrete pile foundations with a steel and/or aluminium and/or fibre composite superstructure. Other construction methods and materials may be used. To construct this section of the pathway, the following is proposed:

- Clearing and grubbing of the area
- Excavation for the piles of the elevated pathway, using an excavator with access from Cadigal Reserve. The piles and piers would then be formed and poured using a ground pump line from Cadigal Reserve Carpark
- Due to the constraints of existing rail bridges and whipple truss overhead, the elevated path superstructure will likely be required to be constructed using a cantilevered method north to south from Cadigal Reserve
- Installation of decking, balustrades and lighting poles and luminaires onto the super structure in a similar fashion.

It is anticipated these works could be undertaken during the day with possible track occupations.

2.2.6 Cadigal Reserve Path

Path works through Cadigal Reserve would largely be earthworks, on-grade concrete paths, stormwater works and associated hard and soft landscaping and lighting and will include the following:

- Access for plant such as earthmoving equipment and trucks would typically be through Cadigal Reserve from Grovesnor Street
- Clearing and grubbing of the site
- Installation of lighting conduit and pole footings along the proposed path alignment
- Construction of the shared path would take place typically in a north to south. The path subgrade would be compacted and then the base would be brought in and compacted and then sections of path would be formed up and poured. Concrete would be pumped from Haig Avenue using a boom pump or from Cadigal Reserve carpark using a ground line pump
- Installation of a switchboard as required likely near Cadigal Reserve carpark and conduits and cabling installed to feed path lighting from north of Parramatta Road, through Longport Street tunnel to north of the Lewisham West Light Rail Stop
- The lighting poles and luminaires would be fitted and connected to the Cadigal Reserve switchboard
- The existing asphalt path on the western side would be milled out and the new informal path laid

- Following completion of all path and lighting works, soil and mulch would be trucked or blown in as required to enabling landscaping of Cadigal Reserve.

It is anticipated these works could be undertaken during the day.

2.2.7 Longport Street Jacked Box Culvert Tunnel

It is likely a jacked box culvert tunnel method would be used to construct the tunnel below Longport Street, although a canopy tube tunnel may also be considered. To construct this section of the pathway, the following is proposed:

- Longport Street would remain open for the majority of the works. Partial closure of Longport Street will be required to facilitate the delivery of plant, equipment and culvert segments by crane
- Construction of an earthen ramp from Malthouse Way into the light rail corridor to provide vehicle access and for the future pathway
- Clearing and grubbing and excavation of the launch and receival areas on either side of the Longport Street would be undertaken by a small excavator and spoil bulked up, stockpiled and trucked out. Spoil would be reused on-site where possible
- Removal of several trees to facilitate access and construction
- Installation of hoardings over and around aboveground Sydney Water assets on the northern side and installation of an acoustic and light shield across the service tunnel which provide threatened micro-bat habitat
- Strengthening of the jacking portals. Bracing of the masonry of the existing bridge structure would be put in place. Monitoring equipment would also be installed to minimise impacts on the existing bridge structure and services
- Excavation of a launch pit on the southern side of Longport Street. A concrete work pad and thrust wall would be poured in the launch pit. Concrete would be pumped from Longport Street
- Jacking equipment would be lifted into place on the work pad from a mobile crane on Longport Street. This will likely require partial or full closure of Longport Street and night works
- Culvert segments would be lifted into place on the work pad in the light rail corridor from a mobile crane in Longport Street and jacked in sequence. This will likely require partial or full closure of Longport Street and night works
- Spoil excavated from within the tunnel would be bulked up, stockpiled and trucked out for off-site disposal or reuse in the Lewisham West link
- Night works and closure of Longport Street may be required during the jacking process works as a risk reduction measure
- Following breakthrough of the jacking, the cutting shield and jacking equipment would be craned out onto Longport Street. This will likely require partial or full closure of Longport Street and night works
- Access for major plant such as cranes and pipe jacking equipment would be from Longport Street. Access for smaller plant such as excavators and trucks would be via Malthouse Way on the southern side via through Grosvenor Crescent and through Cadigal Reserve on the northern side

- It is anticipated these works could largely be undertaken during the day with track occupations, although some works will require night-time works and/or track possessions.

2.2.8 Lewisham West Corridor Construction

Path works through Lewisham West would largely be on-grade concrete paths, associated hard and soft landscaping and lighting. On the eastern side the wetland and dog off leash area would largely be earthworks and landscaping. To construct this section of the pathway, the following is proposed:

- Access for plant such as earthmoving equipment and trucks would typically be from Old Canterbury Road, Hudson Street or Malthouse Way and along the ‘non-active’ light rail corridor
- Clearing and grubbing of the site using an excavator and trucks, with reuse of spoil from the tunnelling where possible
- Installation of lighting conduits and pole footings using an excavator along the proposed path alignment. Concrete would be pumped from Malthouse Way or Edward Street using a ground line
- Construction of the shared path would take place typically in a north to south direction. The subgrade would be compacted, and path base would be brought in and compacted and then sections of path would be formed up and poured. Concrete would be pumped from Malthouse Way or Edward Street using a ground line
- The lighting poles and luminaires would be fitted and connection of the lighting system to the Old Canterbury switchboard would occur
- Installation of a switchboard north of Old Canterbury and conduits and cabling installed to feed lighting from Old Canterbury Road to the path south of the Lewisham West Light Rail Stop
- Bulk earthworks would be undertaken on the eastern side of the light rail using an excavator. Demolition of the existing concrete slabs will likely require a concrete saw and hydraulic breaker
- Installation of stairs to Longport Street at the northern end of the dog off leash area along with the associated path
- Stormwater would be laid for the wetland including connections into Hudson Street and to the Hawthorne Canal Channel in the light rail corridor
- Following completion of the earthworks, paths and lighting, soil and mulch would be trucked or blown in as required to enabling landscaping of both sides of the light rail.

It is anticipated these works could be undertaken during the day with track occupations.

2.2.9 Davis Street and Constitution Road Cut and Cover Tunnels

It is likely that a cut and cover construction method will be used for the Davis Street and Constitution Road tunnels, although a jacked culvert method may also be considered (Refer Longport Street Jacked Culvert Tunnel below for the alternate method). To construct this section of the pathway, the following is proposed:

- The roads would be closed in part or in full for the duration of the tunnelling works. Both roads would not be permitted to be closed at the same time

- Bracing of the masonry of the existing bridge structure would be put in place. Monitoring equipment would also be installed to minimise impacts on the existing bridge structure and services
- At Constitution Road, isolation/protection/diversion of existing water, gas and communications services would be put in place
- Installation of piles either side of the proposed tunnel perpendicular to the roadway. Bored soldier piles would be installed to support the earth either side of the tunnel during excavation
- Excavation between the two rows of piles down to the design road level with bracing installed as required. The subgrade would be compacted, and a concrete base slab will be poured at the bottom of the tunnel from the road surface
- The tunnel will likely be precast concrete culvert lowered from a crane in the roadway. Head walls and wing walls would also be put in place as required. The trench above the tunnel will then be carefully back filled and services and the road surface reinstated
- Excess spoil would be trucked for disposal off site
- Access for plant such as piling rigs, excavators, cranes and trucks would be along the road in question.

It is anticipated these works could largely be undertaken during the day with track occupations, although some works may require night-time works and/or track possessions.

2.2.10 Davis Street to Johnson Park

Path works between Davis Street and Johnson Park would largely be low level elevated paths, associated hard and soft landscaping and lighting. To construct this section of the pathway, the following is proposed:

- Access for plant such as earthmoving equipment and trucks would typically be from Terry Road or Johnson Park and along through the existing bush care sites in the ‘non-active’ light rail corridor
- Clearing and grubbing of the site using an excavator. Care will be needed to limit the impact on adjacent bush care areas
- Stormwater would be laid from Terry Road to the Sydney Water culvert to reduce flooding
- Installation of lighting conduits and pole footings using an excavator along the proposed path alignment. Concrete would be pumped from Terry Road using a ground line
- Construction of the low level elevated shared path would take place typically in a north to south direction. Footings would be constructed using an excavator. Concrete would be pumped from Terry Road using a ground line. The path would then be constructed, and decking installed
- Installation of a new or upgraded switchboard in Johnson Park or Terry Road and cabling installed to feed lighting from Johnson Park to Davis Street
- The lighting poles and luminaires would be fitted and connection of the lighting system to the Johnson Park or Terry Road switchboard would occur
- Following completion of the earthworks, paths and lighting, soil and mulch would be trucked or blown in as required to enabling landscaping.

It is anticipated these works could be undertaken during the day.

2.2.11 Constitution Road to New Canterbury Road

It is likely that the path immediately south of Constitution Road will require a soldier pile retaining wall to facilitate an on-grade concrete path. From the soldier pile retaining wall south to New Canterbury Road it is likely that the elevated path will be constructed from bored concrete pile foundations with a steel and/or aluminium and/or fibre composite superstructure. Other construction methods and materials may be used. To construct this section of the pathway, the following is proposed:

- Access for plant such as earthmoving equipment and trucks would typically be from New Canterbury Road and along the 'non-active' light rail corridor
- Clearing and grubbing of the site using an excavator and trucks. Removal of several trees near Constitution Road will be required to facilitate access and construction, possibly including trees in the adjacent private property
- Construction of a working track with an excavator and bulldozer/grader between New Canterbury Road and the narrow part of the corridor south of Constitution Road. A soldier pile retaining wall would be constructed south to north in staged fashion, two or three piles at a time. The earth in front of these piles would then be excavated before moving to the next stage of piles. The soldier pile wall would likely need to be finished prior to tunnelling under Constitution Road
- Construction of a small retaining wall on the eastern side of the path opposite the soldier pile retaining wall. The path base would be brought in and compacted and then the path would be formed up and poured. Concrete would be pumped from Constitution Road using a boom or ground line
- Excavation for the piles for the elevated pathway using an excavator with access from New Canterbury Road. The piles and piers would be formed and poured using a ground pump line from New Canterbury Road
- Due to the lack of space for cranes, south of the secant wall the elevated path superstructure is anticipated to be constructed using a cantilevered method south to north. Closer to New Canterbury Road a mobile crane could place prefabricated sections from the top of the batter
- Installation of the decking, balustrades and lighting poles and luminaires onto the super structure in a similar fashion
- Installation of a new or upgraded switchboard in Johnson Park or New Canterbury Road and cabling installed to feed lighting from Johnson Park to New Canterbury Road
- The lighting poles and luminaires would be fitted and connection of the lighting system to the Johnson Park or New Canterbury Road switchboard would occur
- Following completion of the earthworks, paths and lighting, soil and mulch would be trucked or blown in as required to enabling landscaping.

Due to the proximity to the light rail it is anticipated a large part of these works would be undertaken during the day with track occupations and during night-time works and/or track possessions.

2.2.12 Hercules Street Parklands

Path works through the Hercules Street Parklands would largely be earthworks, on-grade concrete paths, stormwater works and associated hard and soft landscaping and lighting. To construct this section of the pathway, the following is proposed:

- Access for plant such as earthmoving equipment and trucks would typically be from the southern end of Hercules Street and along the ‘non-active’ light rail corridor
- Clearing and grubbing of the site using an excavator and trucks
- Bulk earthworks using excavators to reshape the landscape, removing steep batters and improving access, amenity, and sight lines. The existing unlined storm water channel would be modified as required to reduce flooding
- Installation of stormwater pipe work and pits and raingardens and wetlands excavated using an excavator
- Installation of lighting conduits and pole footings using an excavator along the proposed path alignment. Concrete would be pumped from within the corridor using a ground line with access from Hercules Street
- Construction of the shared path would take place typically in a north to south direction. The subgrade would be compacted, and path base would be brought in and compacted and then sections of path would be formed up and poured. Concrete would be pumped from within the corridor using a ground line with access from Hercules Street
- Installation of a switchboard at Hercules Street or connected to Jack Shanahan Reserve and conduits and cabling installed to feed lighting from Hercules Street near Consett Street to Jack Shanahan Reserve
- The lighting poles and luminaires would be fitted and connection of the lighting system to the Hercules Street switchboard would occur
- Following completion of the path and lighting, soil and mulch would be trucked in as required to enabling landscaping.

It is anticipated these works could be undertaken during the day.

2.2.13 Finishing works

Landscaping and ancillary works would generally be completed subsequent to all other activities construction in each zone was completed. Following completion of the jacking, a decorative internal skin would be installed along with electrical wiring and lighting.

Landscaping of areas would take place including installation of artwork and signage, street furniture, and planting of all trees, shrubs, grasses and groundcovers.

Any damage from access or construction would be rectified. It is anticipated these works could be undertaken during the day with track occupations or possessions in a few areas as required.

2.3 Machinery, Equipment, Access, and Ancillary Works

2.3.1 Machinery and Equipment

A list of machinery that may be used at different points within the project is provided below:

- Post hole auger
- Hand-held power tools
- Excavator drill rig
- Concrete ground line pump
- Excavator (5T)
- Concrete saw
- Excavator Hammer
- Excavator (20T)
- Concrete Pump
- Concrete Truck
- Concrete Saw
- Site dumpers
- 5T tipper trucks
- Generator
- Oxy acetylene torch
- Piling rig
- Mini site dumper
- Boom pump
- Beam lifter/scissor lift
- Crane
- Positrack
- Compactor

2.3.2 Access

A summary of the proposed access requirements is presented in Table 2-1 below.

Table 2-1: Summary of proposed access requirements for construction activities

Proposed Works	Access Requirements	Road Closure Required? (Y/N)	Track Occupations or Possessions Required? (Y/N)
Compound sites	<ul style="list-style-type: none"> • Grovesnor Crescent • Malthouse Way • Old Canterbury Road • Hudson Street • Weston Street • Davis Street • Terry Road • Constitution Road • New Canterbury Road • Hercules Street 	No	No
Fencing	<ul style="list-style-type: none"> • Cadigal Reserve • Grovesnor Street • Hudson Street • Malthouse Way • Old Canterbury Road • Terry Street • New Canterbury Road • Hercules Street 	No	Yes
Cadigal Reserve Preliminary Works	<ul style="list-style-type: none"> • Closure of Cadigal Reserve • Haig Avenue 	No	No
Parramatta Road under Bridge and Approaches	<ul style="list-style-type: none"> • Haig Avenue • Parramatta Road, near Frenches Lane 	Yes – Parramatta Road	No

Proposed Works	Access Requirements	Road Closure Required? (Y/N)	Track Occupations or Possessions Required? (Y/N)
Longport Street Northern Approach	<ul style="list-style-type: none"> Cadigal Reserve 	No	Yes
Cadigal Reserve Path	<ul style="list-style-type: none"> Cadigal Reserve Grovesnor Street 	No	No
Longport Street Jacked Box Culvert Tunnel	<ul style="list-style-type: none"> Longport Street Malthouse Way 	Yes – Longport Street	Yes
Lewisham West Corridor Construction	<ul style="list-style-type: none"> Old Canterbury Road Malthouse Way 	No	Yes
Davis Street and Constitution Road Cut and Cover Tunnels	<ul style="list-style-type: none"> Davis Street Constitution Road 	Yes – both Davis Street and Constitution Road however, not at the same time.	Yes
Davis Street to Johnson Park	<ul style="list-style-type: none"> Terry Road Johnson Park 	No	No
Constitution Road to New Canterbury Road	<ul style="list-style-type: none"> New Canterbury Road 	No	Yes
Hercules Street Parklands	<ul style="list-style-type: none"> Hercules Street 	No	No

2.4 Duration and Working Hours

Where possible, construction hours will be in accordance with the Department of Environment and Climate Change (DECC) (2009) guidelines:

- 7am - 6pm Mondays to Fridays
- 8am – 1pm Saturdays.

However, it is noted that night works may be required for components of the Project, particularly those requiring Road Occupancy Licences or Track Occupations and Permits. Permits and approvals will be required for all works outside of those hours specified above.

A summary of the proposed working hours for construction activities is outlined in Table 2-2 below.

Table 2-2: Summary of proposed working hours for construction activities

Proposed Works	Daytime or Night-time?	Limitations to Work Periods? (Y/N)
Fencing	Largely during the day, although some works may require night-time works.	No
Cadigal Reserve Preliminary Works	Daytime	No
Parramatta Road under Bridge and Approaches	Largely during the day, although some works may require night-time works for concrete pumping and for craning of prefabricated path segments.	No

Proposed Works	Daytime or Night-time?	Limitations to Work Periods? (Y/N)
Longport Street Northern Approach	Daytime	Yes – only between November and January during the micro-bat migration season.
Cadigal Reserve Path	Daytime	No
Longport Street Jacked Box Culvert Tunnel	Largely during the day, although some works may require night-time works for the jacking process and for craning of prefabricated path segments.	Yes – only between November and January during the micro-bat migration season.
Lewisham West Corridor Construction	Daytime	No
Davis Street and Constitution Road Cut and Cover Tunnels	Largely during the day, although some works may require night-time works.	No
Davis Street to Johnson Park	Daytime	No
Constitution Road to New Canterbury Road	Largely during the day, although some works may require night-time works due to the proximity to the light rail corridor.	No
Hercules Street Parklands	Daytime	No

3. Project Justification and Consideration of Alternatives

3.1 Eastern City District Plan

The *Eastern City District Plan* (Greater Sydney Commission, 2018) covers the Bayside, Burwood, City of Canada Bay, City of Sydney, Inner West, Randwick, Strathfield, Waverley and Woollahra LGAs. It is a 20-year plan to manage growth in the context of economic, social and environmental matters to achieve the 40-year vision for Greater Sydney.

The *Eastern City District Plan* (Greater Sydney Commission, 2018) contains a number of objectives with four main goals in mind. These are to promote infrastructure and collaboration, to increase liveability, to improve productivity and to promote sustainability. This goal of promoting sustainability will be attained through the construction of more Green Grid connections. The Greater Sydney Green Grid will provide a regional network of high-quality green spaces that will support walking, cycling and community access to open spaces, and with urban tree canopy lining streets and neighbourhoods. The design of the GreenWay is intrinsically linked to this goal, as it will create a sequence of connected open spaces that will provide enhanced open space to growing communities along the light rail.

These open space connections are being developed with the intention that they will encourage people to be more physically and socially active, which will improve health outcomes and enhance the overall liveability of the district.

3.2 Our Place Inner West – Local Strategic Planning Statement

Our Place Inner West – Local Strategic Planning Statement (Inner West Council, 2020) sets out the vision for the area in 2036 and the actions that will be taken to achieve this vision. It provides the land-use planning framework for the Inner West, providing a link between the *Eastern City District Plan* (Greater Sydney Commission, 2018) and the priorities of *Our Inner West 2036 – A Community Strategic Plan* (Inner West Council, 2018) for the Inner West Community. The Plan sets out several priorities, with the most relevant to this Project being:

- providing improved and accessible transport infrastructure
- creating a diverse and increasing urban forest that supports connected habitats of flora and fauna
- providing accessible facilities and spaces that support active, healthy communities.

3.2.1 Sustainable Transport

Council is seeking to achieve the sustainable transport objectives set out in the District Plans, which include a 30-minute city and 10-minute walkable neighbourhoods. Within the Inner West LGA, the transport system includes walking and cycling paths, roads, rail lines and ferry wharves, with most residents located within reasonable walking distances to such modes of transport. However, there are still a number of transport challenges, including crowding on public transport and limited safe, separated cycle paths.

Approximately one third of all residents residing within the Inner West LGA commute by walking only. The Local Strategic Plan also recognises that we, as humans, are all pedestrians. Therefore, the movement of people should be prioritised over the movement of vehicles, allowing our roads to be used

for more essential services such as emergencies and deliveries. The GreenWay is recognised as a key regional active transport route, which is currently disjointed and incomplete, resulting in low usage rates. Therefore, the creation of a continuous pathway will aid in achieving the strategic sustainable transport objectives within the LGA.

3.2.2 Urban Forest and Ecology

It is well understood that trees and other layers of vegetation are important urban assets, providing many economic, environmental and social benefits. The District Plans recognise such benefits and have therefore set out a target of 40% tree canopy cover for each LGA. The Inner West LGA currently consists of approximately 16% tree canopy cover. The GreenWay is therefore vital in helping to achieve the state target through protecting existing native trees and replacing exotic species with locally native species, to improve the LGA’s biodiversity, liveability and resilience.

3.2.3 Blue and Green Grid

The GreenWay is a priority blue/green link within the Inner West LGA, which will create a network of vital connections across the landscape and provide numerous benefits including, but not limited to:

- increasing access to recreational open space, routes for walking and cycling and opportunities for active and passive recreation to support healthy living
- expanding the urban forest and vegetation and providing habitat for native fauna
- reducing urban heat and improving air quality
- providing adequate shade to protect the community from over exposure to UV radiation.

3.3 Alternative Options

Council finalised a Masterplan for the GreenWay in August 2018 which will guide implementation of infrastructure both built and natural over the next 10 to 15 years. As part of the Masterplan, a route options assessment (McGregor Coxall, 2019) was conducted to determine the most suitable alignment for the GreenWay path. The Route Options Assessment looked at different routes for each discrete section of the GreenWay, assessed these in terms of criteria established based on best practice example for GreenWays world-wide, and finally assessed how these linked together into a wholistic corridor. A summary of the potential options considered is provided in Table 3-1.

Table 3-1: Alternative options considered (Inner West Council, 2020)

Section of In-Corridor Works Package	Options Considered
<p>Cadigal Reserve and Parramatta Road Crossing</p>	<p>Three options were considered:</p> <ul style="list-style-type: none"> • a path on the western side of Cadigal Reserve and underpass below Parramatta Road • a path on the eastern side of Cadigal Reserve and underpass below Parramatta Road • a path on the eastern side of Cadigal Reserve and overpass above Parramatta Road. <p>An overpass was not preferred due to cost and environmental impacts. A path on the western side of the Canal was not preferred due to impacts on utilities and cost.</p> <p>Therefore, a path on the eastern side of Cadigal Reserve and underpass below Parramatta Road was recommended due to impacts on utilities on the western side. A link on the eastern side of the light rail was not considered feasible due to space constraints and lack of connectivity to the north and south.</p>
<p>Central Links</p> <p>Longport Street Crossing</p>	<p>Three options were considered:</p> <ul style="list-style-type: none"> • a tunnel on the western side of the Hawthorne Canal • a tunnel on the eastern side of the Hawthorne Canal • an on-road option via Grovesnor Crescent and Smith Street. <p>A tunnel on the eastern side of the Hawthorne Canal was recommended to reduce potential impacts on the <i>Miniopterus orianae oceanensis</i> (Large Bent-wing Bat) colony located in Cadigal Reserve and water infrastructure and improve constructability. Consideration of two sub options was subsequently undertaken to assess use of the Malthouse Way or the light rail corridor south of Longport Street. A path through the light rail corridor was recommended and adopted.</p> <p>An on-road option was not preferred due to accessibility and safety considerations. A link on the eastern side of the light rail was not considered feasible due to space constraints and lack of connectivity to the north and south.</p>
<p>Old Canterbury Road Crossing and Lewisham West</p>	<p>Two options were considered:</p> <ul style="list-style-type: none"> • a tunnel on the western side of the light rail tracks • a signalised crossing on the western side at Edward and Weston Streets. <p>Although a tunnel was found to provide better user outcomes, due to the relative cost, signalisation has been adopted as the preferred option in the short to medium term. A link on the eastern side was not considered feasible due to space constraints and lack of connectivity to the north and south.</p>
<p>Davis Street Crossing</p>	<p>Three options were considered:</p>

Section of In-Corridor Works Package	Options Considered
	<ul style="list-style-type: none"> • an on-grade crossing on the eastern side of the light rail corridor and through an easement in Waratah Mills • an on-grade crossing on the eastern side of the light rail corridor and through Hoskins Park • a tunnel in the light rail corridor on the western side of the light rail tracks. <p>A tunnel was preferred and adopted due to user safety, and a preference to connect to links on the western side of the corridor, to both north and south. On-grade crossings were not preferred due to safety concerns. In addition, a path through Hoskins park had no feasible connection to the south.</p>
<p>Constitution Road to Davis Street</p>	<p>Two options were considered:</p> <ul style="list-style-type: none"> • a path on the western side of the light rail tracks • a path through Hoskins park and along the eastern side of the light rail tracks. <p>A path on the western side of the light rail tracks was preferred and adopted due to the very constrained space on the eastern side and impacts on Hoskins Park and residents.</p>
<p>Southern Links</p> <p>Constitution Road Crossing</p>	<p>Three options were considered:</p> <ul style="list-style-type: none"> • a tunnel on the western side of the light rail tracks • a tunnel on the eastern side of the light rail tracks • an on-grade crossing on the western side of the light rail corridor. <p>A tunnel on the western side of the light rail tracks was preferred and adopted due to safety and accessibility and a preference to connect to links on the western side of the corridor, to both north and south. An on-grade crossing was not preferred due to safety concerns whilst a tunnel on the eastern side had poor connectivity to the north and south.</p>
<p>Constitution Road to New Canterbury Road</p>	<p>Two options were considered:</p> <ul style="list-style-type: none"> • a path on the eastern side of the light rail tracks • a path on the western side of the light rail tracks. <p>A path on the western side of the light rail tracks was recommended and adopted due to the constrained space on the eastern side close to New Canterbury Road and potential for an underpass of New Canterbury Road on the western side.</p>
<p>Hercules Street to Jack Shanahan Reserve</p>	<p>One option was explored between Hercules Street and Jack Shanahan Reserve.</p> <p>An option through the light rail corridor on the western side was recommended and adopted as it enables an off-road path, enables opening up of public land and associated ecological and recreational opportunities, links with Jack Shanahan Reserve</p>

Section of In-Corridor Works Package	Options Considered
	<p>and a preference to connect to links on the western side of the corridor, to both north (existing path through light rail corridor) and south (underpass below the Bankstown Rail line).</p> <p>The eastern side of the light rail corridor was not considered feasible as it was very narrow and an on-Road in Hercules Street was also ruled out as it did not provide the same benefits as the option in the light rail corridor.</p>

4. Statutory and Planning Context

Table 4-1 provides a description of the legislative context for the project. Where a particular approval or consideration is required, this report addresses the objectives and requirements of the legislation.

Table 4-1 Legislative Context

Name	Relevance to the project
Commonwealth	
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	<p>The EPBC Act protects Matters of National Environmental Significance (MNES), such as threatened species and ecological communities, migratory species (protected under international agreements), and National Heritage places (among others). Any actions that will or are likely to have a significant impact on the MNES require referral and approval from the Australian Government Environment Minister. Significant impacts are defined by the Commonwealth (reference http://www.environment.gov.au/epbc/guidelines-policies.html) for MNES.</p> <p>MNES have been identified within and near the Project site. A Significance Assessment was undertaken for <i>Pteropus poliocephalus</i> (Grey-headed Flying-fox). The assessment concluded that the proposed works are unlikely to significantly impact this species.</p>
State	
<i>Biodiversity Conservation Act 2016</i> (BC Act)	<p>The BC Act seeks to conserve biological diversity at bioregional and State scales; to maintain the diversity and quality of ecosystems and enhance their capacity to adapt to change and provide for the needs of future generations; to assess the extinction risk of species and ecological communities and identify key threatening processes through an independent and rigorous scientific process; and to establish a framework to avoid, minimise and offset the impacts of proposed development and land use change on biodiversity. Section 7.3 of the Act requires proponents of activities subject to Part 5 of the EP&A Act to determine whether they will have a significant impact on threatened species. The test for significant impact is described in section 7.3 of the Act. A significant impact also occurs if the activity is carried out in an area of outstanding biodiversity value.</p> <p>If a significant impact is likely to occur, the proponent of the activity must prepare a Species Impact Statement (SIS) in accordance with section 7.20 or a Biodiversity Development Assessment Report (BDAR).</p> <p>Tests of Significance was undertaken for the following threatened species:</p> <ul style="list-style-type: none"> • Large Bent-winged Bat • <i>Miniopterus australis</i> (Little Bent-winged Bat) • Grey-headed Flying-fox • Endangered population of Long-nosed Bandicoot (<i>Perameles nasuta</i>) population in the inner West Sydney. <p>The assessments concluded that the works are likely to result in a significant impact to one threatened species (Large Bent-winged Bat) and therefore, in accordance with Section 7.8(3), the preparation of a SIS or BDAR is required.</p> <p>A BDAR was subsequently prepared, the results of which are summarised in Section 5.4.</p>
<i>Biosecurity Act 2015</i>	<p>The Biosecurity Act repealed the <i>Noxious Weeds Act 1993</i> and provides a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.</p>

Name	Relevance to the project
	<p>Part 3 of the Biosecurity Act applies a general biosecurity duty for any person who deals with a biosecurity matter or a carrier to prevent, eliminate or minimise any biosecurity risk they may pose. Under section 23 of the Act, a person who fails to discharge a biosecurity duty is guilty of an offence.</p> <p>Whilst the Act provides for all biosecurity risks, implementation of the Act for weeds is supported by Regional Strategic Weed Management Plans (RSWMP) developed for each region in NSW. Appendix 1 of each RSWMP identifies the priority weeds for control at a regional scale. However, landowners and managers must take appropriate actions to reduce the impact of problem weed species regardless of whether they are listed in Appendix 1 of the RSWMP or not as the general biosecurity duty applies to these species.</p> <p>A number of priority weeds, as identified within the RSWMP, were present within the study area and will require management by Council.</p>
<p><i>Environmental Planning and Assessment Act 1979 (EP&A Act)</i></p>	<p>The EP&A Act is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of proposals.</p> <p>As Council is the proponent, the works are to be assessed as ‘development permissible without consent’ under Part 5 of the EP&A Act (see Section 4.1). Accordingly, Council must satisfy Sections 5.5 and 5.6 of that Act by examining, and taking into account to the fullest extent possible, all matters which 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 5.6.</p> <p>This report also addresses the requirements of s228 of the EP&A Regulation 2000 (see Section 5.17).</p>
<p><i>Fisheries Management Act 1994 (FM Act)</i></p>	<p>The FM Act provides for the protection, conservation and recovery of threatened species defined under the Act. It also makes provisions for the management of threats to threatened species, populations and ecological communities defined under the Act, as well as the protection of fish and fish habitat in general.</p> <p>The proposed works do not involve impacts to Key Fish Habitat (KFH), does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage. A permit or consultation under the FM Act is not required.</p>
<p><i>Heritage Act 1977 (Heritage Act)</i></p>	<p>The Heritage Act provides protection of the environmental heritage of the State which includes places, buildings, works, relics, movable objects or precincts that are of State or local heritage significance. The NSW State Heritage Register (SHR) is the statutory register under Part 3A of the Heritage Act. Listing on the SHR means that any proposed works or alterations (unless exempted) to listed items must be approved by the Heritage Council or its delegates under section 60 of the Act.</p> <p>The study area passes through the curtilage of the SHR listing for the Lewisham Sewage Aqueduct and the Lewisham Viaduct and Whipple Truss. The works at both locations is considered to meet the criteria for Standard Exemption 8: Non-Significant Fabric (s57(2) Heritage Act), which states the following:</p> <ol style="list-style-type: none"> 1. <i>The following development does not require approval under subsection 57(1) of the Act, provided that the Director-General is satisfied that the criteria in (a) have been met and the person proposing to undertake the development has received a notice advising that the Director-General is satisfied:</i> <ol style="list-style-type: none"> a. <i>the alteration of a building involving the construction or installation of new fabric or services or the removal of building fabric which will not adversely affect the heritage significance of the item.</i> 2. <i>A person proposing to do anything of the kind described in paragraph 1 must write to the Director-General and describe the proposed development. If the Director-General is satisfied that the proposed development meets the criteria set out in paragraph 1(a), the Director-General shall notify the applicant.</i>

Name	Relevance to the project
	<p>Therefore, as the proposed works will fall under this standard exemption and the works will not impact on known archaeological sites, no approvals are required from the Heritage Council in regard to archaeological permits.</p>
<p><i>National Parks and Wildlife Act 1974 (NPW Act)</i></p>	<p>The NPW Act is administered by the Director-General of the National Parks and Wildlife Services, who is responsible for the control and management of all national parks, historic sites, nature reserves, and Aboriginal areas (among others). The main aim of the Act is to conserve the natural and cultural heritage of NSW. The Act aims to conserve the natural and cultural heritage of NSW. Where works will disturb Aboriginal objects, an Aboriginal Heritage Impact Permit (AHIP) is required.</p> <p>A requirement of Clause 16 of the Infrastructure SEPP is for consultation with the National Parks and Wildlife Service (NPWS) where the proposed works occur on or adjacent to National Parks Estate. The proposed works are not within or adjacent to national park and therefore consultation is not required.</p> <p>An Aboriginal Heritage Due Diligence Assessment was undertaken to determine any potential impacts to Aboriginal objects or places. The assessment did not identify any Aboriginal items or objects within the study area. Therefore, no further assessment is recommended.</p>
<p><i>Protection of the Environment Operations Act 1997</i></p>	<p>The POEO Act is the key environmental protection and pollution statute. The POEO Act is administered by the NSW Department of Environment, Energy Science and establishes a licensing regime for waste, air, water and pollution. Relevant sections of the Act are listed below:</p> <ul style="list-style-type: none"> • Part 5.3 Water Pollution • Part 5.4 Air Pollution • Part 5.5 Noise Pollution • Part 5.6 Land Pollution and Waste. <p>Any work potentially resulting in pollution must comply with the POEO Act. Relevant licences must be obtained if required. No licences have been identified as being required including an Environmental Protection Licence (EPL).</p>
<p><i>Water Management Act 2000 (WM Act)</i></p>	<p>The WM Act aims to provide for the sustainable and integrated management of water resources for NSW. The Act requires developments on waterfront land to be ecologically sustainable and recognises the benefits of aquatic ecosystems to agriculture, fisheries, and recreation.</p> <p>The WM Act is administered by the Natural Resources Access Regulator (NRAR) and establishes an approval regime for activities within waterfront land, defined as the land 40 m from the highest bank of a river, lake or estuary.</p> <p>A Controlled Activity Approval (CAA) is typically required for work within waterfront land. Section 91E of the Act creates an offence for carrying out a controlled activity within waterfront land without approval. However, according to Section 41 of the <i>Water Management (General) Regulation 2018</i>, a public authority is exempt from Section 91E (1) of the Act. Therefore, Council does not need to obtain a CAA from the NRAR as part of these works. However, works should be designed and constructed as per the NRAR’s ‘<i>Controlled Activities on Waterfront Land: Guidelines for watercourse crossings on waterfront land</i>’ (DPI Water, 2012).</p>
<p>Planning Instruments</p>	
<p><i>State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP)</i></p>	<p>The aim of the Infrastructure SEPP is to facilitate the effective delivery of infrastructure across NSW by identifying whether certain types of infrastructure require consent, can be carried out without consent or are exempt development.</p>

Name	Relevance to the project
	<p>Pursuant to clause 79 of the Infrastructure SEPP, development for the purpose of rail infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land. Under the definitions provided in clause 78 of the Infrastructure SEPP, rail infrastructure facilities include fences, tunnels, bridges, pedestrian and cycleway facilities.</p> <p>Part 2 of the Infrastructure SEPP contains provisions for public authorities to consult with other agencies prior to the commencement of development, as described in Section 6.</p>
<p><i>State Environmental Planning Policy 55 – Remediation of Land (SEPP 55)</i></p>	<p>SEPP 55, along with the Contaminated Land Planning Guidelines provide the planning framework for the management of contaminated land in NSW.</p> <p>SEPP 55 does not technically apply to ‘development without consent’, applying only to Development Applications. However, for completeness and in order to minimise the risks to the contamination of the environment, the recommendations of the relevant contamination reports referenced within this REF should be adhered to.</p>
<p><i>State Environmental Planning Policy (Koala Habitat Protection) 2020</i></p>	<p>The Koala Habitat Protection SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.</p> <p>The Koala Habitat Protection SEPP does not relate to works under Part 5 of the EP&A Act. Therefore, this SEPP is not relevant to the proposed works</p>
<p>Marrickville Environmental Plan (Marrickville LEP)²</p>	<p>In accordance with the Marrickville LEP 2011, the study area is zoned as the following:</p> <ul style="list-style-type: none"> • SP2: Infrastructure • B4: Mixed Use • RE1: Public Recreation • IN2: Light Industrial • R1: General Residential. <p>Terrestrial Biodiversity</p> <p>Portions of the study area are mapped as Terrestrial Biodiversity under the Marrickville LEP (Figure 4-1). The objectives of mapped Terrestrial Biodiversity under the Marrickville LEP are as follows:</p> <p><i>(a) protecting native fauna and flora, and</i></p> <p><i>(b) protecting the ecological processes necessary for their continued existence, and</i></p> <p><i>(c) encouraging the conservation and recovery of native fauna and flora and their habitats.</i></p> <p>The project will be designed to minimise the impacts on terrestrial biodiversity values where possible and will include remediation works and the provision of green infrastructure and native plantings where appropriate.</p>

² The Proposal is located within the Inner West Council Local Government Area (LGA). The provisions of the Infrastructure SEPP mean that Local Environmental Plans (LEPs), prepared by councils for an LGA, do not apply. However, during the preparation of this REF, the provisions of the relevant Local Environment Plans were considered.

Name	Relevance to the project
	<p>Heritage Conservation</p> <p>The following heritage items listed under the Marrickville LEP are located within or in proximity to the study area:</p> <ul style="list-style-type: none"> • Lewisham Sewage Aqueduct – I154 • Lewisham Railway Viaducts and Whipple truss and Lewisham underbridge – I229 • Hoskins Park – I131 • Hoskins Park and Environs Conservation Area – C36 • Former Waratah Flour Mills – I25. <p>It is considered that the proposal will not impact the identified heritage significance of any of the heritage items in the study area or vicinity that are listed under the Marrickville LEP.</p>
<p>Leichhardt Environmental Plan (Leichardt LEP)²</p>	<p>In accordance with the Leichhardt LEP 2013, the study area is zoned as the following:</p> <ul style="list-style-type: none"> • SP2: Infrastructure • RE1: Public Recreation.
<p>Ashfield Local Environmental Plan 2013 (Ashfield LEP)²</p>	<p>In accordance with the Ashfield LEP 2013, the study area is zoned as the following:</p> <ul style="list-style-type: none"> • SP2: Infrastructure • RE1: Public Recreation • R2: Low Density Residential. <p>Heritage Conservation</p> <p>The following heritage items listed under the Marrickville LEP are located within or in proximity to the study area:</p> <ul style="list-style-type: none"> • Former Waratah Flour Mills – C42 • Battle Bridge – 445 • Haig Avenue Conservation Area – C45 • Cadigal Reserve – Item 505 • Lewisham Sewage Aqueduct – 478 • Former Allied Flour Mill complex – Item 619. <p>It is considered that the proposal will not impact the identified heritage significance of any of the heritage items in the study area or vicinity that are listed under the Ashfield LEP.</p>

4.1 NSW Planning and Approvals Process

The EP&A Act is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of proposals. The proposal comprises of the construction of fences, tunnels, bridges, pedestrian and cycleway facilities to form the GreenWay corridor. These works fall under the definition in Clause 1.5.1(d) of the EP&A Act and further categorised under Clause 1.5.3(c) of the Act as *‘development that is an activity requiring environmental assessment under Division 5.1 before it is carried out by a public authority or before a public authority gives approval for the carrying out of the activity’*.

In this case, as detailed above, one environmental planning instrument, namely the Infrastructure SEPP, addresses the type of work proposed and agree that this type of development may be carried out without the need for development consent.

Clause 79(1) of the Infrastructure SEPP states that development for the purpose of a railway or rail infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land. Rail infrastructure facilities are defined in Clause 78 of the Infrastructure SEPP and include:

railway tracks, associated track structures, cuttings, drainage systems, fences, tunnels, ventilation shafts, emergency accessways, bridges, embankments, level crossings and roads, pedestrian and cycleway facilities

Part 5 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by or on behalf of public authorities that are permissible without development consent.

It is therefore concluded that Part 5 is the appropriate approval pathway.

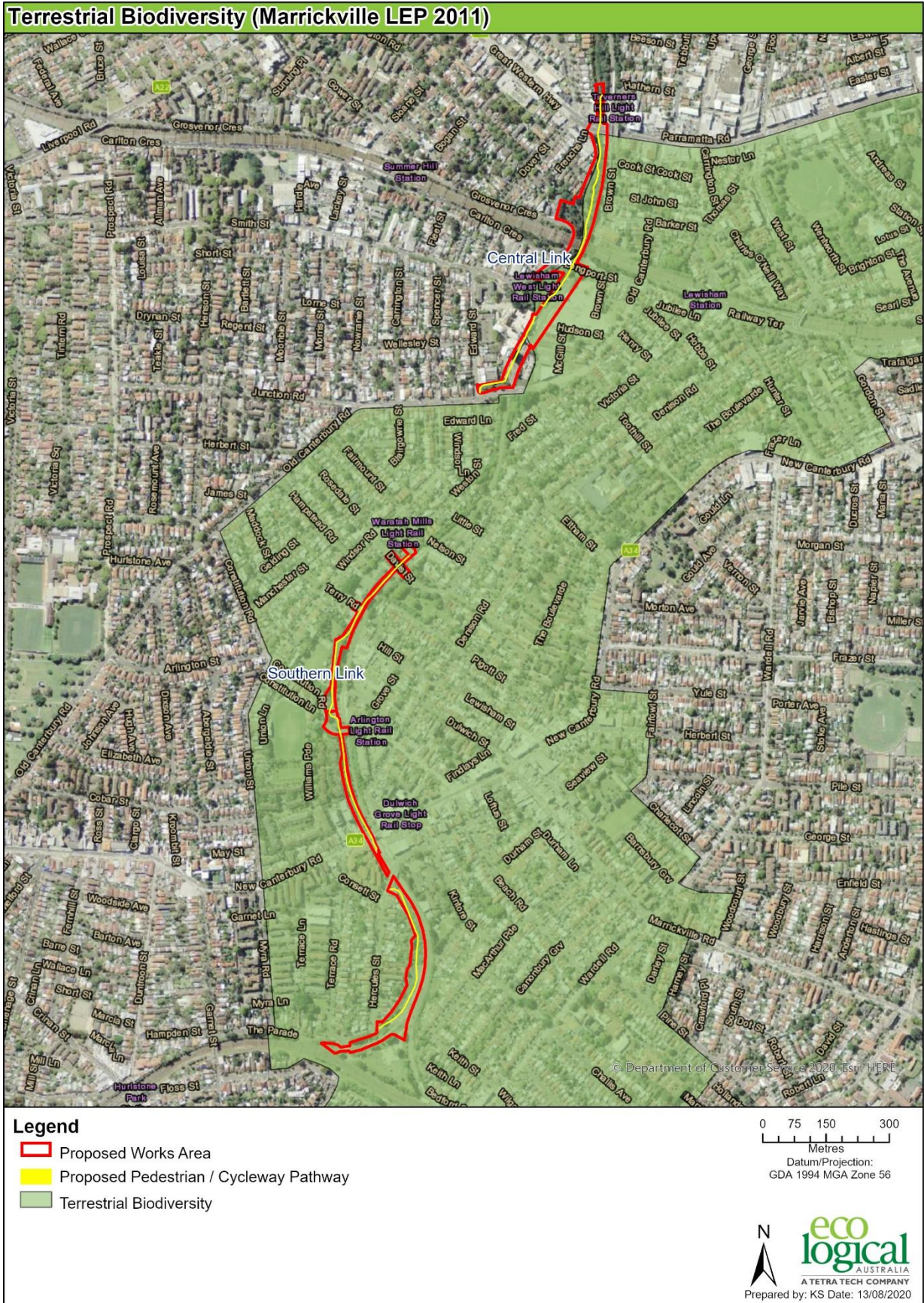


Figure 4-1 Terrestrial biodiversity within the study area (Marrickville LEP 2011)

5. Existing Environment and Impact Assessment

5.1 Landform, Geology, Soils and Geotechnical Considerations

5.1.1 Existing Environment

A Geotechnical Preliminary Site Soil and Contamination Investigation Report was prepared by GHD (2020) for the GreenWay which involved a targeted field and laboratory-testing program and extended from October 2019 to January 2020. The report utilised a number of sources to collect data, which included:

- Reviews of existing information
- Cored borehole drilling
- Augered Borehole Drilling
- Test Pits
- Hand Augers
- Soil Contamination Sampling
- Geotechnical Laboratory Testing.

For the purposes of the report, sampling of the study area was divided into four areas as follows:

- **Area 1:** The Bay Run and Richard Murden Avenue
- **Area 2** (including Area 2D): Cadigal Reserve and Lewisham West
- **Area 3:** South of Davis Street to North of Hercules Street, Dulwich Hill. Includes Johnson Park, IWC Bushcare sites, Inner West Light Rail (IWLR) corridor, surrounding streets and private property
- **Area 4:** South of Hercules Street, Dulwich Hill. Includes IWC Bushcare sites, IWLR and Sydney Trains corridors and surrounding streets.

The findings and results of the report are provided below. It is noted that Area 1 does not fall within the study area of the proposed works and therefore was not included in this assessment.

5.1.1.1 Geology

The geology of the study area is summarised in Table 5-1.

Table 5-1: Geological Landscape of the study area (amended from GHD, 2020)

Area	Description
2	<p>The geology sheet indicates the very northern half of Area 2 is underlain by the same sequence as Area 1, of fill and alluvial deposits.</p> <p>South of Old Canterbury Road the sheet indicates the route is underlain by Ashfield Shale bedrock.</p> <p>Seven igneous dykes are shown to the south and east of the alignment. The dykes on the geology sheet are described as Basalt. It may be interpolated that one of the dykes may intersect the GreenWay alignment within Area 2.</p>
3	<p>The geological sheet indicates the full alignment to be underlain by Triassic age Ashfield Shale bedrock.</p> <p>Seven dykes are shown in the vicinity of Area, with four potentially intersecting the alignment.</p> <p>The east-west trending Fairfield Basin syncline feature is shown passing below the study area in the vicinity of Constitution Road.</p>

Area	Description
4	The geological sheet indicates the alignment to be underlain by Triassic age Ashfield Shale bedrock, to the northernmost section of Jack Shanahan Reserve. The reserve, and the southernmost section of the GreenWay Alignment, is shown to be underlain by Hawkesbury Sandstone.

5.1.1.2 Topography

The topography of the study area is summarised in Table 5-2.

Table 5-2: Topography and Drainage (from GHD, 2020)

Area	Description
2	The topography of Area 2 is varied, with elevations ranging from 22 m AHD at the southern end to 4 m AHD in the centre of the area near the Hawthorne Canal. To the east and west of Area 2, the surrounding areas slope moderately (10°) down towards the site from an elevation of approximately 20-30 m AHD at 300 m distance.
3	The topography of Area 3 is fairly level, with elevations ranging from 22 to 26 m AHD across the area. To the east and west of the area, the surrounding areas slope very gently down towards the area from an elevation of approximately 28 m AHD at 150 m distance.
4	The topography of the Area 4 dips gently to the south, with elevations ranging from 26 m AHD at the northern end of the area to 14 m AHD at the southern end. To the east and west of the area, the surrounding areas slope gently down towards the area and the Cooks River to the south of the area at a slope angle of approximately 5°.

5.1.1.3 Soils

The study area crosses into 3 soil landscapes as described within the Sydney 1:100,000-scale geological sheet. These are the GyMEA landscape to the south, Blacktown in the centre and Birrong to the north. Soil characteristics within the study area are summarised in Table 5-3 below.

Table 5-3: Soil characteristics of the study area (from GHD, 2020)

Area	Map Unit Code	Soil Order	Map Unit Description
1,2,3,4	Pb12	Kurosol	Gently rolling to rounded hilly country with some steep slopes and broad valleys: chief soils are hard acidic red soils with hard neutral and acidic yellow mottled soils on lower slopes and in valleys.
1,2	Tb35	Sodosol	Dissected plateau remnants – flat to undulating ridge tops with moderate to steep slopes are hard acidic yellow and yellow mottled soils and hard acidic red soils; many shallow profiles occur, and profile thickness varies considerably over short distances. Flat ferruginous shale or sandstone fragments are common on and/or in and/or below the soils of this unit.

5.1.1.4 Groundwater

Sixty boreholes were drilled during the investigation. Boreholes were drilled to depths of between 0.8 m and 14.65 m below ground level. Instances where groundwater was encountered are described in Table 5-4 below.

Table 5-4: On-site groundwater conditions (from GHD. 2020)

Area	Description
2	Groundwater was observed at one borehole in Area 2, at a depth of 2.9 mbgl. This level generally correlates with the base of the Hawthorne Canal. It was encountered at the interface of the fill and residual soil, at approximately RL 2 m AHD.
3	Groundwater was observed at one borehole within Area 3, at the interface of the fill and residual soil, at a depth of 4.2 mbgl. Area 3 is not located close to any surface water bodies and deeper groundwater levels are anticipated.
4	Groundwater was observed at a number of boreholes in Area 4, likely due to the presence of the nearby drainage channel. Groundwater was recorded at approximately 0.9 to 4.0 mbgl trending deeper towards the southern low point of the area. This equates to a RL 20 m AHD at the northern section of Area 4 and approximately RL 15 m AHD towards the southern low point of the area. Groundwater levels are likely to vary due to seasonal fluctuations and following major rainfall events.

5.1.2 Impact Assessment

Construction of the proposed works would involve disturbing the ground surface and subsurface. If inadequately managed, excavation and stockpiling activities could have the following impacts:

- Erosion of exposed soil and stockpiled materials
- Dust generation from excavation and vehicle movements over exposed soil
- An increase in sediment loads entering the stormwater system and/or local runoff.

These impacts are considered to be minimal, as they would be temporary and short-term. The potential for impacts would be managed by the implementation of the measures provided in Table 5-5.

If inadequately managed, construction of subsurface structures such as piles and tunnels could have adverse impacts on adjoining property and structures. The potential for impacts would be managed through the recommendations set out in the Geotechnical Preliminary Site Soil and Contamination Investigation Report (GHD, 2020).

5.1.3 Mitigation Measures

Table 5-5: Mitigation measures for soils and landform

Environmental Aspect	Mitigation Measures
Increase in sediment flow into water control	<ul style="list-style-type: none"> • Prepare a CEMP prior to any construction works to address measures to be adopted to minimise impacts on the environment as a result of the construction works, including sediment erosion and sedimentation. • Prepare a Sediment and Erosion Control Plan in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and implement prior to works. • Install soil and erosion control measures such as sediment fencing prior to on-ground works. Inspect these regularly (weekly), and more frequently during rain periods to ensure structures are in proper working order. • Prior to forecast heavy rain, cease work and remove accumulated material from sediment controls. • Schedule the major drainage and earthworks outside of predicted heavy rain periods. • Stop work during and following heavy rainfall to reduce risk of mobilising sediment.

Environmental Aspect	Mitigation Measures
Erosion hazard from work	<ul style="list-style-type: none"> • Inspect erosion controls regularly (daily during workdays) and after rainfall. Fix damaged controls immediately. Remove accumulated sediment or waste material from the sediment controls regularly and dispose of at a licensed waste facility. • Bare areas should be mulched following clearance works to prevent erosion or soil damage. Alternatively, erosion prone areas, when not in use, may be covered with biodegradable weed matting or similar product. • Monitor sedimentation down slope of excavated areas. • Leave erosion and sediment controls in place until after the works are completed.

5.2 Contamination

5.2.1 Existing Environment

A Preliminary Site Soil and Contamination Investigation (2020) was developed by GHD for the GreenWay corridor, which assessed the potential for contamination to be present along an investigation area of approximately 4.5 km, from Iron Cove in the north towards Cooks River to the south.

For the purposes of the report, sampling the study area was divided into four areas as follows:

- **Area 1:** Bay Run and Richard Murden Reserve
- **Area 2:** (including Area 2D): Cadigal Reserve and Lewisham West. Area 2D was originally a discretionary item in the tender at the Cadigal Reserve, however it was later included in the full scope of works
- **Area 3:** Davis Street to New Canterbury Road
- **Area 4:** Hercules Street.

GHD completed a site walkover and desktop assessment including a review of previous investigations and historical data from 1917 to the present day. Following this, targeted soil sampling was undertaken in conjunction with the geotechnical investigation to determine the potential for contamination to exist within the study area.

The desktop review confirmed the historical use of the project area as a combination of residential, recreational and commercial/ industrial land uses. Previous contamination investigations at focused portions of Area 2 concluded that:

- benzo(a), pyrene (B(a)P), total recoverable hydrocarbons (TRH) C16-C34, copper (Cu), lead (Pb) and zinc (Zn) were detected in soil samples at concentrations above the selected human health and ecological screening criteria
- pH_{FOX} results indicated the potential for Acid Sulphate Soils (ASS) to be present
- asbestos was detected in several locations as fragments of asbestos containing material (ACM) in bonded cement form.

A breakdown of on-site conditions as determined through GHD's investigations is presented in Table 5-6 below. It is noted that Area 1 does not fall within the study area of the proposed works and therefore was not included in this assessment.

Table 5-6 Site conditions related to contamination (GHD, 2020 (1))

Area	Description
2	<ul style="list-style-type: none"> • Exceedances of selected human health guideline criteria were noted at one location for arsenic (As), one location for Pb and 10 locations for B(a)P (TEQ) (Toxic Equivalency Quotient) • Asbestos in compressed fibre cement was detected at one location in Area 2. Given the historical land use of the site, it is considered likely that further ACM may be encountered during construction • For urban residential / public open space criteria, sporadic heavy metal exceedances of Ecological Investigation Levels (EIL) were noted As, Cu, Pb, nickel (Ni) and Zn. Exceedances of selected Ecological Screening Level (ESL) guideline levels for F3 (>C16-C34 Fraction), and B(a)P were reported • Waste classification results for Area 2 are a mixture of Hazardous Waste (HW), Restricted Solid Waste (RSW), General Solid Waste (GSW) and Special Waste – Asbestos. The results of Toxicity

Area	Description
	<p>characteristic leaching procedure (TCLP) analysis enabled reclassification of selected samples as GSW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction</p> <ul style="list-style-type: none"> • Previous investigations have reported the potential for ASS to be present in shallow soils in the area. Natural soils may require management during construction if disturbed.
3	<ul style="list-style-type: none"> • Exceedances of selected human health guideline criteria were noted at five locations for B(a)P (TEQ) • Asbestos in compressed fibre cement was detected at one location in Area 3. Given the historical land use of the site, it is considered likely that further ACM may be encountered during construction • For urban residential / public open space criteria, six heavy metal exceedances of EILs were noted As, Ni, and Zn. Exceedances of selected ESL guideline levels for F3 (>C16-C34 Fraction), and B(a)P were reported • Waste classification results for Area 3 are a mixture of HW, RSW, and GSW. The results of TCLP analysis enabled reclassification of selected samples as GSW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction • Groundwater was reported at one borehole in Area 3, at a depth of 4.2 mbgl. Proposed construction works in Area 3 are shallow and are not likely to intersect groundwater in this area.
4	<ul style="list-style-type: none"> • Exceedances of selected human health guideline criteria were noted at one location for Pb, two locations for As, one location for Polycyclic aromatic hydrocarbons (PAH) (sum of total), and 11 locations for B(a)P (TEQ) • No asbestos was detected in Area 4, however, given the historical land use of the site, and the fact that asbestos was identified at the other three areas, it is considered likely that ACM may be encountered here during construction • For urban residential / public open space criteria, heavy metal exceedances of EILs were noted for As, Ni, Cu and Zn. There was one ESL exceedance of >C10-C16 Fraction, and exceedances of ESLs for F3 (>C16-C34 Fraction), and B(a)P were reported • Waste classification results for Area 4 are a mixture of HW, RSW, and GSW. The results of TCLP analysis enabled reclassification of selected samples as GSW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.

5.2.2 Impact Assessment

Within the contamination assessment, chemical concentrations from soil samples were compared with criteria outlined in the NSW EPA (2014) *Waste Classification Guidelines: Part 1 Classifying Waste*. The results are outlined below:

- For Area 2, exceedances of selected human health guideline criteria were noted at one location for As, one location for Pb and 10 locations for B(a)P (TEQ). One collected sample confirmed to contain asbestos as compressed fibre cement
- For Area 3, exceedances of selected human health guideline criteria were noted at five locations for B(a)P (TEQ). One collected sample confirmed to contain asbestos as compressed fibre cement
- For Area 4, exceedances of selected human health guideline criteria were noted at one location for Pb, two locations for As, one location for PAH (sum of total), and 11 locations for B(a)P (TEQ).

Further discussion of this and a breakdown of design elements impacted by potential sources of contamination have been provided in Table 5-7, Table 5-8 and Table 5-9.

Some areas across the GreenWay are considered to be environmentally sensitive, including the Cadigal Reserve and bushcare sites along the study area. For Cadigal Reserve, there is a risk of exposure to ecological receptors where heavy metal and other analyte exceedances are found. A dust control plan written alongside the CEMP will likely be sufficient for control these risks and should include measures for covering exposed soils and capping measures.

Asbestos Management Reports were also written by CONSARA in 2016 for the remediation of asbestos in four bushcare sites along the Inner West Light Rail Extension Corridor. Mitigation measures and steps for removal of contamination across the site have been adopted and included in Section 7.

Table 5-7: Area 2 Contamination Risk Discussion (GHD, 2020 (1))

Design Element	Potential Risk Element	Discussion
Cantilevered structure from Parramatta Road underpass to the Cadigal Reserve Dog Park for approximately 60 m.	<ul style="list-style-type: none"> • ASS • Human Health –B(a)P (TEQ) • Ecological –EILS: heavy metals (Zn), ESLs: B(a)P, TRH (>C16-34) • Preliminary waste classification (no TCLP) – RSW, HW 	<ul style="list-style-type: none"> • Previous investigations have reported ASS to have the potential to be present in shallow soils in the area. Natural soils may require management during construction if disturbed • Exceedances of the human health criterion for B(a)P (TEQ) were reported for this area. Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works • One heavy metal exceedance (Zn) of the EIL criterion was reported and is not considered to pose a risk during construction works. Exceedances of the ESL criteria for B(a)P and TRH (>C16-34) were noted at all sites • Preliminary waste classifications of RSW and HW based were reported in this section. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.
On-grade shared paths foundations and footings generally in the area on an eastern alignment through Cadigal Reserve for 160 m long path plus path lighting poles at nominal 15 m spacings.	<ul style="list-style-type: none"> • ASS • Human Health –B(a)P (TEQ) • Ecological – EILS: heavy metals (Zn), ESLs: B(a)P, TRH (>C16-34) • Preliminary waste classification (no TCLP) – RSW, HW. 	<ul style="list-style-type: none"> • Construction works are expected to be shallow (or on grade) • Comments are as per the discussion section above.
Light pole foundations and footings generally in the area on an eastern alignment through Cadigal Reserve for 160 m at nominal 15 m spacings.	<ul style="list-style-type: none"> • ASS • Human Health –B(a)P (TEQ) • Ecological – EILS: heavy metals (Zn), ESLs: B(a)P, TRH (>C16-34) • Preliminary waste classification (no TCLP) – RSW, HW 	<ul style="list-style-type: none"> • Construction works are expected to be shallow • Comments are as per the discussion section above.
Foundations and footings for a minor 4 m wide, 9 m long single span bridge over the Hawthorne Canal at the southern end of Cadigal Reserve.	<ul style="list-style-type: none"> • ASS • Human Health –B(a)P (TEQ) • Ecological – EILS: heavy metals (Cu, Zn), ESLs: B(a)P • Preliminary waste classification with selected TCLP analysis - GSW 	<ul style="list-style-type: none"> • Previous investigations have reported ASS to have the potential to be present in shallow soils in the area. Natural soils may require management during construction if disturbed • Exceedances of the human health criterion for B(a)P (TEQ) were reported for this area. Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works • Heavy metal exceedances of ecological criteria for Cu and Zn were noted only for A2D_BH08. Exceedances of the ESL criterion for B(a)P was noted at all sites

Design Element	Potential Risk Element	Discussion
<p>Foundations and footings for a 75 m long elevated shared path structure on an eastern alignment at the southern end of Cadigal Reserve.</p>	<ul style="list-style-type: none"> • ASS • Human Health – heavy metals (Pb), asbestos • Ecological – EILs: heavy metals (As, Cu, Pb, Ni, Zn), ESLs: B(a)P, TRH (>C16-34) • Preliminary waste classification with selected TCLP analysis – GSW, and Special Waste – Asbestos. 	<ul style="list-style-type: none"> • The majority of samples reported for this section were slightly above the GSW classification levels and are classified as RSW, with one sample classified as HW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction. • Previous investigations have reported ASS to have the potential to be present in shallow soils in the area. Natural soils may require management during construction if disturbed • Exceedance of the human health criterion for Pb was noted for A2D_BH09 at 0.2 m bgl and was repeated at 0.5 m bgl. Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works • Asbestos was confirmed to be present in a sample of compressed fibre cement at A2D_BH09. It is considered likely that further asbestos may be encountered during construction and an asbestos management plan (AMP) will be required as part of a construction environment management plan (CEMP) • Heavy metal exceedances of EIL criteria were reported in this section. Exceedances of ESL criteria for B(a)P and TRH (>C16-34) were also reported • Preliminary waste classification for this area is Special Waste – asbestos, due to the presence of ACM. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.
<p>30 m long jacked culvert below Longport Street on an eastern alignment.</p>	<ul style="list-style-type: none"> • Human Health –B(a)P (TEQ) • Ecological – EILs: heavy metals (Ni), ESLs: B(a)P • Preliminary waste classification (no TCLP) - RSW 	<ul style="list-style-type: none"> • Exceedances of the human health criterion for B(a)P (TEQ) was reported for this section. Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works • Exceedances of ecological criteria were noted for Ni and B(a)P, but are considered unlikely to impact ecological receptors given that they were taken from the Longport Street overpass bridge and are not proximal to identified receptors • Preliminary waste classification for borehole A2D_LD04 indicates RSW for shallow material (0.5m bgl) and GSW for material at 2.0 m bgl. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.
<p>Wetland with 375 m2 footprint just south of Longport Street on eastern side of light rail tracks.</p>	<ul style="list-style-type: none"> • ASS • Ecological – EILs: heavy metals (As, Zn) • Preliminary waste classification (no TCLP) – RSW, HW. 	<ul style="list-style-type: none"> • Previous investigations have reported ASS to have the potential to be present in shallow soils in the area. Natural soils may require management during construction if disturbed • Minor exceedances of EIL guideline criteria were noted for As and Zn at two locations. There is a potential risk of exposure to ecological receptors during construction which may be managed as part of a dust control in the CEMP.

Design Element	Potential Risk Element	Discussion
<p>Stairs to Longport Street and tiered seating south of Longport Street on western side of light rail tracks.</p>	<ul style="list-style-type: none"> • ASS • Human Health – heavy metals (As), B(a)P (TEQ) • Ecological – EILs: heavy metals (As, Cu, Ni, Zn), ESLs: B(a)P, TRH (>C16-34) • Preliminary waste classification (no TCLP) – RSW, HW. 	<ul style="list-style-type: none"> • Previous investigations have reported ASS to have the potential to be present in shallow soils in the area. Natural soils may require management during construction if disturbed • Exceedances of the human health criteria for As and B(a)P (TEQ) were reported for this section. Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works • Heavy metal exceedances of EIL criteria and exceedances of ESL criteria for B(a)P and TRH (>C16-34) were reported for this section. There is a potential risk of exposure to ecological receptors during construction which may be managed as part of a dust control in the CEMP • Preliminary waste classifications for this section include RSW and HW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.

Table 5-8: Area 3 Contamination Risk Discussion (GHD, 2020 (1))

Design Element	Potential Risk Element	Discussion
30 m long culvert below Davis Street.	<ul style="list-style-type: none"> Ecological – ESLs: B(a)P, TRH (>C16-34) Preliminary waste classification (no TCLP) – GSW. 	<ul style="list-style-type: none"> Exceedances of ESL criteria for B(a)P and TRH (>C16-34) were reported for this section. Ecological receptors are unlikely to be impacted by these exceedances during construction works Preliminary waste classification for this section was GSW. Additional waste classifications will be required for material excavated during construction which requires off-site disposal.
Foundations and footings for 200 m long low-level elevated paths (<0.5 m high) and light pole foundations at nominal 15 m spacings from Davis Street to Johnson Park.	<ul style="list-style-type: none"> Human Health – B(a)P (TEQ) Ecological – EILs: heavy metals (As, Ni, Zn), ESLs: B(a)P, TRH (>C16-34) Preliminary waste classification with selected TCLP analysis – GSW. 	<ul style="list-style-type: none"> Exceedances of the human health criteria for B(a)P (TEQ) were reported for this section. Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works Exceedances of EIL criteria for heavy metals, and ESL criteria for B(a)P and TRH (>C16-34) were reported for this section. Ecological receptors are unlikely to be impacted by these exceedances during construction works Preliminary waste classifications for this section included GSW, RSW and HW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.
On-grade shared paths foundations and footings generally in the area in Johnson Park for 175 m shared paths.	<ul style="list-style-type: none"> Human Health – B(a)P (TEQ) Ecological – ESLs: B(a)P, TRH (>C16-34) Preliminary waste classification with selected TCLP analysis – GSW. 	<ul style="list-style-type: none"> Construction works are expected to be shallow (or on grade) Exceedances of the human health criteria for B(a)P (TEQ) were reported for this section. Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works Exceedances of EIL criteria for heavy metals, and ESL criteria for B(a)P and TRH(>C16-34) were reported for this section. Ecological receptors are unlikely to be impacted by these exceedances during construction works Preliminary waste classifications for this section included GSW and HW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.
Light pole foundations and footings generally in the area in Johnson Park for 175 m at nominal 15 m spacings.	<ul style="list-style-type: none"> Human Health –B(a)P (TEQ) Ecological – ESLs: B(a)P, TRH (>C16-34) Preliminary waste classification with selected TCLP analysis – GSW. 	<ul style="list-style-type: none"> Construction works are expected to be shallow.

Design Element	Potential Risk Element	Discussion
Retaining wall foundations and footings north of Constitution Road on the approach to the proposed culvert below Constitution Road – two 40 m long retaining walls to the north.	<ul style="list-style-type: none"> Human Health –B(a)P (TEQ) Ecological – EILs: heavy metals (Zn), ESLs: B(a)P, TRH (>C16-34) Preliminary waste classification (no TCLP) – RSW, HW. 	<ul style="list-style-type: none"> Exceedances of the human health criteria were reported for B(a)P (TEQ). Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works Exceedances of ecological criteria for zinc, B(a)P and TRH (>C16-34) were reported for this section. Ecological receptors are unlikely to be impacted by these exceedances during construction works Preliminary waste classifications for this section included RSW and HW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.
30 m long culvert below Constitution Road.	<ul style="list-style-type: none"> Human Health – asbestos Ecological – EILs: heavy metals (Zn), ESLs: B(a)P Preliminary waste classification (no TCLP) – Special Waste – asbestos, GSW. 	<ul style="list-style-type: none"> Asbestos was detected in one sample in this section. It is considered likely that further asbestos may be encountered during construction and an AMP will be required as part of a CEMP Exceedances of ecological criteria for zinc and B(a)P were reported for this section. Groundwater in Area 3 is deep (> 4.0 mbgl) and is unlikely to be impacted by these exceedances during construction works Waste classification for this section includes Special Waste – asbestos, and GSW. Further classification will be required to confirm this during construction.
150 m long high level elevated shared path from Constitution Road to south of New Canterbury Road.	<ul style="list-style-type: none"> Ecological – EILs: heavy metals (Zn), ESLs: B(a)P, TRH (>C16-34) Preliminary waste classification with selected TCLP analysis – GSW. 	<ul style="list-style-type: none"> Exceedances of ecological criteria for zinc, B(a)P and TRH (>C16-34) were reported for this section. Ecological receptors are unlikely to be impacted by these exceedances during construction works Preliminary waste classifications for this section included GSW, with RSW and limited HW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.

Table 5-9: Area 4 Contamination Risk Discussion (GHD, 2020 (1))

Design Element	Potential Risk Element	Discussion
Batter slopes or retaining wall foundations and footings for proposed 90 m long earthen ramps at northern end of the area to connect to Hercules Street.	<ul style="list-style-type: none"> • ASS • Human Health –B(a)P (TEQ) • Ecological – heavy metals (Zn), B(a)P, TRH (>C16-34) • Preliminary waste classification with selected TCLP analysis – GSW. 	<ul style="list-style-type: none"> • Based on the Atlas of Australian Acid Sulphate Soils classification, there is potential for ASS to be present within 100 m of the site. Natural soils may require management if disturbed during construction • Exceedances of the human health criteria were reported for B(a)P (TEQ). Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works • Exceedances of ecological criteria for zinc, B(a)P and TRH (>C16-34) were reported for this section. Ecological receptors are unlikely to be impacted by these exceedances during construction works • Preliminary waste classifications for this section included RSW, and HW. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.
On-grade shared paths foundations and footings generally in the area for 225 m.	<ul style="list-style-type: none"> • ASS • Human Health – Pb, B(a)P (TEQ), • Ecological – heavy metals (As, Cu, Ni, Zn), B(a)P, TRH (>C16-34) • Preliminary waste classification with selected TCLP analysis – GSW. 	<ul style="list-style-type: none"> • Construction works are expected to be shallow • ASS is likely to be present within 100 m of the site, however, ASS is unlikely to impact construction works at shallow levels. Groundwater at A4_BH02 is anomalously shallow (0.9 m bgl), and construction works exceeding this depth in the vicinity of this location may need to consider potential ASS • Only one heavy metal (Pb) exceedance of human health criteria was reported. Exceedances of the human health criteria were reported for B(a)P (TEQ). Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works • Exceedances of EIL criteria for heavy metals, and ESL criteria for B(a)P and TRH (>C16-34) were reported for this section • Preliminary waste classifications indicate GSW, RWS and HW for this section. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.
Light pole foundations and footings generally in the area for 225 m.	<ul style="list-style-type: none"> • ASS • Human Health – Pb, B(a)P (TEQ) • Ecological – EILs: heavy metals (As, Cu, Ni, Zn), ESLs: B(a)P, TRH (>C16-34) • Preliminary waste classification with selected TCLP analysis – GSW. 	<ul style="list-style-type: none"> • Construction works are expected to be shallow.

Design Element	Potential Risk Element	Discussion
<p>Batter slopes or retaining wall foundations and footings for proposed 95 m long earthen ramps at southern end of the area to connect to Hercules Street.</p>	<ul style="list-style-type: none"> • ASS • Human Health –B(a)P (TEQ), PAHs (sum of total) • Ecological – EILs: heavy metals (As, Cu, Ni, Zn), ESLs: B(a)P, TRH (>C16-34) • Preliminary waste classification (no TCLP) – HW. 	<ul style="list-style-type: none"> • Based on the Atlas of Australian Acid Sulphate Soils classification, there is potential for ASS to be present within 100 m of the site. Natural soils may require management if disturbed during construction • Exceedances of the human health criteria were reported for B(a)P (TEQ) and PAHs (sum of total). Appropriate exposure control measures should be implemented as part of a health and safety plan during construction works • Exceedances of ecological criteria for heavy metals, B(a)P and TRH (>C16-34) were reported for this section • Preliminary waste classifications indicate HW for this section. Based on the results of selected TCLP analysis, the soil may be reclassified as GSW, however, further classification will be required to confirm this during construction.

5.2.3 Mitigation Measures

Table 5-10: Mitigation measures for contamination

Environmental Aspect	Mitigation Measures
<p>Incidental discovery or disturbance of soil contamination.</p>	<ul style="list-style-type: none"> • Undertake works in accordance with recommendations of the Preliminary Site Investigation (GHD, 2020). • If contaminated soils are uncovered during the works, cease all works within the vicinity of the find and notify the Council Project Manager immediately. • Develop a site-specific Asbestos Management Plan for the Works. • If friable asbestos is deemed to be present or likely on the site, implement the following procedure: <ul style="list-style-type: none"> ○ Cease works and cover the exposed area with substantial plastic sheeting that is securely anchored to the ground surface and enclose within a barrier to prevent access. ○ Notify the Site Manager immediately. ○ The Site Manager is to determine if appropriate signage should be displayed to warn of the presence of these materials. ○ The Site Manager is to contact a suitably qualified Occupational Hygienist to provide further advice. ○ Do not undertake further works on the Site until the Site Manager has provided approval for Low Level Disturbance works to re-commence. • Undertake asbestos removal works in accordance with the requirements of the relevant OH&S regulations and NSW Workcover (Consara, 2016). • Obtain a Bonded Asbestos Licence from NSW Workcover (or as superseded at the time of works) to remove, repair or disturb more than 10 m² of bonded asbestos material such as fibro, corrugated cement sheeting and asbestos cement pipes. • If the removal, repair or disturbance of any amount of friable asbestos, such as sprayed limpet, asbestos cloth, millboard and pipe lagging is proposed, obtain a Friable Asbestos Licence from NSW Workcover. This licence also allows the removal of bonded asbestos (Consara, 2016). • Notify NSW WorkCover seven days before removing bonded asbestos. A work site permit from NSW WorkCover must be obtained before removing any friable asbestos. Applications must be lodged at least seven days before the proposed work is due to start (Consara, 2016).
<p>Pollution of soils from chemical spills (e.g. fuel or oil from machinery).</p>	<ul style="list-style-type: none"> • For any excess spoil material which requires offsite disposal, formally classify waste before being taken to an appropriately licensed landfill in accordance with the EPA (2014) Waste Classification Guidelines. • Store all chemicals (e.g. fuel, oil) in appropriate bunding/storage systems within the approved storage facility. • Ensure appropriate spill kits are carried with the equipment. • Establish dedicated refuelling areas outside environmentally sensitive areas and away from creek lines. These areas are to be bunded to ensure any spills do not enter these sensitive areas.

5.3 Flooding, Waterways and Aquatic Habitat

5.3.1 Existing Environment

The GreenWay follows two watercourses and links two significant waterways – the Cooks River and Iron Cove. From New Canterbury Road to the north, the GreenWay follows Hawthorne Canal, while from New Canterbury Road to the south, the GreenWay follows an unnamed tributary of the Cooks River. Both of these water courses have been piped or channelised for much of their length. For ease of description, the existing environment has been split into these two catchments.

5.3.1.1 Hawthorne Canal Catchment

In the Central Links area, the study area is intersected by a first order stream (Strahler classification) which is known as the Hawthorne Canal. North of the works area, the waterway is also classified as Key Fish Habitat, but no impacts within this area are proposed.

The topography within the catchment varies from steep surface slopes in excess of 15% in the upper catchment to the near flat in the lower catchment in areas adjacent to Long Cove Creek (Hawthorne Canal). The catchment therefore has regions where surface water runoff within the road network has high velocity with shallow depths, whilst in the lower catchment surface water is more likely to pond in sag points with typically lower flow velocities. The lower reaches of the catchment fringing Iron Cove are potentially affected by elevated water levels within Sydney Harbour.

A Floodplain Risk Management Plan for the Dobroyd Canal and Hawthorne Canal was developed by WMA Water (2019) which follows on from a 2014 Floodplain Risk Management Study (WMA Water) for the area. The Plan outlines the flood risks within the catchment, including flood hazard, identification of known flooding issues and hotspots and emergency response during a flood event.

The light rail corridor closely follows the path of the Hawthorne Canal which drains the surrounding catchment. The light rail corridor is subject to flooding between Constitution Road and Davis Street as well as in Lewisham West, upstream of Longport Street. Low lying areas adjacent to the light rail corridor including in Terry Road, and Pigott Street are subject to flooding during minor storm events. In major storm events significant overland flow paths develop flowing into the light rail corridor through Williams Parade, Terry Road, Hudson Street and Smith Street. In storms above the 10% AEP event, much of the light rail corridor between Constitution Road and Davis Street would be inundated.

The Old Canterbury Road embankment has two paths of conveyance through it. The first is through a culvert attached to the open channel network, with a cross sectional area of approximately 4.5 m². The second is through the railway underpass parallel to and located to the west of the open channel. Upstream of the Old Canterbury Road embankment, the existing culvert has an invert elevation of 7.8 m AHD and the railway underpass has an elevation of approximately 12.8 m AHD. Therefore, flow that cannot be immediately conveyed through the culvert does not redirect through the light rail underpass until flood levels reach 12.8 m AHD.

Similarly, the Longport Street embankment has two paths of conveyance through it. The primary path of conveyance is through a culvert attached to the open channel network, with a cross-sectional area of approximately 11.6 m². The secondary path of conveyance is through the light rail underpass parallel to and located to the east of the open channel. Upstream of the Longport Street embankment, the existing culvert has an invert elevation of 2.37 m AHD and the light rail track has an elevation of

approximately 9.5 m AHD. Therefore, flow that cannot be immediately conveyed through the culvert does not redirect through the light rail underpass until flood levels reach 9.5 m AHD.

Where the open channel crosses Parramatta Road, there are two hydraulic control structures. The first occurs approximately 4 m upstream of the road bridge in the form of a steel beam and water supply pipe crossing perpendicular to the open channel. The underside of the steel beam was 2.51 m AHD and the obvert height of the pipe was 3.54 m AHD. The second is the road bridge that has an underside height of 5.2 m AHD (taken from the underside of steel beams supporting services under the Parramatta Road Bridge). The structure 4 m upstream of Parramatta Road is the primary control structure at this location, with peak flood levels upstream of 3.23 m AHD and downstream of 3.17 m AHD for the 1% Annual Exceedance Probability, 2.79 m AHD upstream and 2.71 m AHD downstream for the 5% Average Exceedance Probability (AEP), 2.37 m AHD upstream and 2.30 m AHD downstream for the 20% AEP.

5.3.1.2 Cooks River Catchment

The Southern Links study area is located within the Cooks River Catchment. The Tennyson Street Drainage Study for Marrickville Council (Cardno, 2009) describes the sub-catchment local to the GreenWay and south of New Canterbury Road, known as the Tennyson Street sub-catchment. This sub-catchment is moderately sloping in the upper sections, becoming flatter in the lower reaches near the Cooks River. The drainage system within the Tennyson Street catchment comprises a mixture of pipe, covered conduit and open channel sections, generally following a valley of east of Hercules Street. The drainage system then flows directly into the Cooks River through several pipe outlets in the Marrickville Golf Course. Overland flows also discharge to the river through the Golf Course (Cardno, 2009).

The light rail corridor is subject to localised flooding around the Dulwich Grove light rail stop as well as along the corridor behind Hercules Street. Stormwater frequently inundates the backyards of low-lying properties in Hercules Street. Minor flooding occurs in the sag point at the southern end of Hercules Street, Dulwich Hill, which affects the grounds of three private properties during the 10-year Average Recurrence Interval (ARI) flood or larger (Cardno, 2009).



Figure 5-1: Mapped watercourses (Strahler stream order) within the study area

5.3.2 Impact Assessment

5.3.2.1 Hawthorne Canal Catchment

Due to the proposed construction of the path suspended over the Hawthorne Canal near Parramatta Road, a Flood Impact Assessment for the construction of the GreenWay Shared Path was developed by WMA Water In 2020 to quantify the impacts of the proposed works.

Two alternative structures for the shared path at the crossing of the open channel on Parramatta Road were considered, one being the construction of piers and the other being a suspended cantilever structure. The following aspects were considered:

- the relocation of a 500 mm water main just south of Parramatta Road
- the relocation and replacement of the pedestrian bridge north of Longport Street
- culverts through the embankments at Longport Street and Old Canterbury Road
- two alternative support structures for the crossing of the channel at Parramatta Road (referred to as Option 1 and Option 2).

The culverts through the existing embankments at Longport Street and Old Canterbury Road result in no impact of flood behaviour in the events assessed as the culverts sit above the 1% AEP flood level. Similarly, the culvert proposed through the existing embankment at Constitution Road (21.6 m AHD) is unlikely to impact of flood behaviour in the events assessed as the culverts sit above the 1% AEP flood level (21.4 m AHD).

The culvert proposed through the existing embankment at Davis Street (18.5 m AHD) is marginally below the 1% AEP flood level (18.8 m AHD) but set above the adjacent ground levels of the light rail underbridge (17.8 m AHD) and the adjacent Hawthorne Canal. During major storm events, stormwater would first overtop the channel, then flow through the light rail underbridge before eventually flowing through the proposed culvert. The impacts of this have not been modelled.

The relocation of the 500 mm water main was shown to slightly decrease flood levels in the 1% AEP event under both Options, 0.03m and 0.07m, for Options 1 and 2, respectively. The extent of this minor flood level reduction was more significant under Option 2, extending from Longport Street to Parramatta Road. Under Option 1 the benefit is offset by the negative impacts as a result of the piers.

Under Option 1, there is an increase in peak flood levels of up to 0.05 m in the 1% AEP event associated with the proposed piers. This impact reduces to 0.04 m and 0.0 m in the 5% AEP and 20% AEP events, respectively. In comparison, the relatively minor obstruction presented by the cantilever structure under Option 2 increases flood levels by less than 0.01 m and to a lesser extent in the 1% AEP, 5% AEP and 20% AEP events. The replacement of the pedestrian bridge 80 m north of Longport Street decreased flood levels by up to 0.07 m under Option 1 and at 0.08m under Option 2 in the 1% AEP event. This element did not impact on the 5% AEP and 20% AEP events.

Minor stormwater drainage works are proposed at the bottom of Terry Road, Dulwich Hill to ameliorate flooding in this location. This is likely to reduce flooding in small storm events but will have negligible effect in larger storm events due to the constraints in the downstream storm water system. A constructed wetland is proposed in the Lewisham West area, to the south east of the light rail stop. This wetland will re-establish important habitat for water and wading birds.

Construction in and adjacent to the Hawthorne Canal has the potential to negatively impact waterways and cause downstream impacts if appropriate mitigation measures are not in place. It is recommended that an Erosion and Sediment Control Plan be developed to reduce the risk of mobilising sediment during operations within the Hawthorne Canal.

As works will be conducted outside of mapped KFH, permits or consultation under the FM Act will not be required, but strict measures should be in place to ensure risks of sedimentation within the waterway are reduced.

5.3.2.2 Cooks River Catchment

Minor improvements to the stormwater channel are also proposed in the light rail corridor behind Hercules Street, Dulwich Hill, to ameliorate flooding in the location. This is likely to reduce flooding in small storm events but will have negligible effect in larger storm events due to the constraints in the downstream storm water system.

Construction in the Cooks River catchment has the potential to negatively impact waterways and cause downstream impacts if appropriate mitigation measures are not in place. It is recommended that an erosion and sediment control plan be developed to reduce the risk of mobilising sediment during operations within the Cooks River catchment.

As works will be conducted outside of mapped KFH, permits or consultation under the FM Act will not be required, but strict measures should be in place to ensure risks of sedimentation within the waterway are reduced.

5.3.3 Mitigation Measures

Table 5-11: Mitigation measures for flooding and waterways

Environmental Aspect	Mitigation Measures
Increase in sediment flow into waterways	<ul style="list-style-type: none"> Wash all equipment, including, erosion and sediment control measures and trailers to prevent spread of exotic species. Conduct a visual check for vegetation and seeds on all equipment machinery used in the activities before work commences.
Flood impact	<ul style="list-style-type: none"> Check weather forecasts daily to ensure that work is not carried out before or during high rainfall. Undertake work from within the Hawthorne Canal in accordance with any requirements of Sydney Water.
Reduction in water quality	<ul style="list-style-type: none"> Store all chemicals (e.g. fuel, oil) offsite. If required to be stored onsite, store chemicals in appropriate bunding/storage systems, outside of the riparian zones and only for short periods. Ensure appropriate spill kits, are present onsite. Ensure all equipment is in good working order. Carry associated Safety Data Sheets (SDS) for all chemicals. Do not use any chemicals that are labelled as ‘Class 9 Environmentally hazardous’ as part of the proposed activities. Do not stockpile rubbish or store chemicals near native vegetation or waterways. Limit the use of fuel, chemicals and herbicides near waterways and other sensitive areas.

5.4 Biodiversity

The study area has been the subject of a number of biodiversity assessments in recent years, including:

- Ecological assessment: Sydney Light Rail Extension Stage 1 (Parsons Brinckerhoff 2010)
- Cooks River to Iron Cove Revegetation and Bushcare Plan (Eco Logical Australia 2011)
- GreenWay Biodiversity Strategy (Australian Wetlands Consulting Pty Ltd 2012)
- Cooks to Cove GreenWay – Missing Links Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd (AWC) 2018)
- Biodiversity Development Assessment Report (Cardno 2019)
- Australian Museum Business Services 2007 Fauna Study
- Yuppie Bandicoots of inner western Sydney (Tanya Leary et al 2010)
- Inner West Light Rail Expansion Bandicoot Study (Price and Banks 2016)
- Balmain flora and fauna assessment (Biosis 2012)
- Microbat survey Balmain Tunnel (Eco Logical Australia 2013)
- Cadigal Reserve Eastern Bentwing Bat roost (Narawan Williams 2017)
- Lewisham Light Rail upgrade (Eco Logical Australia 2018)
- Monitoring of Eastern Bentwing Bats in Cadigal Reserve (Hochuli et al 2019).

To accompany this REF, a Flora and Fauna Assessment (FFA) and subsequent BDAR were prepared by ELA (2021) and are summarised below. Detailed survey methodology and results can be found within the respective reports, which can be found in Appendix E and Appendix F respectively.

5.4.1 Existing Environment

5.4.1.1 Vegetation Communities

The vegetation within the study area has been substantially modified due to a long history of vegetation clearance and disturbance. The literature review identified that the study area lacks areas mapped as part of native vegetation communities (Figure 5-2). Additionally, the historic 1943 aerial photography demonstrates the vegetation has been substantially cleared and modified. Vegetation has since been established through revegetation works. The selection of species for revegetation works has resembled some characteristic species of pre-European locally indigenous ecological communities. Under the Biodiversity Assessment Method (BAM), all vegetation native to NSW requires consideration as to the ‘best fit’ Plant Community Type (PCT). Therefore, both areas of revegetation and landscaped native vegetation were assigned to PCTs listed in Table 5-12 and shown in Figure 5-3 - Figure 5-7.



Figure 5-2: Previously mapped vegetation communities within the study area (OEH, 2016)

Table 5-12: Summary of vegetation zones recorded within the study area

PCT	Condition	Area within development site (ha)	Description
PCT 1232 Coastal Freshwater Swamp Forest	Planted	0.20	<p>This vegetation zone was located to the east and west of the existing pedestrian pathway, between Hawthorne Canal and Taverners Hill station. This site has not been previously identified as a bushcare site, however, literature has indicated that this site was subject to revegetation works for the GreenWay project.</p> <p>The native vegetation resembles some characteristic species of PCT 1232, including a dominant canopy of <i>Casuarina cunninghamiana</i> (River Oak), <i>C. glauca</i> (Swamp Oak) and occasional <i>Melaleuca styphelioides</i> (Prickly-Leaved Tea Tree) and <i>Glochidion Ferdinandi</i> (Cheese Tree). Non—locally indigenous native species to PCT 1232 have been incorporated into the GreenWay landscaping such as <i>Angophora costata</i> (Sydney Red Gum), <i>Pittosporum undulatum</i> (Sweet Pittosporum), <i>Ficus rubiginosa</i> (Port Jackson Fig), <i>F. fraseri</i> (Sandpaper Fig) and <i>Banksia integrifolia</i> (Coast Banksia). Clusters of <i>Lomandra longifolia</i> (Spikey Mat-rush) were interspersed with weeds, such as <i>Parietaria judaica</i> (Asthma Weed).</p>
PCT 1281 Turpentine-Ironbark Forest	Planted	1.42	<p>This vegetation zone corresponded to bushcare sites with established native plantings. The field survey identified that the vegetation within the bushcare site varied from areas with an intact canopy and mixed ground layer or dense weeds (<i>Ligustrum lucidum</i> (Large-Leaved Privet)). The largest patch of vegetation zone 2 was represented within the northern section of the development site in Cadigal Reserve.</p> <p>The vegetation within vegetation zone 2 resembles some characteristic species of PCT 1281 Sydney-Turpentine Ironbark Forest such as <i>Syncarpia glomulifera</i> (Turpentine), <i>Acacia parramattensis</i> (Parramatta Wattle), <i>Breynia oblongifolia</i> (Coffee Bush), <i>Bursaria spinosa</i> (Blackthorn) and <i>Lomandra longifolia</i>. However, the remaining native species present in this vegetation zone did not conform to PCT 1281. These include <i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>Melaleuca quinquenervia</i> (Broad-leaved Paperbark) and <i>M. styphelioides</i> (Prickly Paperbark).</p>
Native vegetation (no corresponding PCT)	planted	0.77	<p>This vegetation zone was present as native vegetation in highly modified environments. This includes planted native street trees and shrubs in highly modified or weed infested habitats.</p> <p>Planted street trees include <i>Lophostemon confertus</i> (Brush Box), <i>Ficus rubiginosa</i> and <i>Melaleuca</i> species. These areas were located within parkland or were present as overhanging canopy from street verge plantings. Planted street trees lacked a native ground cover or midstorey layer.</p> <p>Native shrubs include <i>Pittosporum undulatum</i> and <i>Acacia parramattensis</i> and <i>A. decurrens</i>. These native shrubs were often located in areas where the soil profile has been substantially modified such as rail batters. These areas contain dense weed blooms such as <i>Ligustrum lucidum</i> and <i>L. sinensis</i> and lacks the presence of other native species.</p>



Figure 5-3: Validated vegetation communities within the study area (1 of 5) (ELA, 2020)



Figure 5-4: Validated vegetation communities within the study area (2 of 5) (ELA, 2020)

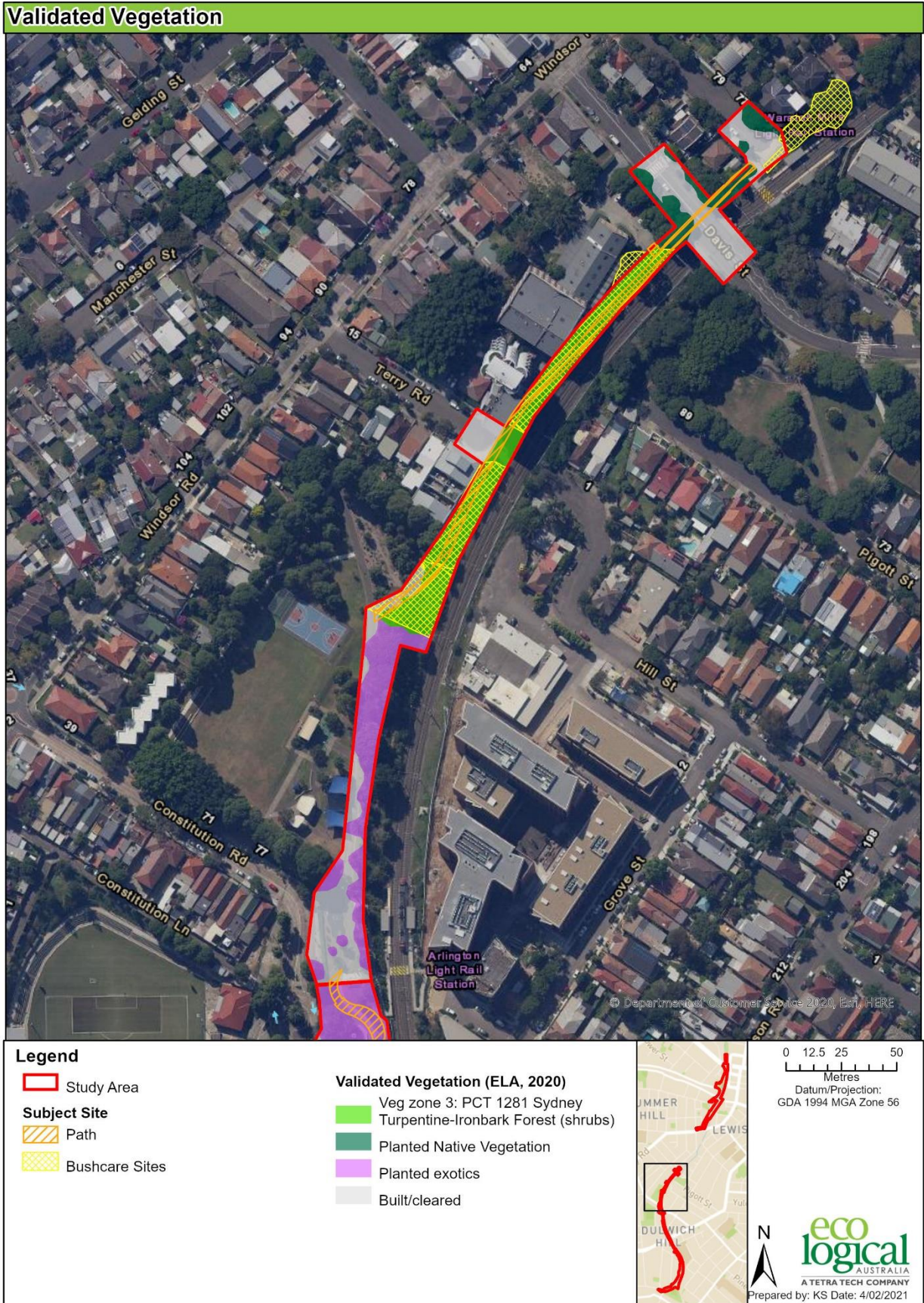


Figure 5-5: Validated vegetation communities within the study area (3 of 5) (ELA, 2020)

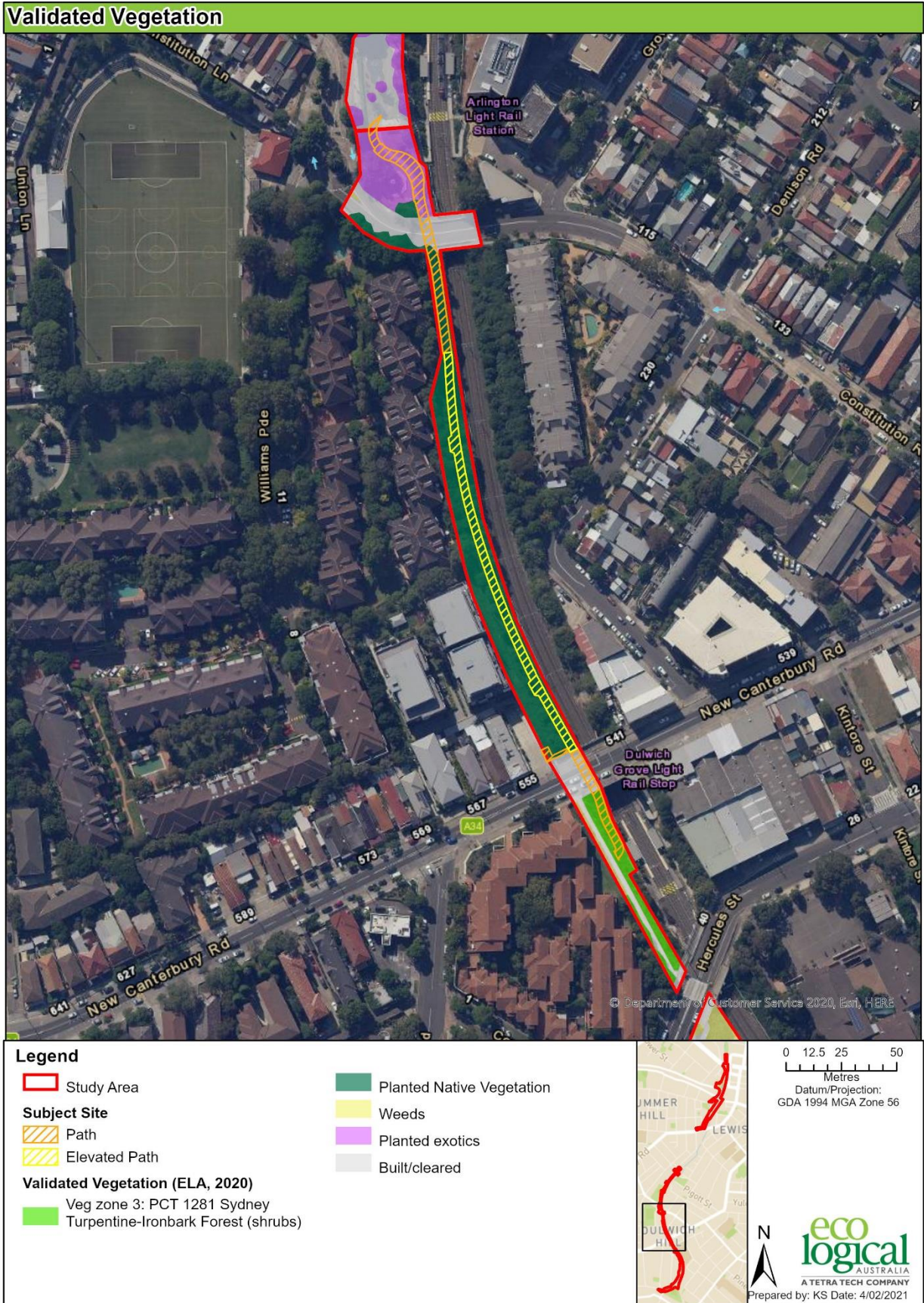


Figure 5-6: Validated vegetation communities within the study area (4 of 5) (ELA, 2020)



Figure 5-7: Validated vegetation communities within the study area (5 of 5) (ELA, 2020)

5.4.1.1.1 Threatened Ecological Communities

The BioNet Vegetation Classification lists PCT 1232 Coastal Freshwater Swamp Forest and PCT 1281 Sydney Turpentine-Ironbark Forest as comprising of Threatened Ecological Communities (TECs); however, the vegetation did not meet the TEC criteria for listing under the BC Act or EPBC Act (Table 5-13). Justifications for each PCT are provided below.

Table 5-13: Threatened Ecological Communities

PCT ID	BC Act			EPBC Act		
	Listing status	Name	Area (ha)	Listing status	Name	Area (ha)
1232	EEC	<i>Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</i>	0*	EEC	<i>Coastal Swamp Oak (Casuarina glauca) Forest of the South-east Queensland and New South Wales</i>	0*
1281	CEEC	<i>Sydney Turpentine Ironbark Forest</i>	0*	CEEC	<i>Turpentine-Ironbark Forest</i>	0*

CEEC – CRITICALLY ENDANGERED ECOLOGICAL COMMUNITY

EEC – ENDANGERED ECOLOGICAL COMMUNITY

* NOTE THAT PCTS DID NOT SATISFY THE REQUIREMENTS FOR LISTING UNDER THE BC ACT OR EPBC ACT.

PCT 1232: Coastal Freshwater Swamp Forest

Components of *PCT 1232 Coastal Freshwater Swamp Forest* may represent *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* which is listed as an endangered ecological community under the BC Act and listed as part of the *Coastal Swamp Oak (Casuarina glauca) Forest of the South-east Queensland and New South Wales* endangered ecological community under the EPBC Act.

The vegetation mapped as part of *PCT 1232 Coastal Freshwater Swamp Forest* in the development site is a landscaped environment in a narrow linear raised garden bed which is not natural habitat. The vegetation has been established for the purpose of providing native landscaping and was not conducted as part of revegetation works to re-establish this TEC into the landscape. However, the vegetation contains representative species of PCT 1231 and as such has been mapped as part of a PCT for this BDAR.

According to the Final determination for *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* under the BC Act this community is associated with saline environments subject to periodic flooding/ inundation. Although Hawthorne Canal is tidal, the vegetation is located above the high tide mark and the vegetation is not subject to inundation. Additionally, it is noted that the soil profile has been substantially modified. According the literature review (AWC 2012) the pre-European vegetation along Hawthorne Canal was previously present as Mangrove species and was established using some characteristic species of PCT 1232 as part of the GreenWay corridor.

The vegetation mapped as part of *PCT 1232 Coastal Freshwater Swamp Forest* within the development site does not constitute as part of a TEC under the BC Act for the following:

- The vegetation been established through landscaping works
- It does not contain remnant or regenerating native vegetation
- It contains some indicative species of the TEC from unknown source of genetic material
- It does not contribute to the extent of *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*
- It does not provide a functioning ecological community with natural regeneration.

The criteria for listing this ecological community as part of the *Coastal Swamp Oak (Casuarina glauca) Forest of the South-east Queensland and New South Wales* endangered ecological community under the EPBC Act is more stringent than the BC Act criteria for listing. Under the EPBC Act, small or degraded patches are excluded from the national protection (Department of Environment and Energy (DoEE) 2018). The vegetation within the development site does not satisfy the listing under the EPBC Act as the patch size is less than 0.5 ha, it does not meet the key diagnostic and does not have a predominantly native understorey.

PCT 1281: Sydney Turpentine-Ironbark Forest

The BioNet Vegetation Classification system identifies that PCT 1281 may conform to *Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion* listed as critically endangered under the BC Act and listed as part of the *Turpentine-Ironbark Forest in the Sydney Basin Bioregion* under the EPBC Act if it meets the criteria for listing.

Planted vegetation which resembles TECs lack the diverse assemblage of characteristic species of the TEC, they also do not function as part of an ecological community (as opposed to landscaped environments) and often do not display evidence of regeneration. The vegetation within the development site resembles some characteristic species of *Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion* however, the landscape has been substantially modified and represents a high percentage of weeds and non-indigenous native species. As such the vegetation does not represent part of the state listing TEC. PCT 1281 was mapped as part of a PCT as the vegetation was established as part of rehabilitation works and does not meet the definition of planted native vegetation as per Appendix D of the BAM.

The criteria for listing as part of the Turpentine-Ironbark Forest under the EPBC Act states that only remnant, intact patches are considered for listing under the national protection, these include (Threatened Species Scientific Committee 2005):

- Vegetation contains characteristic species in all structural layers
- Tree canopy is > 10% and remnant size is > 1 ha
- If tree canopy is less than 10% then patch is > 5 ha patch.

Although the vegetation had a canopy > 10% the patch size was not greater than 1 ha. The vegetation does not satisfy listing under the BC Act or EPBC Act.

5.4.1.1.2 Priority Weeds and Weeds of National Significance (WoNS)

Of the weeds identified during field surveys, six species are listed as State priority weeds, three species are listed as regional level priority weeds and 20 are listed as other weeds of regional concern. The

weeds present, their priority listing under the Act, their associated asset/value at risk and whether they are WoNS, are present in Table 5-14.

Table 5-14: State level determined priority weeds and other weeds of concern present

Scientific name	Common name	WONS	Priority weed obligations
State level priority weeds			
<i>Anredera cordifolia</i>	Madeira Vine	Yes	Asset protection ¹
<i>Genista monspessulana</i>	Cape Broom	Yes	Asset protection ¹
<i>Lantana camara</i>	Lantana	Yes	Asset protection ¹
<i>Olea europaea subsp. cuspidata</i>	African Olive	Yes	Containment ¹
<i>Rubus fruticosus agg.</i>	Blackberry	Yes	Asset protection ¹
<i>Senecio madagascariensis</i>	Fireweed	Yes	Asset protection ¹
Regional level priority weeds			
<i>Arundo donax</i>	Giant Reed	No	Asset protection ¹
<i>Cestrum parqui</i>	Green Cestrum	No	Asset protection ¹
<i>Cortaderia jubata</i>	Pampas Grass	No	Asset protection ¹
Weeds of Other Regional Concern			
<i>Acetosa sagittata</i>	Turkey Rhubarb	No	Environment ²
<i>Ageratina adenophora</i>	Crofton Weed	No	Environment, Agriculture ²
<i>Araujia sericifera</i>	Moth Vine	No	Environment ²
<i>Cardiospermum grandiflorum</i>	Balloon Vine	No	Environment ²
<i>Cenchrus clandestinus</i>	Kikuyu	No	Environment ²
<i>Celtis sinensis</i>	Chinese Celtis	No	Environment, Agriculture ²
<i>Cinnamomum camphora</i>	Camphor Laurel	No	Environment, Agriculture, Human Health ²
<i>Chloris gayana</i>	Rhodes Grass	No	Environment ²
<i>Cotoneaster spp.</i>	Cotoneaster spp.	No	Environment ²
<i>Eragrostis curvula</i>	African Lovegrass	No	Environment ²
<i>Erythrina x sykesii</i>	Coral Tree	No	Environment ²
<i>Ipomoea indica</i>	Blue Morning Glory	No	Environment, Human Health ²
<i>Ligustrum lucidum</i>	Broad-leaf Privet	No	Environment, Human Health ²
<i>Ligustrum sinense</i>	Small-leaf Privet	No	Environment, Human Health ²
<i>Parietaria judaica</i>	Asthma Weed	No	Environment, Human Health ²
<i>Phyllostachys spp.</i>	Bamboo	No	Environment ²
<i>Phoenix canariensis</i>	Phoenix Palm	No	Environment ²
<i>Ochna serrulata</i>	Ochna	No	Environment ²
<i>Solanum mauritianum</i>	Wild Tobacco Bush	No	Environment/ Agriculture ²
<i>Tradescantia fluminensis</i>	Trad	No	Environment ²

¹ MANDATORY MEASURE (WHOLE OF NSW)

² REGIONAL STRATEGIC RESPONSE

5.4.1.2 Threatened Flora and Fauna

The search for threatened species using the Protected Matters Search Tool and BioNet (Atlas of NSW Wildlife) (within a 5 km buffer around the study area) and the review of literature resulted in a list of 6 threatened ecological communities, 22 threatened flora species and 94 threatened or migratory fauna species (including 4 amphibians, one insect, 12 mammals and 77 birds) and one endangered population, which are shown in Figure 5-8.

There are three threatened fauna species previously recorded from BioNet records within and adjacent to the study area:

- Large Bent-winged Bat
- Grey-headed Flying-fox
- Long-nosed Bandicoot endangered population in the inner western Sydney.

There are no threatened flora species BioNet records identified from within the study area. The majority of the BioNet records within a 5 km radius of the study area are historical records:

- *Wilsonia backhousei* (Narrow-leafed Wilson) recorded in 1905
- *Tetraloche juncea* (Black-eyed Susan) 1905 – 1913
- *Acacia bynoeana* (Bynoe's Wattle) 1913
- *Melaleuca deanei* (Deane's Paperbark) 1901-1912.

The exception is *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) recorded in 2006. This species has a highly restricted distribution in the New England Tablelands, although it is widely used as cultivar for street plantings around Sydney. *Eucalyptus nicholii* is not considered a locally indigenous species to the study area.

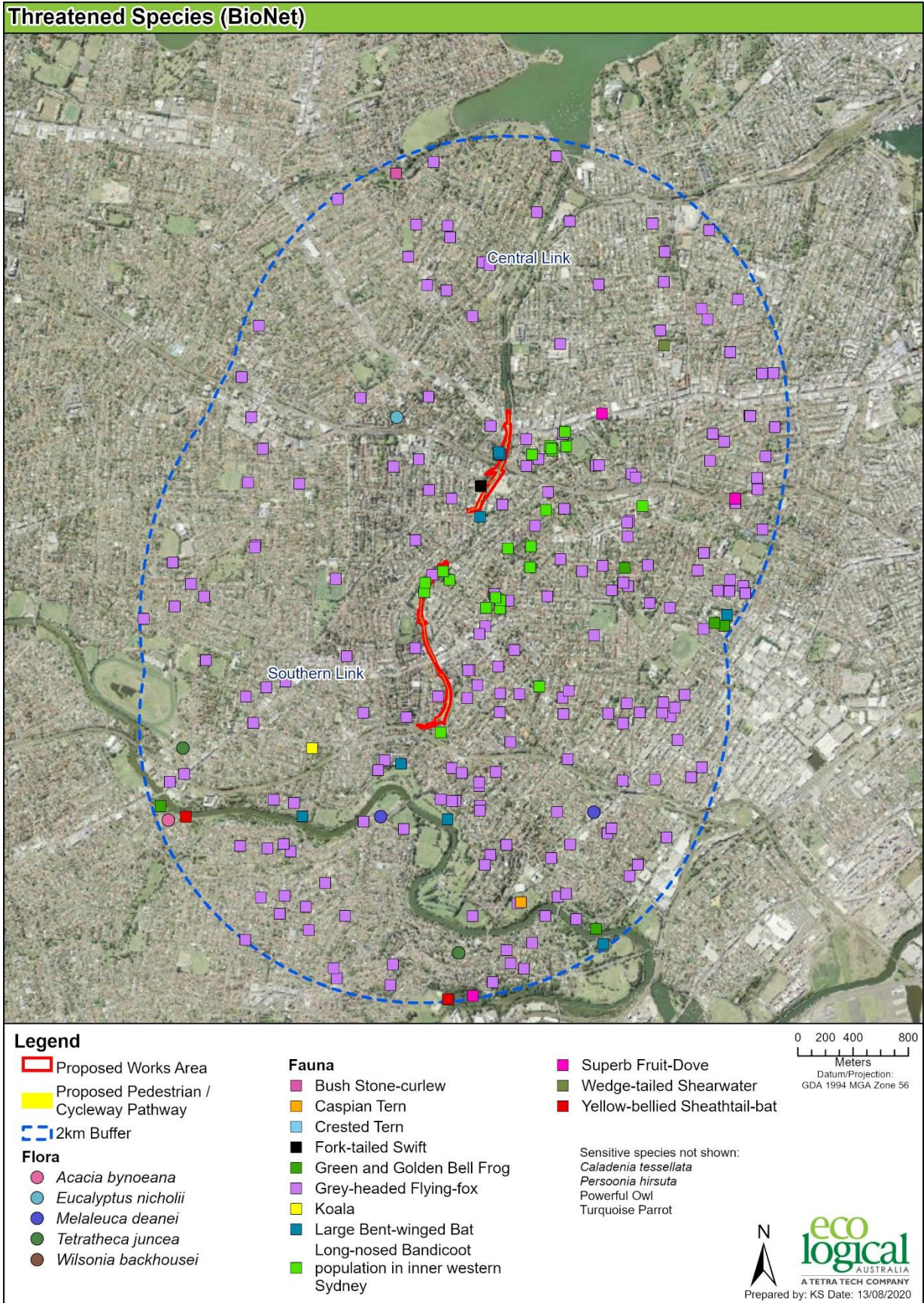


Figure 5-8: Previously recorded threatened species within the study area

5.4.1.2.1 Threatened Flora

No threatened flora species were recorded within the study area during field surveys. The vegetation within the study area has been significantly disturbed and is unlikely to support habitat for threatened species.

5.4.1.2.2 Threatened Fauna

The development site contains limited habitat features such as hollow-bearing trees (HBTs), fallen logs, aquatic habitats or large patches of intact mature native vegetation. Two mature trees which contain nest-boxes were located in the Central Link of the development site.

One Grey-headed Flying-fox was observed roosting within a *Cinnamomum camphora* (Camphor Laurel) during the field surveys. The trees within the development site may be used as potential seasonal foraging habitat for the Grey-headed Flying-fox. The nearest nationally important camp is located at Wollie Creek within 3 km of the development site. The individual located within the development site does not represent a breeding camp. It is likely that suitable breeding habitat would be present outside the development site in this core area. Camps have never been recorded or observed within this development site. Additional habitat resources in the form of planted street trees was recorded in the locality of the development site and may provide supplementary foraging habitat for this species.

The habitat assessment did not record any direct or indirect evidence of the *Long-nosed Bandicoot population in inner western Sydney* endangered population. This species has previously been recorded within the development site prior to the installation of the Light Rail in 2015. There has been no credible recording of a Long-nosed Bandicoot in the inner western Sydney region despite recent targeted surveys. It has been noted during literature review of previous targeted surveys for the Long-nosed Bandicoot that the numbers of cats and foxes within the development site may have contributed to the reduction in bandicoots. Surveys conducted by ELA in association with the Inner West Light Rail project between 2011 and 2015 failed to provide direct (living Long-nosed Bandicoots) or indirect (diggings, nests, fur, scats or a carcass) evidence of Long-nosed Bandicoots. Despite the lack of records, the development site contains native and exotic vegetation which may be used by Long-nosed Bandicoots for connectivity between foraging and sheltering habitat. No targeted surveys were conducted for this species for this current project as literature review and habitat assessment did not identify potential habitat for this endangered population.

Numerous man-made structures such as stormwater drains, culverts and bridges were also identified within the study area. These man-made structures commonly provide potential habitat for several microbat species in an urban and peri-urban setting (Churchill 2008). The majority of structures inspected during the site visit contained some potential roosting habitat for microbats within expansion joints between culvert cells and lifting holes, or within gaps and joints between bricks. Most of these structures were unlikely to support large aggregations of any microbat species for any length of time due to the risk of flooding through the culverts and stormwater drains or exposure to disturbance from humans and predators such as cats, dogs and foxes.

The results of targeted surveys are presented in Table 5-15 below.

Table 5-15: Results of targeted survey and credit requirements.

Target species	Common name	Species recorded during survey	Species credits required
FLORA			
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	No	This species was not recorded within the development site. Furthermore, due to an absence of records and lack of suitable habitat, it is unlikely to occur within the development site.
<i>Hibbertia puberula</i>	-	No	This species was not recorded within the development site. Furthermore, due to an absence of records and lack of suitable habitat, it is unlikely to occur within the development site.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	No	This species was not recorded within the development site. Furthermore, due to an absence of records and lack of suitable habitat, it is unlikely to occur within the development site.
<i>Hibbertia puberula</i>	-	No	This species was not recorded within the development site. Furthermore, due to an absence of records and lack of suitable habitat, it is unlikely to occur within the development site.
<i>Hibbertia superans</i>	-	No	This species was not recorded within the development site. Furthermore, due to an absence of records and lack of suitable habitat, it is unlikely to occur within the development site.
<i>Rhodamnia rubescens</i>	Scrub Turpentine	No	This conspicuous species was not recorded within the development site during targeted surveys. It is unlikely to occur within the development site.
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	No	It is noted that the survey period for this species did not coincide with current surveys. However, targeted surveys conducted by Cardno (2019) within the survey period did not record this species. This conspicuous species is unlikely to occur within the development site.
<i>Tetratheca glandulosa</i>	-	No	This species was not recorded within the development site. Furthermore, due to an absence of records and lack of suitable habitat, it is unlikely to occur within the development site.
FAUNA			
<i>Miniopterus australis</i>	Little Bent-winged Bat	Yes, anabat results	No breeding habitat was recorded. The tunnel in Cadigal Reserve is the only potential breeding habitat for this species present within the

Target species	Common name	Species recorded during survey	Species credits required
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Yes, anabat results	development site. It was inspected during the Little Bent-winged Bat breeding season (Dec – Feb) with no individuals present. No breeding habitat was recorded. The tunnel in Cadigal Reserve is the only potential breeding habitat for this species present within the development site. The tunnel is a known winter roost for Large Bent-winged Bats. The tunnel was inspected during the Large Bent-winged Bat breeding season (Dec – Feb) with no individuals present.
<i>Myotis macropus</i>	Southern Myotis	No, this species was not recorded during targeted surveys.	No, this species is unlikely to utilise the development site as habitat

Following the completion of the habitat assessments and targeted surveys it was determined that the vegetation within the development site is highly disturbed and does not provide habitat for species credit species. Therefore, no additional assessment of species credit species is required.

5.4.2 Impact Assessment

5.4.2.1 Direct Impacts

5.4.2.1.1 Clearing of vegetation

The proposed works will result in the clearing of 1.15 ha of vegetation, of which 0.66 ha is native (Table 5-16).

Table 5-16: Assessment of the vegetation impacted within the study area

Vegetation community	Direct impacts (ha)
PCT 1232 Coastal Freshwater Swamp (planted)	0.04
PCT 1281 Sydney Turpentine-Ironbark Forest (planted)	0.23
PCT 1281 Sydney Turpentine-Ironbark Forest (highly disturbed)	0.10
Planted Native Vegetation	0.29
Weeds / Exotics	0.51
TOTAL	1.15

To offset identified direct impacts to native vegetation, ecosystem credits are required as shown in Table 5-17.

Table 5-17: Ecosystem credits required for native vegetation impacts

Veg zone	PCT ID	PCT name	Trading Group	Direct impacts (ha)	Credits required
1	1232	Coastal Freshwater Swamp Forest	Coastal Swamp Forests ≥ 90% cleared group (including Tier 1 or higher threat status)	0.04	1
2	1281	Sydney Turpentine-Ironbark Forest	Northern Hinterland Wet Sclerophyll Forests ≥ cleared group (including Tier 1 or higher threat status)	0.23	8

5.4.2.1.2 Loss/ Modification of Threatened Species Habitat

There is potential that the removal of flowering tall species may result in a marginal loss of foraging habitat for common peri-urban arboreal species. The removal of flowering species has potential to impact threatened species such as the Grey-headed Flying-fox. Tests of Significance under the BC Act and Assessments of Significance under the EPBC Act were conducted for Grey-headed Flying-fox.

Behavioural changes due to the installation of the pedestrian pathway and associated noise and lighting has the potential to negatively impact upon roosting microbat species. ELA believes the proposed works have a high risk of causing a significant impact on the Large Bent-winged Bat roost in Cadigal Reserve for the reasons stated below.

There are already numerous existing stressors on the roost, which include:

- The roost is used throughout autumn, winter and spring and may be used for mating purposes (e.g. important components of reproduction including ovulation, insemination and fertilisation may occur whilst bats are present in this roost).
- Bats exiting and entering the roost are exposed to several stressors including cat predation and the risk of collision with trains, light rail and cars.
- The number of known Large Bent-winged over-winter roosts in the Sydney Basin have declined drastically in the past 40 years, placing the population under pressure and remaining roosts in secure locations should be protected (Hoye and Spence 2004; Hoye pers comm).
- Large Bent-winged Bat roosts in the Sydney Basin have become smaller and less secure in the past 40 years which may be creating a population sink for Large Bent-winged Bats during the winter period spent in urban Sydney roosts which may be unsustainable for the local population over the medium to long term (Hoye and Spence 2004).
- Cumulative impacts to roosts for this species in the Sydney Basin have not been adequately addressed, and there is currently another project (Western Harbour Tunnel) which may impact a similar sized Large Bent-winged Bat roost in North Sydney. If the Greenway project and the Western Harbour Tunnel project cause bats to abandon both roosts, a significant amount of roosting habitat will be lost and there will be increased pressure on remaining roosts.

The proposed works may have the following impacts:

- The proposed elevated pathway / enclosed tunnel intersects with the emergence and re-entry flight path of bats exiting / entering the roost.

- The proposed elevated pathway / enclosed tunnel would reduce airspace used by bats when exiting and returning to roost.
- The proposed pathway / enclosed tunnel could force bats to change flight paths when exiting and returning to roost or to abandon the roost altogether because of the perception of, and the increased risk of predation.
- Clearing of vegetation required to construct the pathway / enclosed tunnel changes the character of the landscape at the roost entrance, making it more open and accessible to aerial predators such as owls.
- Moving the fence line closer to the roost and introducing lighting into this area could also provide more opportunities for terrestrial predators such as foxes, rats, domestic and feral cats and dogs to interact with bats from the roost.
- Lighting will be required along the elevated pathway and beneath the railway bridge and any increase in lighting may reduce available airspace for bats exiting and returning to roost, will spill over into dimmer / darker areas on the Light Rail corridor and may make it easier for predators to approach the roost (Hale *et al.* 2015; Threlfall, 2012).
- Although Large Bent-winged Bats will forage around artificial light sources (Haddock *et al.* 2019) the introduction of lighting at roost entrances has been shown to have detrimental effects (Stone *et al.* 2015) including delayed emergence with reduced time for foraging, fewer individuals emerging, avoidance of roost entrances that are lit up and roost abandonment. There is good evidence from a Large Bent-winged Bat roost on the northern side of Sydney Harbour that lighting changes near one of the roost entrances have reduced the number of bats emerging from that entrance and forced bats to emerge from an alternative entrance.

The above points indicate that there is a possibility that the bats will abandon the roost in the short, medium or long term, with uncertain availability of secure roosts of equal or greater capacity in proximity to the study area.

To address the above, a BDAR was subsequently prepared. Additional targeted surveys were conducted for two species credit species, Little Bent-winged Bat and Large Bent-winged Bat, to determine if breeding habitat occurs within the development site. Both of these species are listed as species credit species for breeding habitat only. Breeding habitat is defined within the 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (OEH 2018) as sites where female bats give birth and form nursery colonies. The results from visual inspections and emergence surveys of the microbat roosting habitat present on site and ultrasonic recording of microbat calls indicate that neither species is using the microbat roosting habitat as maternity roosting habitat (breeding habitat) within the development site. Both species are utilising the site as foraging habitat and the Large Bent-winged Bat is using the site as winter roosting habitat. Therefore, no breeding habitat was recorded for these species and no species credit species were generated for the proposed works.

In accordance with Section 8.3 of the BAM 2020, the assessor must take into consideration Prescribed Impacts which includes human-made structures such as culverts and bridges. The threatened Large Bent-winged Bat is known to use a human-made structure within the development site as winter-roosting habitat. The threatened Little Bent-winged Bat was recorded foraging on site and there is potential for this species to use human made structures on site as winter roosting habitat. Human made

structures within the development site which provide microbat roosting habitat have been assessed as part of Prescribed Impacts. To address prescribed impacts, an adaptive microbat design plan and microbat management plan which will follow a similar methodology to an Adaptive Management Plan as specified in Section 8.5 of the BAM 2020, will be implemented. These plans will include details of the baseline studies required, mitigation and monitoring measures to be applied prior to and during the construction / operational phases of the proposed development and any additional conservation measures to minimise impacts and benefit these species. The retirement of credits for Prescribed Impacts on artificial structures has not been proposed as part of this BDAR.

Serious and Irreversible Impacts (SAIL) have been considered as part of this assessment. The two Bent-winged Bats are listed as SAIL entities for breeding habitat. As no breeding habitat for these species were recorded the development site does not contain SAIL entities.

5.4.2.1.3 Modification of Fragmentation of Vegetation

Under the proposed works there will be a temporary reduction in the extent of native species which may provide stepping-stone habitat. This may impact upon the movement of any remaining Long-nosed Bandicoots in the area. Although this species has not been recorded within the area since the installation of the Light Rail, a precautionary approach was taken to assume that species may remain. Habitat for this species may include weeds and vegetation zones. A Test of Significance was prepared for this species.

One highly mobile Grey Headed Flying-fox has been recorded in the study area and is considered to utilise the vegetation within the study area for foraging. Additional habitat resources in the form of planted street trees was recorded in the locality of the study area and may provide supplementary foraging habitat for this species.

The GreenWay also provides habitat to support other locally native species which are typically absent or uncommon across the rest of the Inner West, including small birds such as fairy wrens, finches, fantails and some species of honeyeaters. These small birds rely on dense understorey vegetation and adjacent native grassy patches, which occurs along the GreenWay in:

- Bushcare sites where community volunteers have established locally native species
- Other ecological restoration sites
- Patches of weedy vegetation including *Lantana camera* and *Cestrum pargini*

As outlined within the overall GreenWay Masterplan (McGregor Coxall, 2018), this habitat will be protected through the implementation of ecologically sensitive design strategies and revegetating areas in a staged approach so that at any point in time the total disturbed area is minimised. Within the GreenWay In-Corridor works, this has been implemented by only proposing to clear one side of New Canterbury to Constitution Road. This will provide refuge for small native species until the revegetated native vegetation establishes. Weedy understorey vegetation is also proposed to be retained south of the proposed wetland for similar purposes.

5.4.2.2 Indirect Impacts

Indirect impacts are those impacts that do not directly affect habitat and individuals but that have the potential to interfere through indirect action. Indirect impacts considered for this assessment are site

impacts (noise, light and weed invasion) and downwind impacts (sedimentation, dust, accidental spills and leaks).

During the construction, noise, dust and to a small degree vibration will be emitted which could have an indirect impact on local fauna (excluding impacts on microbats which will be addressed separately). These impacts result from the operation of heavy machinery to clear vegetation and construct the buildings and infrastructure. These impacts are short term only and therefore are unlikely to significantly impact fauna. Also, during the construction period there is a risk that sediment runoff may impact adjacent native vegetation and nearby tributaries if appropriate sediment and erosion measures are not in place. These impacts will be managed via an appropriate sediment and erosion control plan. The overall impacts are likely to be minor.

Possible increase in weed infestation can result if weed propagules are introduced or moved around by machinery during construction. Weed control measures are recommended below to minimise this risk.

As such, indirect impacts to threatened species (excluding microbats) and native vegetation are unlikely to be significant and will be managed.

5.4.3 Mitigation Measures

Table 5-18: Mitigation measures for biodiversity

Environmental Aspect	Mitigation Measures
Compaction of soil	<ul style="list-style-type: none"> Stabilise all disturbed areas and implement vegetation protection measures as required. Ensure revegetation of native vegetation is consistent with the relevant vegetation communities or as set out in the GreenWay Masterplan.
Accidental damage / clearing	<ul style="list-style-type: none"> Council staff are to undertake a pre-works briefing advising of sensitive areas and relevant safeguards for these areas. Stop works if any previously undiscovered threatened species or communities are discovered during works. An assessment of the impact and any required approvals must be obtained. Works must not recommence until Council has provided written approval to do so. Ensure the site-specific CEMP includes instructions for dealing with orphaned or injured native animals and ensure the CEMP includes the contact details for the NSW Wildlife Information, Rescue and Education Service Inc (WIRES). Install temporary barrier fencing to prevent entry into adjacent vegetation and appropriate 'no-go zone' signage. Install tree protection measures around trees to be retained in the study area. Structures should be adequate to prevent machinery from entering within the drip zone. Maintain temporary fencing to prevent access into the native vegetation.
Impacts to known roosts of threatened microbats and Grey-headed Flying-fox	<ul style="list-style-type: none"> Prepare a Construction Microbat Management Plan and Microbat Management Plan and Adaptive Microbat Design Plan and begin implementation of the relevant actions of all three plans. Brief contractors on the presence of threatened species.
	<p>Potential Light Impacts to the Microbat Roost</p> <ul style="list-style-type: none"> To avoid potential light impacts to the roost, consider conducting investigations into the effect of: <ul style="list-style-type: none"> Soft barriers replicating elevated pathway on bat flight paths to inform final design specifications and location.

Environmental Aspect	Mitigation Measures
	<ul style="list-style-type: none"> ○ Designing and locating the elevated pathway so that there are minimal impacts to bat flight paths. ○ Scheduling construction for periods when bats are not in residence (Nov to end Feb). ○ Ensuring bat flight paths to / from roost remain open at all times. ○ Monitoring response of bats to elevated pathway during emergence. ● Ensure detailed mitigation measures for design and construction, outlined in the Adaptive Microbat Design Plan and Construction Microbat Management Plan, are adhered to.
	<p>Potential Noise Impacts to the Microbat Roost</p> <ul style="list-style-type: none"> ● To minimise potential impacts of noise on the roost, ensure: <ul style="list-style-type: none"> ○ Daily timing of construction activities is undertaken in accordance with Table 1 of the Interim Noise Guidelines (2009). ○ Construction activities in the vicinity of the roost is scheduled to coincide with periods when bats are not in residence (Nov – end Feb) ○ Noise barriers that do not block flight paths of bats during construction are installed. ○ The elevated pathway is constructed with noise buffering / absorbing materials. ○ Baseline background noise levels within the roost and at the roost entrance prior to construction, during construction and post construction is obtained.
	<p>Potential Vibration Impacts to the Microbat Roost</p> <ul style="list-style-type: none"> ● To avoid potential vibration impacts to the roost, ensure: <ul style="list-style-type: none"> ○ Construction activities for the piling for elevated pathway and construction of jacked box culvert beneath Longport Street coincide with periods when bats are not in residence (Nov – end Feb). ○ Lowest vibration equipment and techniques when excavating / piling / tunnel boring beneath Longport Street are utilised. ○ Active monitoring of vibration levels and bat arousals during piling and tunnel boring is undertaken. ○ Active piling and tunnel boring daily work hours are limited and include stop work periods throughout the day to provide some relief from vibrations if impacts on bats are being detected. ○ No piling or tunnel boring is conducted within 50 m of roost entrance from 1 hour prior to sunset until 1 hour after sunrise daily throughout construction.
	<p>Potential Human Impacts to the Microbat Roost</p> <ul style="list-style-type: none"> ● Ensure fencing is maintained to exclude members of the public from an area within 50 m of the roost entrance. ● Retain existing locked fencing in the area between southern boundary of Cadigal Reserve beneath main Western Rail Line and Longport Street, so access to microbat roost and area surrounding it remains restricted. Future activation of this area to view historical Whipple Truss is considered high risk as an impact to roosting bats.
	<p>Grey-headed Flying-fox</p> <ul style="list-style-type: none"> ● Conduct a pre-clearance survey to ensure that no Grey-headed Flying-foxes are present within the study area or adjacent vegetation prior to vegetation removal. ● If Grey-headed Flying-fox is located during works, stop works and notify the Project Ecologist to provide ecological advice.
<p>Spread of priority weeds</p>	<ul style="list-style-type: none"> ● Wash down equipment and vehicles prior to and after use, to manage the introduction and spread of weed propagules. ● Thoroughly clean all equipment of soil and weed propagules prior to entry into the study area.

Environmental Aspect	Mitigation Measures
	<ul style="list-style-type: none"> • Remove Priority weeds using best management practices (including appropriate controls to prevent impacts to threatened species) prior to removal of native vegetation. Remove weed propagules offsite. • Bag and remove all weed propagules offsite, preferably the same day and dispose of at designated green waste facility. • Consider the implementation of a Weed Management Plan and revegetation works following the completion of works for the adjacent riparian corridor.
Disease into bushland or threatened species habitat	<ul style="list-style-type: none"> • Limit the use of chemicals due to the indirect impacts to threatened fauna and native vegetation. • Clean all equipment before exiting the study area.

5.5 Arboriculture

5.5.1 Existing Environment

An Arboricultural Impact Assessment (AIA) was prepared by ELA (2021) (Appendix G) which included a visual assessment of 372 trees. An additional number of trees were previously assessed by Council in 2018 and Birds Tree Consulting in 2019. They assessed 59 and 303 trees respectively. ELA's report also included the results from these previous assessments in order to assess the impacts of the proposed works to trees within the study area.

The definition of a tree is defined under the Australian Standard, *AS 4970-2009, Protection of Trees on Development Sites* as a long lived woody perennial plant usually greater than 3 m in height with one or relatively few main stems or trunks.

The Council, Leichhardt Development Control Plan (DCP) defines a 'prescribed tree' as:

'any tree with a height equal to or greater than 6 m above ground level (existing); or any tree that is under 6 m in height that has a trunk diameter of more than 300 mm at ground level (existing); or any tree with a canopy spread equal to or greater than 3 m; or any palm or fern with a stem length equal to or greater than 4 m above ground level (existing); or any tree that is required as the habitat of native animals' (Inner West Council, 2020).

5.5.1.1 Retention Value

The retention value or importance of a tree or group of trees is determined in accordance with the Institute of Australian Consulting Arborists (IACA) Significance of a Tree Assessment Rating System (STARSCO). The method considers the Useful Life Expectancy (ULE) and landscape significance of a tree. Trees are provided one of the following ratings:

- **High - priority for retention.** These trees are considered important 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 AS 4970–2009 Protection of trees on development sites
- **Medium - consider for retention.** These trees are moderately important for retention. Their removal should only be considered if adversely affected by the proposed works and all other alternatives have been considered and exhausted
- **Low - consider for removal.** These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.

A total of 734 trees are located within the study area. Of these, 45 are considered to have a high retention value, 379 with a medium value and 310 with a low value.

5.5.2 Impact Assessment

For the purposes of the AIA, impacts were defined as follows:

- **Major encroachment** - If the proposed encroachment is greater than 10% of the Tree Protection Zone (TPZ) or inside the Structural Root Zone (SRZ), the project arborist must demonstrate that the tree(s) would remain viable. The location and distribution of roots may be determined through non-destructive excavation (NDE) methods such as hydro-vacuum excavation (sucker

truck), Air Spade or manual extraction. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

- **Minor encroachment** – If the proposed encroachment is less than 10% of the TPZ, and outside of the SRZ, detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

Consideration was also given to presence of weed species and dead or unhealthy trees including:

- Weed of National Significance (WoNS): trees listed on the National Significance Weed List (NSW Department of Primary Industries 1999)
- Priority Weed: trees listed on the Priority Weed List under the *NSW Biosecurity Act 2015*
- Undesirable Species List: trees listed on the Inner West Council’s Undesirable Species List
- Dead or Unhealthy: trees assessed as dead and/or having a useful life expectancy (ULE) of less than five years

The AIA indicated that a total of 231 trees are proposed for removal, which is equivalent to approximately 31% of the total tree present within the study area.

An additional 106 trees are proposed to be retained if possible. Such trees may be potentially impacted by minor works such as the construction of the on-grade path and lighting. However, measures to protect these trees during detailed design and construction will be undertaken where possible. Such measures will include:

- Shallow excavation
- Constructing the path over tree roots, with minimal impact
- The use of Non-Destructive Digging for lighting conduit
- Adjusting the path alignment to be 1 m clear of tree trunks

The remaining 397 trees will be retained, which is equivalent to approximately 54% of the total trees present within the study area.

A summary of the trees to be removed, retained if possible and retained sorted by retention value and native/exotic species are provided in Table 5-19 and Table 5-20 respectively.

Table 5-19: Summary of retention values and removal percentages

Retention value	Remove	Retain if possible	Retain	Total	Percentage removal (%)
High retention	0	2	43	45	0%
Medium retention	79	80	220	379	21%
Low retention	152	24	134	310	49%
Total	231	106	397	734	31%

Table 5-20: Summary of removal percentages of native trees, unhealthy/dead trees and weeds/undesirable species

	Remove	Retain if possible	Retain	Total	Removal percentage (%)
Native Trees	469	96	326	491	14%
WoNS	11	0	0	11	100%
Priority Weeds	88	6	47	141	62%
Undesirable Species	45	4	23	72	62%
Dead or Unhealthy	19	0	0	19	100%
Total	232	106	396	734	31%

5.5.3 Mitigation Measures

Table 5-21: Mitigation measures for trees

Environmental Aspect	Mitigation Measures
Minor impacts to trees proposed to be retained if possible.	<p>Design</p> <ul style="list-style-type: none"> • Where possible, relocate services/pathways outside of TPZs. • Consider designing pathways so they are above grade, minimising/eliminating excavation within tree protection zones. • Consider designing pathways using porous materials (eco-paving, porous asphalt, decomposed granite) to allow water and oxygen to reach the root zone. • Consider designing pathways using tree sensitive techniques (pier and beam, suspended slabs). <p>Construction</p> <ul style="list-style-type: none"> • Engage a suitably qualified Project Arborist (minimum AQF Level 5 Diploma of Arboriculture qualification) for the duration of the works. The Project Arborist shall: <ul style="list-style-type: none"> ○ Prepare a project specific tree protection plan. ○ Ensure contractor compliance with specified tree protection measures, including monitoring of trees through the works. ○ Provide advice to the contractor for work near trees, tree work or pruning including advice on alternative construction methods. ○ Supervise works on or near trees, including all works within TPZs, root pruning, dead wooding, aerating, mulching and any temporary irrigation. • Install tree protections. • Consider tree sensitive techniques to install services within the TPZ such as non-destructive excavation (NDE). • Consider tree sensitive techniques during demolition of existing pavements and other work within the TPZ. • Consider tree sensitive techniques during any works within the TPZ including works to facilitate soft landscaping. • Determine the location and distribution of roots through ground-penetrating radar or NDE methods such as hydro-vacuum excavation (sucker truck), air spade and manual excavation. • If any additional trees are proposed to be removed during the design and construction phase that are not identified for removal in this REF (i.e. those in the retain or retain if possible categories), this will require approval by Council’s tree officer. <p>Post Construction</p>

Environmental Aspect	Mitigation Measures
	<ul style="list-style-type: none">• Trees removed are to be replaced with advanced tree stock (min. 200L) at a minimum rate of 1:1 as part of the works. Replacement species will be locally native and selected based on the Greenway Masterplan.

5.6 Aboriginal Heritage

An Aboriginal Heritage Due Diligence Assessment was undertaken by ELA (2020), which can be found in Appendix H. This assessment was undertaken in accordance with the *Due Diligence Code of Practice for the protection of Aboriginal Objects in New South Wales* (DECCW 2010a) to identify if Aboriginal objects were likely to be located within the proposed study area and, if so, whether the proposed works have the potential to harm those objects.

5.6.1 Existing Environment

A search of the Aboriginal Heritage Information Management System (AHIMS) database, which is maintained by Heritage NSW and regulated under Section 90Q of the NPW Act was conducted on 3 August 2020 to identify if any registered Aboriginal sites were present within, or adjacent to the study area.

No Aboriginal sites have previously been recorded inside the study area or within 1 km (Figure 5-9). The majority of the AHIMS sites within the search area are located adjacent to the Cooks River and its tributaries, the Parramatta River and Sydney Harbour and the Sydney CBD.

Searches of the Australian Heritage Database, the SHR, the Ashfield LEP 2013, Leichhardt LEP 2013 and Marrickville LEP 2011 covering the study area were conducted on 2 September 2020 in order to determine if any places of archaeological significance are located within the study area.

No Aboriginal archaeological sites recorded on these databases occur within the study area.

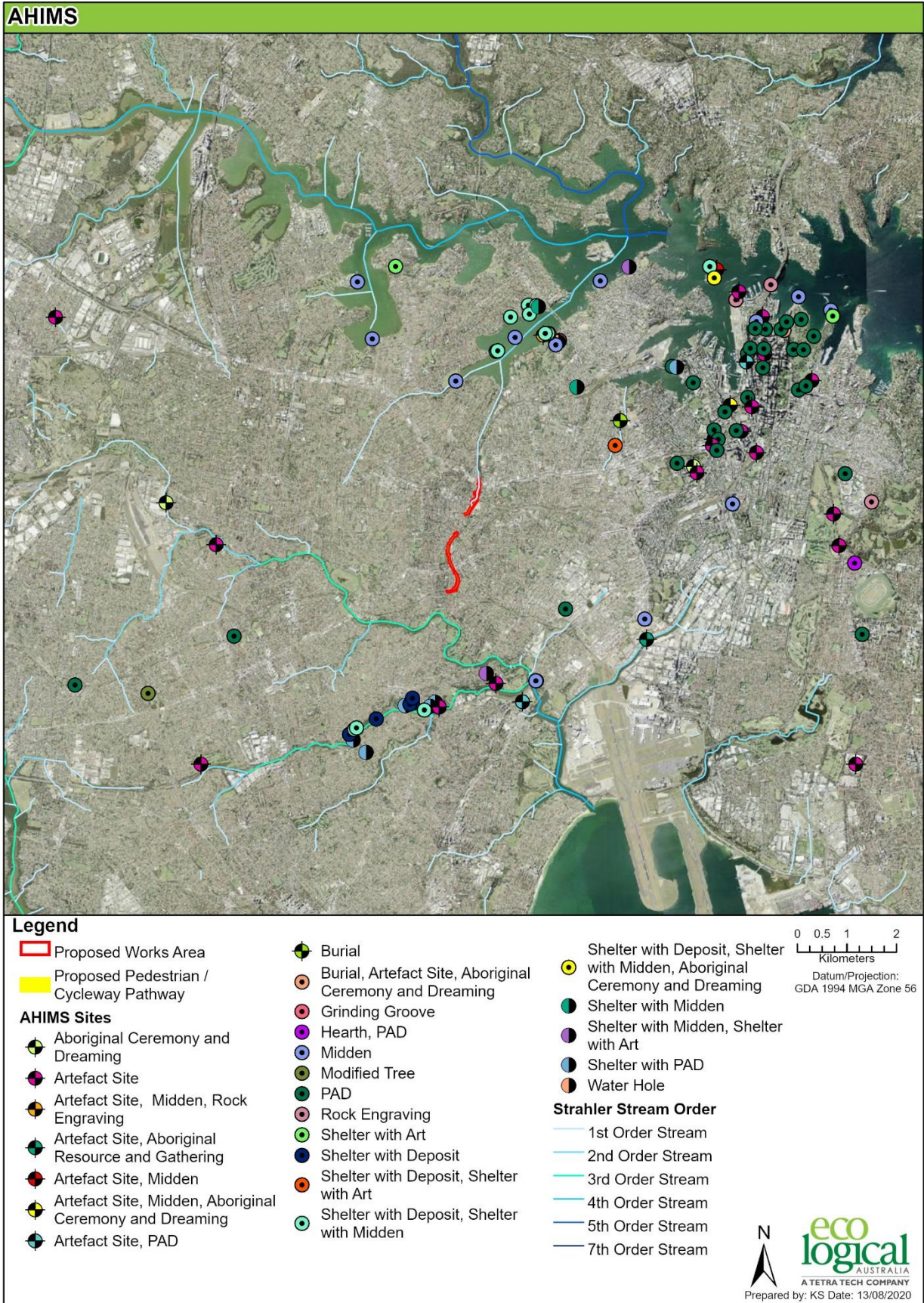


Figure 5-9: AHIMS sites in proximity to the study area

5.6.2 Impact Assessment

The purpose of the Aboriginal Heritage Due Diligence Assessment is to identify if there are registered Aboriginal sites and/or sensitive landforms which may indicate the presence of Aboriginal sites and may therefore require further assessment and approval under Part 6 of the NPW Act.

ELA has undertaken an extensive search of the AHIMS database maintained by Heritage NSW and a review of available background reports discussing past Aboriginal heritage assessment that have been undertaken within the Inner West area.

The AHIMS data has been mapped over on the preliminary development area (Figure 5-9) showing zero AHIMS sites in the study area or within 1 km. The lack of Aboriginal heritage assessments of the Inner West area reflects the low survival rate of Aboriginal sites in the region due to the early and ongoing heavy disturbance and urbanisation of the area.

A site inspection undertaken by ELA Principal Consultant Karyn McLeod on Friday 4 September 2020 confirmed this heavy disturbance, with the study area comprising bitumen bike/walking tracks, the Hawthorne Canal and the light rail corridor. The study area is located in densely developed urban areas and no areas of archaeological potential were identified.

Due to the above assessment, Aboriginal objects are unlikely to be present in the study area and the proposed works will not impact sites and objects. As such, no further assessment will be required and only the below mitigation measures will be required to ensure no harm will occur.

5.6.3 Mitigation Measures

Table 5-22: Mitigation measures for Aboriginal heritage

Environmental Aspect	Mitigation Measures
Discovery of unsuspected Aboriginal objects	<ul style="list-style-type: none"> Brief all contractors undertaking works on site on the protection of Aboriginal heritage objects under the NPW Act, and the penalties for damage to these items.
Discovery of human remains	<ul style="list-style-type: none"> If human remains are discovered, cease works immediately and contact the NSW Police. If the remains are suspected to be Aboriginal, consider contacting DPIE to assist in determining appropriate management.
Harm to AHIMS sites as well as other area of Aboriginal Significance	<ul style="list-style-type: none"> Should an unexpected Aboriginal object be identified during construction, stop works in the immediate vicinity of the find and fence the area off with suitable markers (star pickets, flagging or barrier mesh). Notify the Council Project Manager and engage an archaeologist to determine the significance of the find. If required, determine the notification, consultation, and approval requirements. Works must not recommence until Council has provided written approval to do so.

5.7 Historic Heritage

A Statement of Heritage Impact (SoHI) was undertaken by ELA (2020), which can be found Appendix I. The SoHI outlined the impacts of the proposed works on registered heritage items within the area. The findings of this assessment are outlined below.

5.7.1 Existing Environment

There are ten heritage items located within or adjacent to the study area (Figure 5-10), some have been listed on multiple registers:

Ashfield LEP:

- Haberfield Conservation Area – C42
- Battle Bridge – 445
- Haig Avenue Conservation Area – C45
- Cadigal Reserve – Item 505
- Lewisham Sewage Aqueduct – 478
- Former Allied Flour Mill complex – Item 619.

Marrickville LEP:

- Lewisham Sewage Aqueduct - I54
- Lewisham Railway Viaducts and Whipple truss and Lewisham underbridge - I229
- Former Waratah Flour Mills - I25
- Hoskins Park - I131
- Hoskins Park and Environs Conservation Area – C36.

State Heritage Register

- Lewisham Sewage Aqueduct – SHR 01326
- Lewisham Railway Viaducts and Whipple Truss and Lewisham Underbridge – SHR 01043.

Roads and Maritime Service Heritage Register

- Battle Bridge – RMS s170 4305024.

Transport for NSW Heritage Register

- Lewisham Railway Viaducts and Whipple Truss and Lewisham Underbridge - TfNSW s170 4801584.

5.7.2 Impact Assessment

Table 5-23 outlines the potential impacts on the listed heritage items within or adjacent to the study area.

Table 5-23 Potential impacts to heritage items (from SoHI, ELA 2020)

Item	Proposal	Potential heritage Impacts
Battle Bridge	An underpass below Parramatta Road connecting to a path on the eastern side of Cadigal Reserve to the west of the light rail line.	Inadvertent or accidental harm to the bridge or canal during path construction. Barriers or new fixings anchored into significant fabric. Low potential for archaeological evidence associated with brickworks
Cadigal Reserve including sewage aqueduct	Construction of an on-grade path on the eastern side of the Hawthorne Canal (on land owned by Rail Corp NSW) within Cadigal Reserve; Creation of a channel access ramp and bridge construction in Cadigal Reserve to facilitate construction and maintenance; Ecological restoration, a rest/nature play area on the eastern side and a separate observation area on the western side of Cadigal Reserve.	Inadvertent or accidental harm to the sewage aqueduct. It is considered unlikely that any archaeological evidence will be exposed or disturbed in this area.
Lewisham Viaduct and whipple truss	An elevated path under the main western rail line viaduct and whipple truss bridge (in land owned by Rail Corp NSW) and a jacked box culvert tunnel under Longport Street (a regional road managed by Council).	Inadvertent or accidental harm to the railway viaduct, whipple truss bridge and the sewer aqueduct from construction. Barriers or new fixings anchored into significant fabric. The elevated pathway ensures surface disturbance is kept to a minimum and archaeological impacts will not occur.
Allied Mills	A path through the western side of the light rail corridor from Longport Street to Old Canterbury Road connecting to the Allied Mills near Lewisham West light rail, and inclusive of rest areas and a signalised crossing at Edward and Weston Streets. Dog off leash area on the eastern side of the light rail tracks and north of Lewisham West Light Rail Stop. A wetland on the eastern side of the light rail tracks and south of Lewisham West Light Rail Stop.	There are a number of remnant items associated with the industrial precinct located in this area however none of it is significant in its own right nor is there likely to be any archaeological potential due to past disturbances.
Waratah Mills	A tunnel in the light rail corridor on the western side of the light rail tracks to link with the path on the western side of the light rail tracks	No heritage impacts. It is considered unlikely that any archaeological evidence will be exposed or disturbed in this area.

It was included that the study area has low potential for significant archaeological features or deposits and that the proposed works will result in negligible impacts to the heritage significance of listed items within the study area, provided the recommendations outlined in Section 7 are adhered to. The proposed works will also benefit the community by:

- providing users of the precinct with the opportunity to appreciate the unique view of the Battle Bridge arch, the rail viaduct and the whipple truss from underneath which has not been previously possible
- highlighting the bush regeneration efforts associated with Cadigal Reserve area and present the significant railway infrastructure to an audience that may not be fully aware of its significance
- opening the precinct to visitors and allowing them to appreciate the past industrial heritage of the precinct through propose works at Allied Mills.

5.7.3 Mitigation Measures

Table 5-24: Mitigation measures for historic heritage

Environmental Aspect	Mitigation Measures
Impacts to Heritage items	<ul style="list-style-type: none"> • In accordance with Section 146 of the Heritage Act, cease work if an archaeological relic (such as a deposit or artefact) is uncovered during works and contact a qualified archaeologist to assess the find. Further advice and clarification may be sought from the Heritage Council of NSW, or the Heritage Division under delegation regarding assessment and approvals. • Should any unexpected historical archaeology be uncovered during any future excavation works, adhere to the following procedure: <ul style="list-style-type: none"> ○ Stop all work in the immediate area of the item and notify the Project Manager. ○ Establish a ‘no-go zone’ around the item. Use high visibility fencing, where practical. Inform all site personnel about the no-go zone. ○ No work is to be undertaken within this zone until further investigations are completed. ○ Engage a suitably qualified and experienced Archaeologist to assess the finds. ○ Notify the Heritage Council if the finds are of local or state significance. Additional approvals will be required before works can recommence on site (s146 permit).
	<p>Battle Bridge</p> <ul style="list-style-type: none"> • Erect measures to protect Battle Bridge from inadvertent or accidental harm to heritage fabric such as fencing and covering. • Ensure any permanent or temporary barriers or fixings are not anchored into significant fabric. • Removal of non-significant, intrusive or unsympathetic fabric is acceptable. • Consider interpretation to increase appreciation.
	<p>Cadigal Reserve including sewage aqueduct, railway viaduct and whipple truss</p> <ul style="list-style-type: none"> • Erect measures to protect the sewage aqueduct, railway viaduct and whipple truss from inadvertent or accidental harm to heritage fabric such as fencing and covering. • Ensure any permanent or temporary barriers or fixings are not anchored into significant fabric. • Removal of non-significant, intrusive or unsympathetic fabric is acceptable. • Consider interpretation of these items to increase appreciation.
	<p>Allied Mills</p>

Environmental Aspect	Mitigation Measures
	<ul style="list-style-type: none"> • Erect measures to protect heritage buildings from inadvertent or accidental harm to heritage fabric such as fencing and covering. • Where possible, avoid removal of remnant rail infrastructure or sidings. • Consider interpretation of these items to increase appreciation. <p>General</p> <ul style="list-style-type: none"> • Submit a Standard Exemption Notification (8: Non-Significant Fabric s57(2) Heritage Act), to the Heritage Council with the Statement of Heritage Impact Assessment (ELA, 2021) for endorsement for works within the heritage curtilage of the sewage aqueduct and the rail viaduct. • Engage a suitable qualified heritage consultant to prepare a Heritage Interpretation Strategy in accordance with the NSW Heritage Interpretation Guidelines (www.environment.nsw.gov.au/resources/heritagebranch/heritage/interpretationpolicy) • Consult with TfNSW Heritage Specialists to ensure that significant fabric is appropriately protected at Battle Bridge, the rail viaduct and whipple truss. • Engage a suitably qualified heritage consultant to prepare a photographic Archival Record of Battle Bridge and the whipple truss, consistent with the Heritage Office Guidelines Photographic Recording of Heritage Items Using Film or Digital Capture. (environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/).

5.8 Noise and Vibration

A Noise and Vibration Impact Assessment (NVIA) was undertaken by Marshall Day Acoustic (2021), which can be found in Appendix J. The NVIA quantifies and outlines the potential impacts of noise and vibration associated with the proposed construction works. An assessment of operational noise impacts of the Greenway was not undertaken due to the nature of use (walking and cycling). The findings of this assessment are outlined below.

5.8.1 Existing Environment

Existing noise levels in the vicinity of the study area are variable. A survey of background noise levels was conducted at various locations along the project study area and close to the project boundary to determine the existing noise environment. This was necessary to determine the appropriate noise design goals known as Noise Management Levels (NMLs) in accordance with the Interim Construction Noise Guideline 2009 (ICNG). Five (5) monitoring locations were utilised for unattended noise monitoring, these locations were:

- 8 Haig Avenue, Summer Hill
- 101 Malthouse Way, Summer Hill
- Bush care site at Fred Street, Lewisham
- 3 Williams Parade, Dulwich Hill
- 49A Hercules Street, Dulwich Hill.

Noise loggers measured 24-hour noise levels at 90-minute intervals between 21 October 2020 and 5 November 2020. The measured NMLs are summarised in Table 5-25.

Table 5-25: measured average background and ambient noise levels (Marshall Day Acoustics, 2021)

Receiver Reference	Period	RBL L _{A90} dB	L _{Aeq} dB
BG-01	Standard hours – Day	44	54
	Outside Standard hours-1 (OSH-1) Evening	42	54
	Outside Standard hours-2 (OSH-2) Night	34	50
BG-02	Standard hours – Day	36	55
	Outside Standard hours-1 (OSH-1) Evening	42	53
	Outside Standard hours-2 (OSH-2) Night	37	50
BG-03	Standard hours – Day	43	55
	Outside Standard hours-1 (OSH-1) Evening	37	60
	Outside Standard hours-2 (OSH-2) Night	30(29)	50
BG-04	Standard hours – Day	40	56
	Outside Standard hours-1 (OSH-1) Evening	39	54
	Outside Standard hours-2 (OSH-2) Night	31	49
BG-04	Standard hours – Day	37	51
	Outside Standard hours-1 (OSH-1) Evening	33	53
	Outside Standard hours-2 (OSH-2) Night	30 (27)	48

STANDARD HOURS: MONDAY TO FRIDAY FROM 7 AM TO 6 PM, SATURDAY 8 AM TO 1 PM. NO WORK ON SUNDAYS OR PUBLIC HOLIDAYS.
 OUTSIDE STANDARD HOURS-1 (OSH-1): MONDAY TO FRIDAY 6 PM – 10 PM.

OUTSIDE STANDARD HOURS-2 (OSH-2): MONDAY TO FRIDAY 10 PM – 7 AM.

*IN ACCORDANCE WITH NPFI, WHERE RBL IS BELOW THE ‘MINIMUM ASSUMED RBL’ FOR THE RELEVANT PERIOD, THE ‘MINIMUM ASSUMED RBL’ IS SELECTED. NOISE LEVEL WITHIN BRACKETS SHOWS THE MEASURED RBL.

For residential receivers located in proximity to compound sites, the following applicable NMLs based on background noise measurements were developed to describe acceptable noise levels from construction activities (Table 5-26).

Table 5-26: Residential Construction NMLs applicable to receivers near compound Sites [CS-01 - CS-07], L_{Aeq} dB (From Marshall Day Acoustics 2021)

Compound Site	Standard Hours		Outside Standard Hours (OSH)	
	“Noise Affected “	“Highly Affected”	Noise OSH-1	OSH-2
CS-01 - Weston Street	50	75	N/A	N/A
CS-02 – Davis Street	50	75	N/A	N/A
CS-03 – Constitution Road	50	75	N/A	N/A
CS-04 – Canterbury Road	50	75	N/A	36*
CS-05 – Hercules Street	47	75	N/A	N/A
CS-06 – Lewisham West	56	75	N/A	N/A
CS-07 – Cadigal Reserve	54	75	N/A	N/A

NOTE: *ONLY DURING THE OPERATION PHASE OF THE COMPOUND SITE DURING THE CONSTRUCTION WORKS (NO WORKS ARE PROPOSED DURING THE CONSTRUCTION PHASE OF THE COMPOUND SITE)

In accordance with the *NSW Road Noise Policy*, the traffic noise criteria in Table 5-27 was also deemed applicable to the project.

Table 5-27: Road Traffic Noise Criteria (from Marshall Day Acoustics 2021)

Type of Development	Criteria	
	Day 0700-2200hrs	Night 2200-0700hrs
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{eq(15hr)}$ 60 dBA (external)	$L_{eq(9hr)}$ 55 dBA (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{eq(1hr)}$ 55 dBA (external)	$L_{eq(1hr)}$ 50 dBA (external)

Vibration targets which are likely to cause cosmetic damage to surrounding properties of the site were assessed in accordance with *DIN 4150-3:1999 Structural Vibration – effects of vibration on structures*, and the targets in Table 5-28 were considered applicable to assess the works for the GreenWay.

Table 5-28: Vibration limits according to DIN 4150: Peak Particle Velocity mm/s

Line	Type of Structure	Vibration at the foundation of building at a frequency of		Vibration in horizontal plane of highest floor, at all frequencies	
		1Hz to 10Hz	20 to 40	40 to 50	40
I	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
II	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
III	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines I and II and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

5.8.2 Impact Assessment

Based on the proposed construction location and methodology, a number of scenarios were developed to represent construction works at various construction sites within the project study area. These included:

- Construction at compound sites
 - **Establishment Phase (E):** During this phase, the compound site would be established, and all proposed plant items nominated by Marshall Day Acoustics will be working concurrently towards the centre of the relevant compound site for between 25-100% of the time over a 15-minute period
 - **Operation Phase (O):** During this phase the compound would support GreenWay construction and all proposed plant items nominated by Marshall Day Acoustics will be working concurrently towards the centre of the relevant construction site for between 25-100% of the time over a 15-minute period.
- Fencing
 - Fencing works assumed that all proposed plant items for this activity would operate concurrently at the boundary of the project.
- Construction of GreenWay
 - **Typical Average Case (TA):** it is assumed that all proposed plant items will be working concurrently towards the centre of the relevant construction site for between 25% to 100% of the time over a 15-minute period
 - **Typical Worst Case (TW):** it is assumed that two of the noisiest proposed plant items will be working concurrently simultaneously near the boundary of the relevant construction site for between 25% to 100% of the time over a 15-minute period.

5.8.2.1 Potential Noise Impacts

For the various compound sites, the predicted noise levels outlined in Table 5-29 have been assumed based on an assumed list of construction plant and equipment.

Table 5-29: Predicted noise levels during works at Compound Sites [CS-01 – CS-07], $L_{Aeq, 15min}$ (dB) (Marshall Day Acoustics 2021)

Assessment Scenario	Receiver Distance from the boundary of the construction site					
	5 m	10 m	20 m	60 m	80 m	100 m
Establishment of Compound site	88	82	76	67	64	62
Operation if the compound site	83	77	71	61	59	57

For fencing works between Constitution Road and New Canterbury Road, the predicted noise levels outlined in Table 5-30 were developed.

Table 5-30: Predicted noise levels during ‘Fencing Works’ [FW], $L_{Aeq, 15min}$ (dB)

Assessment Scenario	Receiver Distance from the boundary of the construction site					
	5 m	10 m	20 m	60 m	80 m	100 m
Fencing Works	87	81	75	66	63	61

For the 10 defined works areas outlined in the NVIA, the following predictions of noise levels resulting from the works were determined (Table 5-31).

Table 5-31: Predicted noise levels during works at each work site, $L_{Aeq, 15min}$ (dB)

Location	Assessment Scenario	Receiver Distance from the boundary of the construction site					
		5 m	10 m	20 m	60 m	80 m	100 m
W-01	Typical Worst Case	85	79	73	64	61	59
	Typical Average Case	78	77	73*	64	61	59
W-02	Typical Worst Case	89	83	77	68	65	63
	Typical Average Case	82	80	77	68	65	63
W-03	Typical Worst Case	89	83	77	68	65	63
	Typical Average Case	80	78	75	68	65	63
W-04	Typical Worst Case	90	84	78	68	66	64
	Typical Average Case	76	75	72	67	65	64
W-05	Typical Worst Case	86	80	74	64	62	60
	Typical Average Case	80	78	74	64	62	60
W - 06	Typical Worst Case	90	84	78	69	66	64
	Typical Average Case	85	82	77	69	66	64
W-07	Typical Worst Case	92	86	80	70	68	66
	Typical Average Case	82	80	76	69	67	65
W-08	Typical Worst Case	87	81	75	66	63	61

Location	Assessment Scenario	Receiver Distance from the boundary of the construction site					
		5 m	10 m	20 m	60 m	80 m	100 m
W-09	Typical Average Case	83	80	75	66	63	61
	Typical Worst Case	92	86	80	70	68	66
W-10	Typical Average Case	86	83	79	70	68	66
	Typical Worst Case	92	86	80	70	68	66
	Typical Average Case	82	80	77	70	68	66

From the above scenarios, it was determined whether the works had the potential to exceed the site specific “highly noise affected” and “noise affected” management goals at the nearest residential receivers. A summary of these impacts on Residential and Other Land Uses is provided in Table 5-32.

Table 5-32: Summary of potential construction noise impact at receivers near proposed construction sites based on land uses (from Marshall Day Acoustics, 2021)

Work ID	Work / Site	Works Period			
		Standard Hours		Evening	Night
		Noise Affected	Highly Noise Affected	Noise Affected	
CS-01	A Compound Site at Weston Street	R, OLU	R	-	-
CS-02	A compound site at Davis Street	R, OLU	R	-	-
CS-03	A compound site at Constitution Road	R, OLU	R	-	R
CS-04	A compound site at Canterbury Road	R, OLU	R	-	-
CS-05	A compound site at the east of Hercules Street	R	R	-	-
CS-06	A compound site at Lewisham West	R	Not Expected	-	-
CS-07	A compound site at Cadigal reserve	R, OLU	R	-	-
WF	Fencing	R	R	-	-
W-01	Cadigal Reserve Preliminary Works	R, OLU	R	-	-
W-02	Parramatta Road under Bridge and Approaches	R, OLU	R	R	-
W-03	Longport Street Northern Approach	R, OLU	R	-	-
W-04	Cadigal Reserve Path	R, OLU	R	-	-
W-05	Longport Street Jacked box Culvert	R, OLU	R	R	-
W-06	Lewisham West Corridor Construction	R, OLU	R	-	-
W-07	Davis Street & Constitution road Cut and Cover Tunnel	R, OLU	R	-	-
W-08	Davis Street to Johnson Park	R, OLU	R	-	-
W-09	Constitution Road to New Canterbury Road	R, OLU	R	-	R
W-10	Hercules Street Parklands	R	R	-	-

NOTE: ‘-’ INDICATES THAT NO WORKS ARE PROPOSED DURING THIS PERIOD, ‘R’ INDICATES RESIDENTIAL RECEIVERS AND ‘OLU’ INDICATES OTHER LAND USES

Note that the above does not indicate that the noise management goals will be exceeded during construction, as these predictions are based on assumed construction methodologies and some noise control measures without the incorporation of all feasible and reasonable noise controls. It does however indicate that there is potential for noise impacts along most of the corridor that will need to be managed during construction.

A high level construction traffic noise impact assessment was also undertaken as part of the NVIA, which determined that it is unlikely that the project will generate traffic noise on local roads greater than 2dB above the existing traffic noise during the Daytime period and is not anticipated to generate significant traffic noise impacts as a result of daytime works. However, some construction works would be required during the Night-time period at some work areas where potential sleep awakening is probable. Therefore, a detailed traffic noise impact assessment as part of the CNVMP will be required once a detailed construction traffic assessment is available.

5.8.2.2 Potential Vibration Impacts

Vibration propagation through the ground is considered complex and depends on several factors including damping, reflection and impedance in ground conditions. Vibration impacts for specific plant items and site conditions cannot be readily predicted at this stage. However, for the purpose of this assessment, Table 5-33 shows a ‘Safe Working Distance’ from vibration intensive plant indicating the minimum distance at which vibration levels from intensive vibration activities are not predicted to exceed the cosmetic damage targets.

Table 5-33: Safe working distance – cosmetic damage (Marshall Day Acoustics, 2021)

Plant Items	Safe Working Distance (m)
Hydraulic Impact Hammer – Small (300 kg – 5-12t excavator)	2
Hydraulic Impact Hammer – Medium (900 kg – 12-18t excavator)	7
Hydraulic Impact Hammer – Large (1,600 kg – 18-34t excavator)	22
Pile Boring	2
Jackhammer	1

It is recommended that once a detailed construction methodology is known and specific equipment items are selected, a detailed review of proposed plant locations, close working zones, equipment selections and work activities for these receivers is conducted. Baseline vibration measurements for vibration generating works to develop site-specific exclusion zones should be considered. Detailed vibration impact assessment for works near sensitive receivers are also required to be prepared as part of the full CNVMP.

A number of specific vibration requirements will also be in place to ensure that the Jemena Gas Mains near the Constitution Road tunnel site are protected (Marshall Day Acoustics 2021), which include:

- Peak particle velocity being felt by gas main to not exceed 20 mm/s
- Construction methodology should be provided and submitted to Jemena for approval
- An integrity inspection of Jemena gas main would be required to be performed
- Depending on the final depth of cover, a protection slab may be required over Jemena gas main

- Being a secondary main, pipeline patrol would be required
- In relation to the crane operations, loading assessment would be required.

5.8.3 Mitigation Measures

Table 5-34: Mitigation measures for noise and vibration

Environmental Aspect	Mitigation Measures
General	<ul style="list-style-type: none"> • Prepare and implement a CNVMP.
Site management	<ul style="list-style-type: none"> • Avoid the use of radios or stereos outdoors where neighbours can be affected. • Avoid shouting and minimise talking loudly and slamming vehicle doors. • Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).
Consultation and Negotiation	<ul style="list-style-type: none"> • Ensure consultation outlining building times, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur is undertaken. • For works outside standard hours, inform affected residents and other sensitive land use occupants between 5 – 14 days before commencement. • Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English. A website could also be established for the project to provide information.
Plant and Equipment	<ul style="list-style-type: none"> • Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fracture. The suitability of alternative methods should be considered on a case-by-case basis. • Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric controlled units where feasible and reasonable. Where there is no electricity supply, use an electrical generator located away from residences. • Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber-wheeled tractors can be less noisy than steel tracked tractors. • Pneumatic equipment is traditionally a problem – select super silenced compressors, silenced jackhammers and damped bits where possible. • Operate plants in a quiet and efficient manner. • Reduce throttle setting and turn off equipment when not being used. • Regularly inspect and maintain equipment to ensure it is in good working order. Also, check the condition of mufflers.
Vibration	<ul style="list-style-type: none"> • Implement Safe Working Distances specified in Table 5-33. • Undertake baseline vibration measurements for vibration generating works to develop site-specific exclusion zones. • Undertake detailed vibration impact assessment as part of the CNVMP.
On-site considerations	<ul style="list-style-type: none"> • Place as much distance as possible between the plant or equipment and residences and other sensitive land uses. • Restrict areas in which mobile plant can operate so that it is away from residences and other sensitive land uses at particular times. • Avoid the use of reversing alarms by designing site layout to avoid reversing, such as by including drive through for parking and deliveries.

Environmental Aspect	Mitigation Measures
	<ul style="list-style-type: none"> In all circumstances, the requirements of the relevant Occupational Health and Safety legislation must be complied with. For information on replacing audible warning alarms on a mobile plant with less annoying alternatives. Use temporary site buildings and materials stockpiles as noise barriers. Use natural landform as a noise barrier – place fixed equipment in cuttings, or behind earth berms.
Work Scheduling	<ul style="list-style-type: none"> Consult with affected education facilities to ensure that noise-generating construction works in the vicinity of affected education buildings are not scheduled to occur during examination periods, unless other arrangements (such as relocation to an alternative location) acceptable to the affected parties can be made. Where night work near residences cannot be feasibly or reasonably avoided, restrict the number of nights per week and/or the number of nights per calendar month that the works are undertaken, in consultation with residents who will be most affected. Organise work to be undertaken during the recommended standard hours where possible. When works outside the recommended standard hours are planned, avoid scheduling on Sundays or public holidays. Schedule work when neighbours are not present (for example, commercial neighbours, colleges and schools may not be present outside business hours or on weekends). Schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) where possible to provide masking or to reduce the amount that the construction noise intrudes above the background. Schedule deliveries to nominated hours only.
Transmission Path	<ul style="list-style-type: none"> Reduce the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers. Erect temporary noise barriers before work commences to reduce noise from works as soon as possible.
Complaints handling	<ul style="list-style-type: none"> Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow. Implement all feasible and reasonable measures to address the source of the complaint. Keep a register of any complaints, including details of the complaint such as date, time, the person receiving the complaint, complainant’s contact number, the person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate.

5.9 Landscape and Visual Amenity

5.9.1 Existing Environment

A Landscape and Visual Impact Assessment Report was prepared by MODE (2021) and can be found in Appendix K. The results of which are summarised below.

5.9.1.1 Landscape

The landscape character assessment within the report was presented through the assessment of ten ‘landscape zones’. A description of each contributing element to the overall landscape character of the zones is provided in Table 5-35 below.

Table 5-35: Landscape elements contributing to the overall landscape character of the study area (MODE, 2021)

Element	Description
Light Rail Stations	
Topography	Variable: elevated, level with street, below street level (rock cutting).
Hydrology	Overland stormwater drains to subsurface urban drainage, swales and Hawthorne Canal.
Ecology/vegetation	Remnant bushland mostly established native trees, and some new tree and shrub plantings. Weedy shrubs and grasses.
Land use	SP2 Rail Infrastructure.
Built form	Small shelters and light rail infrastructure (e.g. electrical poles, light poles, signal boxes, fencing).
Spatial	Enclosed - by trees, medium density apartment blocks, heritage industrial buildings, parkland and a rock cutting
Light Rail Corridor	
Topography	Elevated, level with street, below street level.
Hydrology	Overland stormwater drains to subsurface urban drainage, swales and Hawthorne Canal.
Land use	SP2 Rail Infrastructure.
Built form	Small shelters and light rail infrastructure (e.g. electrical poles, light poles, signal boxes, fencing).
Existing GreenWay Corridor	
Topography	Varied: elevated, level with street, below street level.
Hydrology	Overland flow drains to subsurface urban drainage, natural and formed swales and Hawthorne Canal.
Ecology/vegetation	Remnant bushland, mostly established native trees, exotic weeds and some new tree and shrub plantings.
Land use	RE1 Public Recreation.
Built form	Minimal built elements – bitumen pathways, metal handrails and fencing.
Roads	
Topography	Elevated, level with street, below street level.
Hydrology	Rainfall drains to subsurface urban drainage, swales and Hawthorne Canal.
Ecology/vegetation	Remnant bushland, mostly established native trees, and some new tree and shrub plantings.
Land use	SP2 Infrastructure (Classified Roads).
Built form	Arterial roadways, bridges, barrier walls, screens and associated road infrastructure / lighting.
Commercial Properties + Infrastructure developments	

Element	Description
Topography	Varied: level with street, below street level – primarily 2-5 Storey developments.
Hydrology	Overland flow drains to surface drainage, stormwater infrastructure and Hawthorne Canal.
Ecology/vegetation	Remnant bushland, mostly established native trees, and some new tree and shrub plantings.
Land use	IN2 Light Industrial / B4 Mixed Use / SP2 Industrial.
Built form	Predominantly 2-5 storey buildings with limited outlooks.

Low density Residential Development

Topography	Primarily street level, top of Hawthorne Canal embankments.
Hydrology	Overland flow drains to subsurface urban drainage, swales and Hawthorne Canal.
Ecology/vegetation	Remnant bushland, embankments with mostly established native trees and dense exotic weed growth.
Land use	RE1 Public Recreation (Bushland Reserve).
Built form	Canalised artificial waterway (Hawthorne Canal).

Medium Density Residential Development

Topography	Elevated slightly above light rail corridor, level with street - 2-4 storeys (varying)
Hydrology	Overland flows to surface drainage, stormwater infrastructure and on-site detention basins
Ecology/vegetation	Disturbed remnant bushland, established trees, turf and exotic weed growth
Land use	R3 Medium Density Residential
Built form	2-4 Storey residential buildings / mixed-use developments

High Density Residential Development

Topography	Elevated slightly above light rail corridor, level with street - 5+ storeys (varying).
Hydrology	Overland flows to surface drainage, stormwater infrastructure and on-site detention basins.
Ecology/vegetation	Disturbed remnant bushland, established trees, turf and exotic weed growth.
Land use	R3 Medium Density Residential / R4 High Density Residential.
Built form	5+ Storey residential buildings / mixed-use developments.

Parkland

Topography	Level with street, community open space.
Hydrology	Overland flow drains to surface and subsurface urban drainage, swales and stormwater infrastructure.
Ecology/vegetation	Mostly established native trees, open turf areas, palms, and associated vegetation.
Land use	RE1 Public Recreation.
Built form	Play equipment, amenities buildings, retaining walls, concrete pathways.

Dulwich Hill Public School

Topography	Varied: level with street at Blackwood Avenue, below street level at Hercules Street
Hydrology	Overland flow drains to subsurface urban drainage
Ecology/vegetation	Established native trees; small trees and shrubs
Land use	SP2 Infrastructure (Educational Establishment)
Built form	School buildings along railway corridor edge, brick retaining/privacy wall

5.9.1.2 Visual

The visual assessment aspect of the investigation by MODE (2021) aimed to take into account the impact of views and visual amenity while evaluating the effects of change and development in the landscape. It is concerned with how the surroundings of individuals or groups of people may be specifically affected by change in the landscape. The study area traverses a variety of landuses, including parkland and sports facilities, low and medium density residential development and commercial properties. It is bisected by the T2 inner West railway line and multiple major roads.

5.9.2 Impact Assessment

5.9.2.1 Landscape

Impacts to landscape character are based primarily on the themes of magnitude and sensitivity. Sensitivity is described as the degree to which a particular type of landscape character zone can accommodate change arising from a development without detrimental effects on its character. Areas with a high sensitivity to change include zones with substantial natural landscape.

The magnitude of impact is based off a consideration of:

- Existing built form in the landscape and how closely the development matches this in bulk, scale and form
- The scale or degree of change to the landscape resource
- The nature of the effect and its duration including whether it is permanent or temporary.

The overall potential impacts to the landscape character are summarised in Table 5-36.

Table 5-36 Overall impacts to landscape character for different landscape zones within the study area.

Impact Assessment Criteria		Overall Impact Rating
Light Rail Stations		
Sensitivity		The majority of the light rail stations in the zone of influence of the project have a low degree of sensitivity, as they are located in a highly modified urban landscape setting.
Magnitude		The magnitude of change is generally low, as the GreenWay is often only partially visible from the light rail stations as it is visually buffered by existing and proposed vegetation, and/or is sunken or elevated in relation to the GreenWay route.
Summary/ Character Impact	Landscape	A low impact rating has been recorded, due to the low sensitivity and magnitude of the light rail stations. There is minimal to no visual impacts to view corridors to and from the stations. Any potential visual impacts could be mitigated through increased planting of trees and shrubs concentrated around the light rail stations.
Light Rail Corridor		
Sensitivity		This character zone presents a low sensitivity rating, primarily as the areas to be developed along the light rail corridor are generally either barren or congested with exotic weed growth. These areas are typically neglected land, seen mostly at higher speeds from the light rail. Some multi-residential developments overlook the corridor and have a slightly higher sensitivity rating due to different context.
Magnitude		The magnitude of change is considered moderate. The proposed development will present changes to these areas; however, this is associated with new tree and vegetation planting, which presents an improvement to the existing landscape character.
Summary/ Character Impact	Landscape	A moderate-low impact rating is proposed due to variable impacts which are proposed by the development, most of which could be considered improvements to the landscape character.
Existing GreenWay Corridor		
Sensitivity		This character zone presents a moderate sensitivity due to their significant natural setting and subsequent value as regional wildlife and vegetation corridors. Consideration is also given to the alternating portions of viewpoint enclosure, openness and landscape features.
Magnitude		The considered change magnitude is low, as the proposed design seeks to improve and upgrade adjacent planted areas, including pocket parks, and naturalised stormwater channels / vegetated swales.
Summary/ Character Impact	Landscape	A moderate-low impact rating has been established to these areas. It should be noted however, this rating could potentially be reduced with consideration to the improvements to some of the degraded areas proposed by the development.
Roads		
Sensitivity		A negligible sensitivity rating has been assigned. These zones are highly urbanised and are primarily only viewable by / at pedestrian eye level, due to the height of barrier walls and speed of cars travelling over these roadways. This prevents drivers having views toward the development. These barrier walls and safety screens obstruct most opportunities for pedestrians to overlook the development.
Magnitude		Generally, these character zones have a low magnitude consideration, as these highly built-up urbanised conditions are not currently visually appealing. The degree of change would go largely unnoticed as the development is largely located below road level.

Impact Assessment Criteria		Overall Impact Rating
Summary/ Character Impact	Landscape	The proposed development is unlikely to present any discernible visual impacts in these landscape character areas.

Commercial Properties + Infrastructure developments

Sensitivity		Low sensitivity is associated with the bulk of these developments, as the current outlooks are limited to small viewsheds, small or obstructed windows or no facing windows or doors. Generally, the existing view corridors are either filtered through vegetation, looking across areas of exotic weed growth or densely vegetated / enclosed.
Magnitude		The development presents low magnitude for change to these zones. Although permanent structures - pathways and elevated boardwalks are proposed, these are conceptually lightweight in their visual form. The supplementary landscape treatments proposed are intended to provide adequate visual buffering / softening of hard structures and built forms.

Summary/ Character Impact	Landscape	The proposed development is unlikely to have a marked effect on the existing landscape quality of these zones.
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Low density Residential Development

Sensitivity		A moderate sensitivity is associated with this landscape character zone, as the existing landscape (whilst degraded), provides a vegetated wildlife corridor and affords 'borrowed views' to the residences.
Magnitude		<p>Generally, low magnitude effects of the development are presented.</p> <p>Within the Central Links portion, the bulk and form of the sharepath is proposed to be visually lightweight in its form and is set low on the embankment to the opposite side of the canal. This presents a lower viewing height and viewshed to the development from the adjacent properties on Hawthorne Parade. On Haig Avenue, dense existing vegetation will screen much of the proposed GreenWay path.</p> <p>Within the Southern Links portion, the sharepath runs closer to adjacent residential dwellings; where feasible, vegetation has been proposed to mitigate the visual impact of the path and lighting.</p> <p>Throughout this landscape zone it is anticipated that light spill from proposed pole-mounted lighting will be partially screened by existing trees and shrubs, as well as proposed vegetation. Careful consideration of pole location, as well as luminaire type and angle is recommended for subsequent design phases to reduce light spill to adjacent residences. Where possible, additional vegetation could be planted to further reduce impact of light spill on residences.</p>

Summary/ Character Impact	Landscape	A moderate-low overall impact may be presented by the development; however, this may be lower once supplementary planting has established on the development site.
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High Density Residential Development

Sensitivity		<p>A moderate sensitivity is associated with this landscape character zone, as the existing landscape (whilst degraded), provides some visual amenity for the residences.</p> <p>The areas to be developed along the light rail corridor are generally either barren or congested with exotic weed growth, so can accommodate change in the forms of upgrades, which are proposed in the design in the forms of dog parks and supplementary tree planting</p>
Magnitude		A moderate magnitude is presented by the development landscape character zone, as the primary views to the development are from the higher floors of the apartment buildings. These views are more distant and are likely to be filtered through the new tree planting and supported by the new small parks and associated vegetation.

Impact Assessment Criteria	Overall Impact Rating
Summary/ Character Impact	Landscape The development provides a recognisable new form in the existing landscape, which is, however not deemed to significantly affect the overall character of its location within the light rail corridor, due to its industrial setting and currently degraded landscape features.

Medium Density Residential Development

Sensitivity	A moderate sensitivity is associated with this landscape character zone, as the existing landscape (whilst degraded), provides some visual amenity for the residences. The areas to be developed along the light rail corridor are generally either barren or congested with exotic weed growth, so can accommodate change in the forms of upgrades, which are proposed in the design in the forms of dog parks and supplementary tree planting.
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Magnitude	A moderate magnitude is presented by the development landscape character zone. The visual impact of the proposed Project varies according to its distance from and height relative to the residential development. For example, Within the Southern Links portion, the sharepath runs closer to adjacent residential dwellings; where feasible, vegetation has been proposed to mitigate the visual impact of the path and lighting. Throughout this landscape zone it is anticipated that light spill from proposed pole-mounted lighting will be partially screened by existing trees and shrubs, as well as proposed vegetation. Careful consideration of pole location, as well as luminaire type and angle is recommended for subsequent design phases to reduce light spill to adjacent residences. Where possible, additional vegetation could be planted to further reduce impact of light spill on residences.
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Summary/ Character Impact	Landscape The development provides a recognisable new form in the existing landscape, which is, however not deemed to significantly affect the overall character of its location within the light rail corridor, due to its industrial setting and currently degraded landscape features.
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Parkland

Sensitivity	A moderate sensitivity is associated with this landscape character zone. The existing landscape includes mature existing palms, trees and underplanting, and significant impacts to its character such as the removal of trees could present impacts to the park users and adjacent residential developments. It is noted that the development will tie into an existing path at key junctions.
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Magnitude	A moderate magnitude is presented by the development landscape character zone, as the development passes through the edges of parkland zones. These share paths are however proposed at grade and tie into existing at grade pathways, also likely to be filtered through the new and existing tree and vegetation planting.
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Summary/ Character Impact	Landscape The development provides a recognisable new form in the existing landscape, which is, however not deemed to significantly affect the overall character of its location as it ties into existing similar conditions. The development also allows an opportunity for supplementary tree and vegetation planting to upgrade edge conditions.
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Dulwich Hill Public School

Sensitivity	A low sensitivity is associated with this landscape character zone, as the focus of activity within this landuse is not dependent on the view.
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Magnitude	The development presents low magnitude for change to this zone. Whilst Dulwich Hill Public School occupies an elevated position relative to the GreenWay path, the existing brick wall and established vegetation along the eastern edge of the light
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Impact Assessment Criteria	Overall Impact Rating
	rail corridor will provide significant visual screening. Furthermore, any views of the Project will be mitigated by proposed screening vegetation along the GreenWay path edge.
Summary / Landscape Character Impact	A moderate-low overall impact may be presented by the development; however this may be lower once planting has established on the development site.

5.9.2.2 Visual

The visual assessment utilised a number of representative viewpoints along the alignment of the study area to determine the potential visual impacts of the project. The study area was broken up into three areas, Area 1 – Taverners Hill to Old Canterbury Road, which consisted of 13 viewpoints, Area 2 – Waratah Mills to New Canterbury Road, from which 10 viewpoints were gathered, and Area 3 – New Canterbury Road to Hercules Street, with seven viewpoints. A list of visual impacts is provided in Table 5-37 below.

Table 5-37: Visual impact of the works resulting from the Project (Mode, 2021)

Viewpoint	Visual Impact	Reasoning	Commentary
Area 1			
1 - Hawthorne Parade Residential	High Moderate	<p>– The Project is likely to be partially visible from 2-3 dwellings along the southern end of Hawthorne Parade. The existing GreenWay path runs along this portion of the canal.</p> <p>It is anticipated that light spill from proposed pole-mounted lighting will be partially screened by existing trees and shrubs along the opposite side of the canal.</p>	<p>Careful consideration of light pole location, as well as luminaire type and angle is recommended for subsequent design phases to reduce light spill to adjacent residences. Additional vegetation could be planted between the fence line and the canal to further reduce impact of light spill on residences.</p> <p>To minimise potential conflict between pedestrians and cyclists, a change in paving material and/or pavement treatment could be considered to alert users to the intersection of the new pathway with the existing Greenway path.</p>
2 - Taverners Hill Light Rail Station	Moderate	<p>The Project is likely to be partially visible through screening vegetation when looking towards the Greenway from the station steps. The existing GreenWay path runs along this portion of the canal.</p> <p>Despite the close proximity of the project to the station, the visual impact will be mitigated by existing screening vegetation. Furthermore, as the GreenWay extends out into Hawthorne Canal and grades down to go under Parramatta Road, the viewshed from the elevated station is minimised.</p>	<p>Future design phases should consider overarching signage and wayfinding strategy to help direct users to entry points and new connections to existing and new sections of the GreenWay.</p> <p>This will be especially important for connections that are heavily screened by vegetation and/or located below eye level, such as the proposed cantilevered Greenway path under Battle Bridge at Parramatta Road.</p>
3 - Parramatta Road Commercial	High Moderate	<p>– Overall, a high-moderate visual impact is expected here, as the path is cantilevered over the canal.</p> <p>Views of the project may be partially obscured by branches of the large existing fig tree overhanging Hawthorne Canal; where possible. These should be retained to reduce the overall visual impact of the project. The existing GreenWay path runs along this portion of the canal.</p> <p>A cluster of semi-mature Casuarina trees will be removed to allow access and construction. These are fast-growing species which could be replaced adjacent the new pathway once installed</p>	<p>Additional vegetation / understorey planting to both embankments of the canal corridor would provide further visual screening of the Project from adjacent Parramatta Road Commercial properties.</p> <p>An open-design style balustrade would provide a lightweight look to the cantilevered pathway and allow more view to adjacent planting.</p> <p>Replacement tree planting to offset the casuarinas being removed would provide gentle screening from the existing Eastern bitumen pathway, adjacent the station.</p>
4 - Parramatta Road (Pedestrian)	Low – Moderate	<p>The quantum view is reduced by the oblique angle of view from Parramatta Road down to the elevated walkway, the existing sandstone wall and the large fig tree branches which overhang the Hawthorne Canal. These</p>	<p>Future design phases should consider overarching signage and wayfinding strategy to help direct users traveling along</p>

Viewpoint	Visual Impact	Reasoning	Commentary
		<p>branches should be retained to reduce the overall visual impact of the project.</p> <p>The period of view is very short for passing motorists (who are traveling at up to 60 km/hr). As this is a highly urbanised area with little incentive to stop or linger, it is anticipated pedestrians will be moving quickly through this area.</p> <p>The existing GreenWay path crosses Parramatta Road adjacent to this viewpoint location.</p>	<p>Parramatta Road to entry points and new connections to existing and new sections of the GreenWay.</p> <p>This will be especially important for connections that are heavily screened by vegetation and/or located below eye level, such as the proposed cantilevered GreenWay path under Battle Bridge at Parramatta Road.</p> <p>Replacement tree planting to offset the casuarinas being removed would provide gentle screening from the existing Eastern bitumen pathway, adjacent the station.</p>
5 - Haig Avenue Residential	Moderate	<p>The Project is likely to be partially visible from Haig Avenue dwellings that are immediately adjacent to the existing Greenway corridor. The existing GreenWay path runs along this portion of the canal.</p> <p>It is anticipated that minimal trees and vegetation will require removal as the pathway alignment travels through the mostly clear central area of the embankment. Impacts will be reduced due to the existing dense visual screening provided by existing vegetation within the GreenWay corridor.</p>	<p>Low massed understorey planting to assist with bank stabilisation and reduction of sedimentation downslope could be considered.</p> <p>Although these areas have been planted, species should be selected from species found naturally with the Sydney Turpentine-Ironbark Forest ecological community.</p>
6 - Haig Avenue Public Domain	Moderate	<p>The Project is likely to be partially visible from the end of Haig Avenue looking east across Hawthorne Canal to the existing GreenWay corridor.</p> <p>It is anticipated that minimal trees and vegetation will require removal as the pathway alignment travels through the mostly clear central area of the embankment. Impacts will be reduced due to the existing dense visual screening provided by existing vegetation within the GreenWay corridor.</p>	<p>Considerations for ongoing design development could include replacing the existing metal fencing to the end of Haig Street with a more accessible solution such as timber bollards or sandstone blocks which also prevent vehicular access to the GreenWay.</p> <p>Low massed understorey planting to assist with bank stabilisation and reduction of sedimentation downslope could be considered.</p> <p>Although these areas have been planted, species should be selected from species found naturally with the Sydney Turpentine-Ironbark Forest ecological community.</p>
7 - Flour Mill Residential (North)	High	<p>The Project occupies both sides of the light rail corridor and will be highly visible from this viewpoint, despite some visual screening from proposed vegetation at the outer edges of the Project.</p> <p>It should be noted however that the area is currently limited in vegetation cover, and the proposed tree planting to both edges of the rail corridor</p>	<p>The significant vegetation proposed here should provide increasing visual screening to the share path from the Flour Mill Residential (North) apartments over time.</p>

Viewpoint	Visual Impact	Reasoning	Commentary
		should provide a much-improved landscape character and community benefit to these currently underutilised areas.	When selecting vegetation species, consideration should be made for the significant level change between Malthouse Way and the (lower) light rail corridor. Consideration of privacy and screening of the GreenWay must be balanced with Crime Prevention through Environmental Design (CPTED) principles to ensure clear sightlines and lighting to create a safe space.
8 - 'Luna' Residential	High	The Project occupies both sides of the light rail corridor and will be highly visible from this viewpoint, despite some visual screening from existing and proposed vegetation at the outer edges of the project. It is anticipated there will be minimal removal of significant vegetation required, as the pathway alignment is proposed through areas which are currently primarily turf grass of low significance.	Privacy and screening of the GreenWay must be balanced with CPTED principles to ensure clear sightlines and lighting create a safe space. The dog off leash area should activate this space and increase passive surveillance, providing a benefit to the local community and much needed open space.
9 - Lewisham West Public Domain (Including Harvest Park)	High Moderate	– The Project is likely to be partially visible from Harvest Park, and clearly visible from the western end of Hudson Street. The proposed changes to the landscape visible from these two viewpoints are minor, i.e. low vegetation to each side of the corridor, and a row of trees to the western edge of the corridor - as these trees establish they will screen views to the Project.	Additional vegetation and pavement upgrades where the light rail station interfaces with Hudson Street could be considered in future design stages, to enhance and create a more consistent high-quality public domain within this precinct. Where possible, continuing the tree canopy and landscaped areas that characterise these two parks will elevate the experience of the user and create visual continuity as users move across the light rail corridor. Importantly, these upgrades will also extend the cooling benefits of increased tree canopy and vegetation already experienced in these parks, which is especially critical within and around the light rail corridor. This is currently very exposed and dominated by hardscape.
10 - Lewisham West Light Rail Station	High Moderate	– Multiple areas within the Project will be highly visible from this viewpoint, including the proposed dog off leash area, new share path and wetland. Visual access to medium-high density residential developments that line the western edge of the corridor will be reduced as proposed trees mature. It should be noted, however that this area is currently limited in vegetation cover, and the proposed tree planting to both edges of the rail corridor	Where possible, establishing tree canopy and landscaped areas to reduce heat and improve pedestrian amenity will provide high benefits, as this area is very exposed and dominated by hardscape and pavement.

Viewpoint	Visual Impact	Reasoning	Commentary
		should provide a much-improved landscape character and community benefit to these currently underutilised areas.	
11 - Light Rail Corridor	Moderate	<p>Multiple areas within the Project will be highly visible from the light rail corridor, including the proposed dog off leash area, new share path and wetland. Visual access to medium-high density residential developments that line the western edge of the corridor will be reduced as proposed trees mature.</p> <p>The period of view is limited as most receptors will only see this view for a short period of time, e.g. crossing the light rail line, traveling on the light rail.</p>	<p>Additional vegetation and pavement upgrades where the Lewisham West light rail station interfaces with Hudson Street could be considered in future design stages to enhance the consistency of the public domain.</p> <p>Where possible, establishing tree canopy and landscaped areas to reduce heat and improve pedestrian amenity will provide high benefits, as this area is very exposed and dominated by hardscape and pavement.</p>
12 - Flour Mill Residential (South)	High	<p>The Project occupies both sides of the light rail corridor and will be highly visible from this viewpoint, however proposed vegetation at the outer edges of the project should benefit residents. Some existing screening vegetation adjacent to the light rail pedestrian crossing is proposed to be removed for the share path alignment construction.</p> <p>Some apartments within the Flour Mill may be affected by light spill from proposed pole-mounted lighting and potential lighting to rail heritage items. There is an existing high level of existing light spill from light rail infrastructure (especially Lewisham West Light Rail station and pedestrian crossover). Proposed vegetation will provide visual screening to light spill for most apartments.</p> <p>Replanting and screening will be provided to mitigate adverse impact and provide visual screening from the light rail corridor, providing an overall positive visual impact.</p>	<p>Privacy and screening of the GreenWay must be balanced with CPTED principles to ensure clear sightlines and lighting create a safe space. Tree and revegetation replanting will be key for resident’s visual amenity.</p>
13 - Lewisham West Residential	High	<p>The Project proposes minimal changes to the eastern side of the corridor (i.e. closest to this viewpoint) and proposes a share path and new tree plantings to the western side.</p> <p>Several advanced existing trees adjacent Old Canterbury Road are proposed to be removed to allow for construction. It should be noted these trees are considered weed species of various significance</p>	<p>Proposed screening vegetation is expected to visually mitigate views of the proposed wetland from the Lewisham West Residential apartments.</p> <p>While changes proposed to the western edge of the corridor will be clearly visible, especially from higher apartments within Lewisham West Residential apartments, these will be visually mitigated by proposed screening vegetation.</p>

Viewpoint	Visual Impact	Reasoning	Commentary
			<p>Furthermore, this section of the light rail corridor is expected to take on a greener and more amenable character over time as this new vegetation becomes more established over time. This is consistent with the character of other sections of the light rail corridor and provides benefits both for path users and residents of adjacent apartments such as those within Lewisham West.</p> <p>Consideration should be given to the advanced existing trees adjacent Old Canterbury Road and replacement species should be advanced to assist in softening the overall construction impacts.</p>

Area 2

1 - Waratah Mills Light Rail Station	Moderate	<p>The proposed GreenWay path re-joins the light rail corridor at the end of Weston Street, moving in a south-westerly direction through a proposed tunnel under Davis Street.</p> <p>The entry to the tunnel will be visible from Waratah Mills Light Rail Station. It is recommended that this sightline remains clear in the interests of safety and in line with CPTED guidelines, and to ensure user experience is one of perceived safety.</p> <p>It is worth noting that an oblique view of the tunnel entry may be present from the residential townhouses at 1-15 Nelson Street. However, as these windows are very narrow and located approximately 50 m from the tunnel entry, the visual impact is considered to be negligible.</p> <p>While vegetation clearing will be required along the new pathway alignment, impacts will be reduced by existing dense visual screening provided by existing vegetation within the GreenWay corridor. Additional replacement planting is proposed to assist with vegetated screening and softening to the pathway for the residents along this area</p>	<p>As the proposed tunnel entrance will not be visually apparent from Weston Street or Davis Street, signage and lighting will be important to assist users with wayfinding.</p> <p>Additional vegetation planting should be carefully considered to create fast-growing and ample density screening for the residential properties, however CPTD principles are to be considered to ensure safety for pedestrians, residents and users.</p>
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2 – Waratah Mills Residential	High Moderate	<p>– The Project is likely to be visible from higher Waratah Mills Residential apartments, especially those within the repurposed silo. Additional screening vegetation along the GreenWay path would help to mitigate the visual impact of the pathway.</p>	<p>As the proposed tunnel entrance will not be visually apparent from Davis Street, signage and lighting will be important to assist users with wayfinding.</p> <p>Additional advanced trees and dense vegetation along the GreenWay share path would help to visually screen the Project</p>
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Viewpoint	Visual Impact	Reasoning	Commentary
		While vegetation clearing will be required along the new pathway alignment, impacts will be reduced by existing dense visual screening provided by existing vegetation within the GreenWay corridor. Additional replacement planting is proposed to assist with vegetated screening and softening to the pathway for the residents along this area.	from Waratah Mills Residential apartments. This should match the desired character of the original vegetation.
3 - Terry Road	Moderate	While the Project will be fully visible for both motorists and pedestrians using Terry Road, the view is not likely to change greatly. Initially there may be less vegetation visible as some will need to be cleared for the proposed pathway; however, fencing will also be removed, opening up both physical and visual access to the proposed pathway. Further, views will be softened as the proposed vegetation establishes over time.	As the proposed tunnel entrance will not be visually apparent from Terry Road, signage and lighting will be important to assist users with wayfinding.
4 - Johnson Park	Moderate	The Project is likely to be heavily filtered by existing trees and shrubs within Johnson Park. The most visible element of the Project will be the proposed path that will connect the existing internal path within Johnson Park to the GreenWay. Impacts will be reduced due to the existing dense visual screening provided by existing vegetation within the GreenWay corridor.	The GreenWay share path is expected to bring an increase in numbers of users passing through and using Johnson Park, and therefore increase passive surveillance and safety. Proposed upgrades to lighting along the footpath is likely to also increase safety.
5 - Arlington Residential	Low – Moderate	While higher apartments will have more open views across Johnson Park towards the Project, existing trees and shrubs along the eastern edge of Johnson Park will provide significant visual screening. The most visible elements of the Project will be the new path and tunnel that will run under Constitution Road, as well as the proposed path that will connect the existing internal path within Johnson Park to the GreenWay. Both of these new features are expected to be screened by existing vegetation. Impacts will be reduced due to the existing dense visual screening provided by existing vegetation along the eastern edge of Johnson Park and within the GreenWay corridor.	The addition of significant planting should provide a more cohesive and inviting public domain experience overall.
6 - Arlington Light Rail Station	Moderate	The Project is likely to be partially visible from Arlington Light Rail station. However, existing vegetation and the sunken nature of the station will significantly reduce visual access to the Project.	As the proposed tunnel entrance will not be visually apparent from most areas Johnson Park, Constitution Road or Grove Street, signage and lighting will be important to assist users with wayfinding.
7 - Light Rail Corridor	Moderate	Significant vegetation will be removed to make way for the new GreenWay path. The path will be clearly visible from the light rail line; however,	This section of light rail corridor has a heavily vegetated character. As construction of the GreenWay here will

Viewpoint	Visual Impact	Reasoning	Commentary
		<p>existing trees adjacent to Williams Parade apartments will provide a vegetated backdrop.</p> <p>The period of view is limited as receptors will only see this view for a short period of time while traveling on the light rail.</p> <p>While significant vegetation clearing will be required along the new pathway alignment, future amenity and impacts will be improved by additional replacement tree and shrub planting, proposed to assist with vegetated screening and softening to the pathway for the residents along this area.</p>	<p>necessitate the removal of some vegetation, it is important that vegetation is reinstated to retain its character.</p> <p>Careful consideration is to be taken prior and during construction to ensure impacts to resident privacy are minimised.</p>
<p>8 – Williams Parade Residential</p>	<p>High</p>	<p>Existing trees and shrubs between these apartments and the light rail corridor will provide significant visual screening of the Project. However, significant vegetation along the western edge of the light rail corridor will be removed to make way for the new GreenWay path.</p> <p>While the ground floor apartments are expected to be approximately level with the GreenWay path, the second-floor apartments are expected to have elevated views, thus reducing the overall visual impact of the Project.</p> <p>While significant vegetation clearing will be required along the new pathway alignment, future amenity and impacts will be improved by additional replacement tree and shrub planting, proposed to assist with vegetated screening and softening to the pathway for the residents along this area.</p>	<p>This section of light rail corridor has a heavily vegetated character. As construction of the GreenWay here will necessitate the removal of some vegetation, it is important that vegetation is reinstated to retain its character. Specifying more established vegetation is recommended the process</p> <p>Significantly, this vegetation will also help to visually screen the Project from Williams Parade Residential apartments. Additional tree planting along the existing vegetation corridor to visually screen the Project is recommended.</p> <p>Careful consideration of light pole location, as well as luminaire type and angle are recommended for subsequent design phases to reduce light spill to adjacent residences. Additional vegetation could be planted between the fence line and the sharepath to further reduce impact of light spill on residences.</p>
<p>9 – Denison Road Residential</p>	<p>Moderate</p>	<p>Existing trees and shrubs between these apartments and the light rail corridor will provide significant visual screening of the Project. While significant vegetation along the western edge of the light rail corridor will be removed to make way for the new GreenWay path, no vegetation on the eastern side closest to these apartments in proposed to be removed, therefore this visual screening will remain unchanged.</p> <p>The higher floor apartments will have elevated views across the Project, thus reducing the overall visual impact.</p>	<p>This section of light rail corridor has a heavily vegetated character. As construction of the GreenWay here will necessitate the removal of some vegetation, it is important that vegetation is reinstated to retain its character and scale</p>

Viewpoint	Visual Impact	Reasoning	Commentary
10 - 553 Canterbury Residential	New Road High	<p>Existing trees and shrubs between these apartments and the light rail corridor will provide significant visual screening of the Project. However, significant vegetation along the western edge of the light rail corridor will be removed to make way for the new GreenWay path.</p> <p>The higher apartments are expected to have elevated views across the GreenWay path, thus reducing the overall visual impact of the Project.</p> <p>Additional tree planting along the existing vegetation corridor to visually screen the Project is recommended. Taller tree species will assist with screening views from higher apartments.</p>	<p>Careful consideration of light pole location, as well as luminaire type and angle are recommended for subsequent design phases to reduce light spill to adjacent residences.</p> <p>Additional vegetation could be considered for new planting between the fence line and the sharepath to further reduce impact of light spill on residences, and to replace any trees removed as part of construction.</p>
Area 3			
1 - 1-9 Terrace Residential	Road Moderate	<p>Existing vegetation to both sides of the existing footpath filters views to the light rail corridor and will provide significant visual screening of the Project. As the GreenWay path is proposed to run through a tunnel underneath New Canterbury Road then connect to the existing footpath adjacent to New Canterbury Road, the scope of works visible from this viewpoint is limited.</p> <p>While significant vegetation clearing will be required along the new pathway alignment, future amenity and impacts will be improved by additional replacement tree and shrub planting, proposed to assist with vegetated screening and softening to the pathway for the residents along this area.</p> <p>The main residents to be affected will be those in the northernmost apartment building, who will have direct views to the tunnel entry underneath New Canterbury Road. Other residents in buildings further south will have oblique views towards the Project.</p>	<p>As the proposed underpass entrance will not be visually apparent from New Canterbury Road, signage and lighting will be important to assist users with wayfinding.</p> <p>This section of light rail corridor has a heavily vegetated character. As construction of the GreenWay here will necessitate the removal of some vegetation, it is important that vegetation is reinstated to retain its character and scale.</p>
2 - Dulwich Grove Rail Station	Light Moderate	<p>Due to being an underpass, the project is likely to be minimally visible from Dulwich Grove Light Rail Station. From further south oblique views will be available however, are likely to be filtered by existing and proposed vegetation.</p> <p>As construction of the GreenWay here will necessitate the removal of some vegetation, it is important that vegetation is reinstated to retain its character and scale.</p>	<p>New narrow planting between the new share path and the light rail line would help reduce the visual impact of the new share path.</p>

Viewpoint	Visual Impact	Reasoning	Commentary
3 - Hercules Street Bridge	Moderate – Low	The Project meets this viewpoint at street level, proposing planted beds to extend the kerb and loss of some parking. These changes are immediately adjacent to Hercules Street Bridge and so will be very visually apparent.	Should the acquisition of property be accommodated to provide the concept design pathway orientation, there is opportunity to provide ample planted buffer / wetlands to soften the pathway. This should provide a much-improved character and through-site legibility for the users.
4 - Hercules Street Residential	High Moderate	<p>– The Project is likely to be well screened by existing and proposed vegetation between the back property/fence line of houses on Hercules Street and the light rail corridor. With time, the many proposed trees within this relatively wide portion of light rail corridor will provide increased visual screening.</p> <p>Furthermore, while the views from the backyards of these properties directly face the Project, the majority of properties have a significant distance between the back of their dwelling and the Project. Therefore, affected views are most likely from backyards, not dwellings themselves.</p> <p>This section of light rail corridor has a vegetated character. As construction of the GreenWay here will necessitate the removal of some vegetation, it is important that vegetation is reinstated to retain its character and scale. It should be noted that the proposed GreenWay path is located along a mound, and so will be more visually accessible from this viewpoint.</p> <p>The impact is reduced due to the existing dense visual screening provided by existing and proposed vegetation within the GreenWay corridor.</p>	<p>Careful consideration of light pole location, as well as luminaire type and angle are recommended for subsequent design phases to reduce light spill to adjacent residences.</p> <p>Additional vegetation could be planted between the fence line and the GreenWay share path to further reduce impact of light spill on residences. Consideration should be given to advanced tree plantings to replace existing trees to be removed.</p>
5 - Blackwood Avenue	Moderate – Low	<p>While the Project will be visible for both motorists and pedestrians using Blackwood Avenue, existing and proposed vegetation is likely to reduce the overall visual impact of the Project.</p> <p>Initially there may be less vegetation visible as some will need to be cleared for the proposed pathway; however, views will be softened as proposed vegetation establishes over time.</p>	Future design development should consider a landscaped solution that prioritises CPTED principles and is aesthetically pleasing for the user experience, while providing complaint gradients.
6 - Light Rail Corridor	High Moderate	– The Project will be clearly visible from this viewpoint. Existing and proposed vegetation, especially proposed trees, will increasingly screen views across the GreenWay path over time.	<p>This section of light rail corridor has a heavily vegetated character. As construction of the GreenWay here will necessitate the removal of some vegetation, it is important that vegetation is reinstated to retain its character.</p> <p>Also, as the share path runs along the ridge of an elevated mound that wraps around the back of houses on Hercules</p>

Viewpoint	Visual Impact	Reasoning	Commentary
			<p>Street, careful consideration of light pole location, as well as luminaire type and angle is recommended for subsequent design phases to reduce light spill to adjacent residences. Where possible, additional vegetation could be planted between back fences and the share path to further reduce impact of light spill on residences.</p>
7 - Hercules Street	Moderate	<p>The Project is likely to be visible looking eastward on Hercules Street, however, will be highly screened by existing and proposed vegetation, especially existing street trees on Hercules Street.</p>	<p>Future design phases should consider overarching signage and wayfinding strategy, especially in this location as its the main southern connection the Greenway.</p>

The proposed works will infer varying levels of impact on the visual and landscape character of the study area, depending on the sensitivity of individual locations near the works and their sensitivity to change. A number of mitigation measures are provided below which will work to minimise these impacts where possible.

5.9.3 Mitigation Measures

Table 5-38: Mitigation measures for visual and landscape

Environmental Aspect	Mitigation Measures
Impact on the community	<ul style="list-style-type: none"> • Notify community or neighbours where light impacts are anticipated. • Position lighting in residential areas to direct light away from houses wherever possible. • Ensure all access restrictions are removed following construction. • Consider mitigating potential visual impacts through increased planting of trees and shrubs concentrated around the light rail stations. • To reduce light spill to adjacent residences, consider location of pole as well as luminaire type and angle during the detailed design stage. • Where possible, consider additional revegetation to further reduce impact of light spill on residences. • If possible, retain the large fig tree branches which overhang the Hawthorne Canal to reduce the overall visual impact of the project. • The entry to the tunnel will be visible from Waratah Mills Light Rail Station. It is recommended that this sightline remains clear in the interests of safety and in line with crime prevention through environmental design guidelines, and to ensure user experience is one of perceived safety.

5.10 Traffic and Transport

5.10.1 Existing Environment

The road network surrounding the study area is comprised of local roads within a coarser grid of collector, arterial and sub-arterial roads. Typical Annual Average Daily Traffic (AADT) on this road network is relatively high. Approximate AADT volumes are provided in Table 5-39 below for the main distributor and arterial roads located near the study area that influence traffic volumes.

Table 5-39: Road Classification and indicative AADT traffic volumes (Inner West Council)

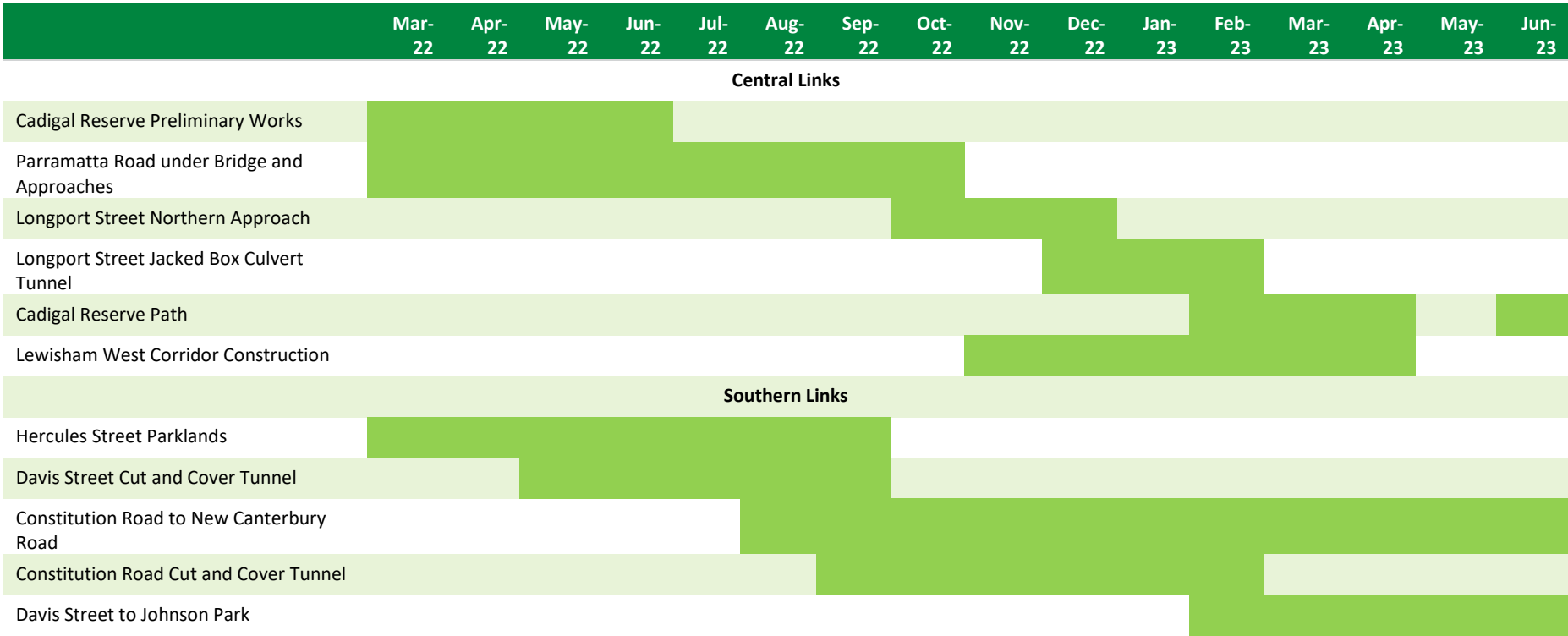
Road	Traffic Volumes	Functional Classification
Parramatta Road	62,000	Arterial
Hawthorne Pde	<1,500	Local
Haig Ave/ Frenches Lane	<500	Local
Grovesnor Street	5,700	Collector
Longport Street	21,000	Sub-arterial
Smith Street	4,500	Collector
Malthouse Way	<500	Local
Old Canterbury	32,000	Arterial
Weston Street	<500	Local
Davis Street	<1,500	Collector
Windsor Road	<1,500	Collector
Constitution Road	4,400	Collector
Williams Pde	1,600	Local
New Canterbury Road	29,000	Arterial
Hercules Street	2,200	Collector
Terrace Road	4,000	Collector
Ewart Street (west of Terrace)	9,100	Sub-arterial
Marrickville Road	13,000	Sub-arterial
Wardell Road	15,000	Sub-arterial

Construction traffic would likely access the compounds and works areas within the Central Links works area from Grovesnor Crescent, Old Canterbury Road and Hudson Street. For the southern links works areas and compounds, construction traffic will likely access the compounds and works area from Terry Road, Constitution Road, New Canterbury Road and Hercules Street. Works within the Cadigal Reserve will be accessed from Cadigal Reserve and Grovesnor Street. In order to facilitate the works, approximately one vehicle movement per fifteen minutes (4/hr) will be required per construction site has been assumed.

5.10.2 Impact Assessment

Staging for the Central and Southern links will likely be undertaken simultaneously, and this assessment has been based upon the following timeline as provided by Council in Table 5-40.

Table 5-40: Proposed Construction Timeline



For each stage of the above works, it has been assumed that the compound sites outlined in Table 5-41 will be utilised.

Table 5-41: Assumed compound sites for each stage of works

Stage	Compound Area Used
Central Links	
Cadigal Reserve Preliminary Works	Cadigal Reserve Compound
Parramatta Road under Bridge and Approaches	Cadigal Reserve Compound
Longport Street Northern Approach	Lewisham West Compound Cadigal Reserve Compound
Longport Street Jacked Box Culvert Tunnel	Lewisham West Compound Cadigal Reserve Compound
Cadigal Reserve Path	Cadigal Reserve Compound
Lewisham West Corridor Construction	Lewisham West Compound
Southern Links	
Hercules Street Parklands	Hercules Street Compound
Davis Street Cut and Cover Tunnel	Davis Street Compound Weston Street Compound
Constitution Road to New Canterbury Road	Constitution Road Compound
Constitution Road Cut and Cover Tunnel	Canterbury Road Compound
Davis Street to Johnson Park	Constitution Road Compound

Within the Central Links, preliminary works within the Cadigal Reserve and the delivery of sections associated with the Parramatta Road Under bridges and Approaches will be undertaken first. For these works, vehicle access will predominantly travel through Grovesnor Crescent and Old Canterbury Road and would require approximately 4 additional vehicle movements to site per hour, or 44 per day (during standard construction hours). Consideration of the AADT volumes within these two roads indicates that this increase in traffic volume will not significantly disrupt local residents, however it should be ensured that access for residents on these streets is not compromised, and construction vehicles and staging does not block driveways.

Works for the Longport Street Northern Approach will begin at the conclusion of the works on Parramatta Road and lead into the construction of the Longport Street Jacked Box Culvert tunnel. These works will continue to utilise the Cadigal Reserve site compound where possible but may require the use of the Lewisham West compound. It will require the same number of vehicle movements to site as the above.

Works for the Lewisham West Corridor Construction will commence within the same timeframe as the works on Longport Street, and coincide with the Cadigal Reserve Path Construction. An additional site compound may be required on the western side of Cadigal Reserve. Considering this, and the works proposed for this period, it is assumed that there would be 88 vehicle movements to site per day

between the Cadigal reserve and Lewisham West Compounds. The majority of the impacts on traffic flow at this time would be felt on Malthouse Way, which experiences <500 vehicle movements per day.

Within the Southern Links works area, the works within the Hercules Street Parklands will be undertaken first and will require approximately 4 additional vehicle movements to site from Weston Street, Davis Street and Hercules Street per hour. These impacts will be mitigated by ensuring that heavy vehicles are not idling or parking within residential streets. As the Dulwich Hill Public school is located adjacent to Hercules Street, it is important to ensure that communication with the school is undertaken prior to works commencement, and vehicle routes are determined to ensure safety and minimal disruption of activities. Construction deliveries should avoid Hercules Street where possible, or where they must be undertaken, be performed outside of school pick up/drop off times.

The works for the Davis Street Cut and Cover tunnel will coincide with those within the Hercules Street Parklands and will utilise construction compounds located on Davis Street. An approximate 88 vehicle movements per day will be required during these times. Due to the relatively low AADT volumes on these streets, mitigation measures will need to be adhered to, to ensure that resident access is not blocked and parking is maintained.

Works on Constitution Road, including the Cut and Cover tunnel will likely be undertaken following these works on Davis Street, with further works between Davis Street and Johnson Park commencing following the completion of the tunnel. Assuming that at points, works will be undertaken within these three project areas simultaneously, 132 vehicle movements may be required to site per day. These movements would likely utilise Constitution Road, New Canterbury Road.

It has been assumed that the construction works for the GreenWay will require approximately:

- 970m³ or 2,330 T of concrete
- 1,450 m³ or 1,880 T of soil/aggregate
- 290 T of steel
- Removal of 2,260 m³ of spoil or 2,940 T.

It is assumed that a 10 T truck is utilised for haulage, the amount of heavy vehicle trips required for the project is assumed to be 5.2 per day (Table 5-42).

Table 5-42: Construction heavy vehicle trips for project

Tonnes of Material	Truck trips (includes an inbound and outbound trip)	Duration of activity in days	Average daily truck trips
7,440	785	300	5.2

Throughout the life of the project, temporary partial road closures will be required in order to enable delivery of construction materials. Sections of Parramatta Road will require partial closures that have the potential to disrupt traffic as Parramatta Road is an arterial road that experiences approximately 62,000 vehicle movements per day. This being the case, delivery of materials that will require access through Parramatta Road may need to be undertaken at night, when traffic volumes are lower.

Works for both the central and southern links will require intermittent closures of New Canterbury Road and Longport Street to allow construction material delivery, particularly for the Jacked Box Culvert

tunnel on Longport Street. It is anticipated that the staging of these two stages of the project will overlap, and considering the AADT volumes of New Canterbury Road and Longport Street (29,000 and 21,000 respectively), there is potential for significant traffic delays within the area if road closures are undertaken at the same time. This compiled with the increased number of vehicle movements to the sites (which may be up to 200 per day) mean that careful consideration should be taken when developing a works timeline.

The proposed works will also require a closure of the bridges on both Davis Street and Constitution Road, which run parallel and connect Windsor Road and Denison Road. Staging for these works will be taken one after the other to ensure that bridges are not closed simultaneously, and traffic impacts are minimised. These temporary closures are anticipated to require approximately 6 - 8 weeks per bridge. Davis Street receives <1500 vehicle movements per day, and Constitution Road approximately 4,400. Commuters expecting to utilise Davis Street or Constitution Road during the respective stage of the project will likely be forced to make a detour (1.5 km approx.) along Denison Street and Windsor Road instead of using the temporarily closed bridge crossing.

It is recommended that a Traffic Management Plan be implemented prior to the commencement of any construction works. Appropriate signage should be erected to notify commuters of detours and road closures, and consultation with the relevant road authority (including Council and TfNSW) for proposed road closures should be undertaken to develop this Traffic Management Plan. It is recommended that community consultation be undertaken, and complaints register be maintained during the life of the project to mitigate potential community issues and minimise complaints.

Operational traffic impacts from the GreenWay are expected to be low, and likely positive, as it would encourage local residents to utilise the walking tracks and existing light rail. It is anticipated that the majority of impacts to the road network and on traffic in the area will be felt during construction.

5.10.3 Mitigation Measures

Table 5-43: Mitigation measures for traffic

Environmental Aspect	Mitigation Measures
Disruption to traffic flows	<ul style="list-style-type: none"> Position vehicles, materials and equipment to minimise impacts to public access and parking. If required, restrict heavy vehicles to specified routes. Implement a Traffic Management Plan prior to the commencement of any construction works to ensure that traffic disruptions are mitigated, and commuters are notified of detours and closures through signage. Maintain a project complaint register as part of the Traffic Management Plan.
Temporary road closures	<ul style="list-style-type: none"> Consider night works where road closures are required on large classified roads such as Parramatta Road to avoid traffic impacts. Undertake consultation, in accordance with Section 138 of the Roads Act, with TfNSW for any road closures required on classified Roads. Notify nearby businesses and sensitive receivers and give opportunity to comment on temporary road closures prior to commencement of construction. Do not undertake closures of Constitution Road and Davis Street simultaneously.
Safety	<ul style="list-style-type: none"> Ensure that truck movements and construction material delivery is not undertaken during school pick up/drop off times near Dulwich Hill Public School (Hercules Street).

5.11 Infrastructure

Council Developed a Draft Operational Management Plan in June 2020, which describes, at a high level, the proposed operational management for the GreenWay which will come into effect between 2021 and 2023. Furthermore, a concept Design Report was developed in July 2020 that provided notes on services in the vicinity of the proposed works and identified known details on service types, depths and dimensions, potential issues and proposed actions.

5.11.1 Existing Environment

Land within the GreenWay corridor is owned and managed by a number of government agencies. Assets of respective agencies would continue to be managed by the respective agencies. This will include:

- All areas and light rail assets within the dedicated light rail corridor, as amended by the GreenWay works, would be would continue to be managed by Transdev under licence from Transport for NSW
- Water, sewer and trunk stormwater assets would continue to be managed by Sydney Water
- High voltage electrical feeder 761 and rail bridges would continue to be managed by Transport for NSW
- High voltage electrical feeders would continue to be managed by Ausgrid and Transgrid
- Gas assets would continue to be managed by Jemena
- Traffic signals and state roads would continue to be managed by Transport for NSW.

In order to accommodate the GreenWay, the light rail corridor in the following areas will require a 3.5 m Infrastructure Service Requirement Zone. A trackside fence would be located a nominal 3.5 m from the track centreline.

5.11.2 Impact Assessment

The GreenWay will need to be closed from time to time to facilitate maintenance or works in the dedicated light rail corridor. Whilst sections of the corridor are closed, maintenance light vehicles will be able to utilise on-grade paths for access along the light rail as required.

The GreenWay will also require occasional closures due to maintenance operations to Sydney Water stormwater, water and sewer assets.

In most cases, it is likely that service conflicts can be avoided, however buried services will need to be located to confirm locations and depths so that detailed design can work around existing infrastructure.

Issues with Services within the Study Area

The Concept Design Technical Report written by McGregor Coxall on behalf of Council (2020) flags potential issues with services in the proximity of the proposed works. A summary of these potential conflicts is provided in Table 5-44.

Consultation with the relevant asset owners is currently being undertaken where services are potentially at risk of being impacted by excavation works associated with the GreenWay. Outcomes of this consultation will be included within the detailed design of the proposed works.

Table 5-44: Service locations, details and potential issues (from Concept Design Technical Report, 2020)

Location	Service	Issue	Proposed Actions	Extra Notes	
Parramatta Road	Water	– Water main crosses the stormwater channel immediately south of Parramatta Rd. Conflict with proposed underpass.	Relocation of water main to cross the stormwater channel approximately 15 m further south of Parramatta Road.	500 mm water main. Refer to Water Services Co-ordinator report (Warren Smith and Partners, 2021) for further details.	
	Water	– 450 mm main, north side of road	Support beams are low under Parramatta Road and constrain headroom for underpass.	Modification of the 450 mm water main has been proposed to remove support beams and replace with self-supporting pipe span.	450 mm Cast Iron Cement Lined (CICL). Refer to Water Services Co-ordinator report (Warren Smith and Partners, 2021) for further details.
	Sewer	Sewer main over canal south of Parramatta Rd.	Confirm locations. Provide temporary pumped bypass during works with reinstatement as new at completion of works.	225 mm VC. Refer to Water Services Co-ordinator report (Warren Smith and Partners, 2021) for further details.	
	Gas	Disused gas main constrains headroom for underpass.	Modification to smaller diameter self-supporting span under Parramatta Road, to improve headroom.	Existing man is 900 mm. Proposed 500 mm (Refer to Gas Main Options Report (TLB, 2018).	
Longport Street	Water	– Elevated path will pass over above-ground water main immediately north of Longport St.	Proposed pier locations avoid water main. Consider maintenance access in design.	1200 mm CICL. Refer to Water Services Co-ordinator report (Warren Smith and Partners, 2021) for further details.	
Lewisham West: west of light rail	Sewer	South end- pit proud of existing surface level.	Either lower pit or raise surface levels. Discuss with Sydney Water.	Refer to Water Services Co-ordinator report (Warren Smith and Partners, 2021) for further details.	
Davis St tunnel	TfNSW Light Rail infrastructure	Isolation transformer clashes with path alignment.	Relocation.	It is proposed to relocate the isolation transformer. This work would be complete ahead of other works in the corridor and is subject to a separate design process.	
	TfNSW Light Rail infrastructure	Signal box in close proximity to tunnel alignment.	Temporary protection works during construction; seek exemption from minimum offset recommended elsewhere.		
Davis Street to Johnson Park	Water	Crossing site at Terry Road.	Service location, minimal excavation/compaction.	Refer to Water Services Co-ordinator report (Warren Smith and Partners, 2021) for further details.	

Location	Service	Issue	Proposed Actions	Extra Notes
	Stormwater	New drainage connection to Sydney Water stormwater system may be required.	Service location, design around existing infrastructure. Engage Water Services Co-ordinator for new connection to channel downstream of Terry Rd.	Refer to Water Services Co-ordinator report (Warren Smith and Partners, 2021) for further details.
Constitution Rd tunnel	Stormwater	Pipes under new footpath.	Building over Sydney Water major storm water. Refer to Water Services Co-ordinator report (Warren Smith and Partners, 2021) for further details.	
	Gas	Pipes under Constitution Rd.	Service location, consult with Jemena regarding options to manage this service during tunnel construction.	32mm dia 210kPa NY ends right near edge of tunnel. 150mm dia 1050kPa ST runs under Constitution Rd protect high pressure line in place and minimise vibration.
	Power	Under new footpath.	Service location, consult with Ausgrid regarding options to manage this service during tunnel construction.	1x LV
	Sydney Trains HV power	Pole above tunnel + overhead aerials.	Relocation.	It is proposed to relocate the overhead aerials and poles. This work would be complete ahead of other works in the corridor and is subject to a separate design process.
	Water	Pipe under Constitution Rd.	Provide rider main during works with reinstatement as new at completion of works.	200mm dia CICL (may be old/brittle)/
	Comms	Under Constitution Rd.	Service location, consult with Telstra to determine how to manage this service during tunnel construction.	Telstra, may require relocation.
Elevated path between Constitution Rd and Hercules St	Sydney Trains High Voltage power	Overhead aerials above and to western side of path.	Relocation.	It is proposed to relocate the overhead aerials and poles. This work would be complete ahead of other works in the corridor and is subject to a separate design process.

Location	Service	Issue	Proposed Actions	Extra Notes
Hercules Street open space	Power	Adjacent North West edge of S wetland.	Service location, minimal excavation/compaction, only grasses to be planted.	
	Stormwater	Along North and East edge of North upper wetland. Diversion proposed.	Field verify locations.	
	Stormwater	Along creekline.	Field verify locations.	
	Stormwater	Under lower wetland.	Field verify locations.	

5.11.2.1 Water Main Relocation

Immediately south of Parramatta Road, there is a 500 mm water main that crosses the Hawthorne Canal stormwater channel. Relocation of this water main has been proposed to allow construction of the underpass under Parramatta Road. The water main would be realigned for a length of approximately 25 m and would cross the channel approximately 15 m further south of Parramatta Road. On the eastern side of the stormwater channel, the water main will need to be supported with a contiguous pile wall socketed into bedrock due to slope stability issues here.

5.11.3 Mitigation Measures

Table 5-45: Mitigation measures for infrastructure

Environmental Aspect	Mitigation Measures
Potential impacts to Sydney Water and Transport for NSW infrastructure	<ul style="list-style-type: none"> Further investigations are essential to inform detailed design in line with the findings of the Concept Design Report (2020).
Potential impacts to private and public buildings and infrastructure	<ul style="list-style-type: none"> Where significant groundworks (such as tunnelling or soldier pile walls) are proposed in close proximity to structures (both public and private buildings and infrastructure), undertake pre and post work dilapidation surveys prior to the commencement of works.

5.12 Air Quality

5.12.1 Existing Environment

The works area is located within areas that are primarily utilised for residential activities. Existing air quality is considered to be typical of a Sydney suburban area.

Potentially affected receivers near the project include residential properties, childcare centres, aged care facilities and schools. A number of residences and businesses are located in close proximity to the study area. With respect to the Central links, the study area is located in close proximity to a number of streets, including:

- Hawthorne Parade
- Hathern Street
- Brown Street
- Haig Avenue
- Frenchs Lane
- Cook Street
- St John Lane
- St John Street
- Barker Street
- Grosvenor Crescent
- Longport Street
- Hudson Street
- Old Canterbury Road
- Edward Street

The elderly and children are considered to be the most at risk of adverse air quality impacts of the proposed works. Sensitive receivers within proximity to the Central links include, but are not limited to:

- Learn & Laugh Early Learning, Lewisham - <50 m from study area
- Rise and Shine Kindergarten, Summer Hill - <100 m from study area.

In relation to the Southern Links, the study area will be located adjacent to the following streets:

- Davis Street
- Terry Road
- Hill Street
- Constitution Road
- Constitution Lane
- Canterbury Road
- Hercules Street
- Blackwood Lane
- Terrace Road

Sensitive receivers within proximity to the Southern links include, but are not limited to:

- Dulwich Hill Public School - <25 m from the study area
- Dulwich Hill ELC and Preschool - <100 m from the study area
- Users of the Dulwich Hill Skate Park - <50 m from the study area.

Additionally, local residents, particularly those located within the streets mentioned above, as well as residents located within streets that provide access for construction vehicles to the proposed construction sites and local businesses, particularly those located near the proposed construction compounds and construction vehicle access points will be sensitive to air quality impacts from the works.

5.12.2 Impact Assessment

Anticipated sources of dust and dust-generating activities from the project include:

- operation of machinery across the entire project area
- excavation and fill transfer works associated with the GreenWay shared path underpasses
- dust loading and transfers from aggregate material on trucks, loaders and excavators
- emissions of dust from the movement of vehicles on unsealed roads
- wind erosion from exposed surfaces at disturbed areas.

The total amount of dust generated depends on the properties of soil materials (silt and moisture content), techniques adopted during excavation, demolition, grading and transfer of soils, and the prevailing meteorological conditions.

The dispersion of the dust relates to the quantity and drift potential of the particles. Larger particles generally settle out near the source, whereas fine particles can be dispersed over greater distances. Typically, the impacts on nearby sensitive receivers decrease with increased distance from the source. Receptors greater than 100 m from construction works are anticipated to experience negligible dust impacts.

During unfavourable meteorological conditions, dust emissions may be higher. The closeness of sensitive receptors, such as residential properties, the schools listed above, and the various business located in proximity to the works areas would require strict dust suppression measures to be implemented throughout the life of the project.

Earthworks being undertaken at Cadigal Reserve, Lewisham West, between New Canterbury and Constitution Road and behind Hercules Street have the potential to generate excessive amounts of dust. Where earthworks are proposed, and within project compound areas, a number of dust suppression methods will be required to ensure that the potential for dust generation is mitigated and negative impacts to sensitive receivers located within 100 m of the proposed works are minimised. These methods include utilising fencing with shade cloth, wetting down of stockpiled material, staging excavation works and water cart rotations or the application of misting systems.

Works located within 50 m of schools should include specific measures to minimise the generation of dust and where generation cannot be minimised, notification should be given at least 2 weeks prior to any works commencement.

Emissions from construction vehicles and equipment associated with the combustion of fuel and petrol are also anticipated as a result of the works. Construction plant and equipment must be maintained to manufacturer's operating standards, shut down when not in use and simultaneous use should be minimised where possible. Provided that appropriate mitigation measures are adhered to and good site practices are used, the impacts of the works on greenhouse gas emissions are anticipated to be low. Furthermore, utilisation of the GreenWay following completion is anticipated to decrease local residents' reliance on vehicle use.

5.12.3 Mitigation Measures

Table 5-46: Mitigation measures for air quality

Environmental Aspect	Mitigation Measures
Dust generation from vibrating and ground disturbing works	<ul style="list-style-type: none"> • Minimise works during high wind periods. • Apply dust suppression as required to limit excessive dust generation. • Ensure vehicles maintain recommended speed. • Look for excessive dust generation and slow down if needed. • Minimise site movements. • Locate stockpiles away from sensitive receptors where possible. • Cover or water stockpiles that are not used for extended periods and keep moist to minimise transmission of dust. • Apply water cart rotations and misting systems to minimise dust dispersion beyond construction areas. • Erect shade cloth surrounding excavation works to suppress dust. • Rehabilitate construction sites following completion of the works.
Fumes generation from machinery	<ul style="list-style-type: none"> • Do not have machinery running while not in use. • Minimise use of machinery for required activity only. • Where odour emissions are perceivable and may impact nearby sensitive receivers, consider odour suppression systems.
Cumulative impacts of greenhouse gas emissions	<ul style="list-style-type: none"> • Maintain plant and equipment in accordance with manufacturer’s specifications to ensure that it is in a proper and efficient condition. • Regularly inspect plant and equipment to ascertain that fitted emission controls are operating efficiently. • On site burning of waste of any kind is not permitted

5.13 Waste Management

5.13.1 Existing Environment

The project has the potential to utilise a range of different resources and generate a number of different types of waste throughout its construction and operational phases. The construction of the project would require the use of resources such as electricity, water, fuel, concrete and paving materials. Other resources would be required for infrastructure such as signage, landscaping and retaining walls.

The maintenance and occasional repair of project infrastructure during operation would require resources. However, it is not anticipated that these activities would place a significant demand on resources.

5.13.2 Impact Assessment

Waste may be generated from excess spoil from earthworks, vegetation clearing, drainage works, demolition, equipment maintenance, road infrastructure upgrades, waste concrete, wood and metal, materials packaging and as general waste from staff and contractors. Potential impacts from waste generation include:

- reduced aesthetics in community areas
- health impacts to residential receivers
- minor spills from hazardous fuel and chemical use
- pollution of the environment from other general wastes.

Any excess spoil from earthworks is proposed to be classified in accordance with Waste Classification guidelines (EPA, 2014) and disposed of at an appropriately licenced waste facility. No waste is to be imported into the site.

Removal and appropriate disposal of general waste generated by the contractors during the proposed works is the responsibility of the contractors unless advised differently by Council.

Hazardous waste arising from the construction phase of the project would also be removed and disposed of in accordance with the relevant guidelines, including the DECCW *Environmental Guidelines: Assessment, Classification and Management of Liquid and Nonliquid Wastes* (Environment Protection Authority 1999).

5.13.3 Mitigation Measures

Table 5-47: Mitigation measures for waste management

Environmental Aspect	Mitigation Measures
Excess spoil in the form of excavated material	<ul style="list-style-type: none"> • Consider resource management options for the project against a hierarchy of the following order embodied in the Waste Avoidance and Resource Recovery Act 2001: <ul style="list-style-type: none"> ○ Avoid unnecessary resource consumption ○ Recover resources (including reuse, reprocessing, recycling and energy recovery) ○ Dispose (as a last resort)

Environmental Aspect	Mitigation Measures
	<ul style="list-style-type: none"> • Classify all wastes and excess spoil in accordance to the Waste Classification Guidelines (DECC, 2009) prior to disposal and transported to a licensed waste disposal facility. • Remove all waste from the site on completion of the works. • Upon completion of waste disposal, retain all original weighbridge / disposal receipts issued by the receiving waste facility in a waste register as evidence of proper disposal.
Litter left on-site by staff/contractors	<ul style="list-style-type: none"> • Ensure an adequate number of bins are placed at the site for workers and that all litter is placed in these bins. Ensure work areas of the project site are kept clean and free of litter, including cigarette butts, at all times.

5.14 Socio-Economic Considerations

5.14.1 Existing Environment

Council developed a Local Strategic Planning Statement in March 2020 titled ‘Our Place Inner West’. This statement outlines the vision for the area in 2036 within the context of the socioeconomic landscape within the relevant planning frameworks and utilises Census data to develop a number of planning priorities and actions to be undertaken to meet this vision. The Statement also suggests that population forecasts indicate the LGA will grow to approximately 230,667 residents by year 2036, with a 52% increase in residents over 65 and a 17% increase in children between 0 and 15.

Forecasts also indicate that employment within the study area will continue to grow, with an anticipated net increase of approximately 17,000 jobs by 2036. The main growth industries are proposed to be retail trade, health care and social assistance, and public administration and safety.

Compared to the Sydney average (13%), the study area has a higher portion of households without a car (20%) and has a greater reliance on the use of public transport and other sustainable means of travel.

Over the last 20 years, there has been extensive community involvement within the GreenWay in the form of bushcare activities. Such activities are helping to re-establish native vegetation that would have grown in the locality prior to clearing for European settlement. There are currently nine Bushcare sites within the GreenWay, managed by local community groups such as the Inner West Environment Group and the Cooks River Mudcrabs and supported by both Inner West Council and Canterbury-Bankstown Council, which include:

- Waratah Mills
- Pigott Street
- Davis Street
- Johnson Park
- Little Street
- Fred Street
- Lewisham West
- Hercules Street
- Cadigal Reserve

5.14.2 Impact Assessment

The GreenWay will ultimately provide a number of socioeconomic impacts within the local area, these will primarily be positive in the longer term, but may have some small short-term negative impacts. Potential impacts include:

- **Viability of local business:** this could include a slight negative impact during construction from a decrease in trade/demand for services due to noise, vibration, access and visual amenity, congestion and road closures. Some businesses may benefit from increased trade from construction works or demand for construction-related services and construction workers utilising local businesses. In the longer term, it is likely that the increased usage of the GreenWay, associated public recreation areas and ability for residents to walk through the municipality will incentivise expenditure in local business.

- **Construction disruption:** local residents and businesses are likely to have concerns about disruption and disturbances resulting from constructing the project, which may result in a slight negative impact in the short term. Maintenance activities once the construction of the GreenWay is completed are anticipated to be short term and infrequent and cause negligible disruptions on residents.
- **Impact to amenity:** sensitive receivers may be disrupted due to noise, vibrations, dust and increased traffic congestion during construction. Following construction, the design of the GreenWay will improve the local area’s visual amenity through further planting of native vegetation and landscape design that will fit into the District’s Blue and Green Grid goals.
- **Access to services and jobs:** all access to businesses, community and educational services would be maintained during the project’s construction; however, there may be some minor hindrance to access in some areas from construction-related traffic. Following construction, the viability of the local public transport network will be improved and accessibility for residents will be increased through the provision of unhindered walking paths.
- **Visual amenity:** construction sites, work sheds, machinery and other equipment would detract from the visual integrity and character of construction areas, all vehicles and temporary signage is to be removed following completion of the works. The construction of the GreenWay will improve the area’s visual amenity in the long term as significant vegetation planting and management will be undertaken and further designs will be developed to ensure that views and vistas for sensitive receivers are improved or only minimally altered.
- **The level of trade and demand for services:** in the short term, trade may be hindered as a result of construction noise and vibration, though access to businesses will not be impacted. In the longer term, trade and service demand would potentially increase in the immediate vicinity of light rail stations due to increased pedestrian activity, enhanced level of amenity and a greater appreciation of the suburbs along the GreenWay resulting from its use.
- **Property values:** negligible impacts to property value are anticipated during construction. The project would deliver a number of improvements that would enhance the aesthetic and recreational amenity of the area, which could result in higher values for residential properties in the longer term.
- **Increased private production:** major public investment would benefit private production and the economy.
- **Short-term impacts to established bushcare sites:** During construction, public access will not be permitted to some bushcare sites including, Cadigal Reserve, Waratah Mills and Johnson Park. Construction is anticipated to occur between 6-12 months. However, other bushcare sites such as Davis Street and Pigott Street, Fred Street and Little Street will be accessible during this time. It is also recognised that the proposed works will result in the loss of approximately 0.1 ha of existing bushcare area within Johnson Park and Waratah Mills. However, the proposed works will result in the overall net increase of approximately 0.6 ha of new bushcare areas available to community volunteer groups within the GreenWay corridor. The additional bushcare areas will be within Cadigal Reserve, Lewisham West and Hercules Street.

The GreenWay will encourage healthy lifestyle choices for the growing local community, which will ultimately be able to reduce healthcare costs provided that ample opportunity is provided for active recreation for both younger and older residents.

5.14.3 Mitigation Measures

Table 5-48: Mitigation measures for socio-economic considerations

Environmental Aspect	Mitigation Measures
General	<ul style="list-style-type: none"> • Prepare a CEMP to include the required management and mitigation measures. The CEMP will provide a framework for establishing how these measures will be implemented and who will be responsible for their implementation. The CEMP will be prepared prior to the proposal’s construction and must be reviewed and certified by Council, prior to the start of any on site work. The CEMP will include sub plans for all impacts identified within this REF. • The Contractor is required to prepare a community engagement plan to keep residents informed of progress and specific construction activities.
Safety	<ul style="list-style-type: none"> • The Contractor is required to prepare a community engagement plan to keep residents informed of progress and specific construction activities.
Impacts to amenity, noise, traffic and dust	<ul style="list-style-type: none"> • Ensure all recommended mitigation measures for noise and vibration (Table 5-34), amenity (Table 5-38), traffic (Table 5-43) and air quality (Table 5-46) are adhered to. • Where there are private properties near the proposed works and there is no established vegetation, provide shade cloth to reduce impacts on privacy as required.

5.15 Cumulative Impacts

5.15.1 Existing Environment

A search of the Department of Planning’s ‘Major Project Assessments Register’ (December 2020) indicated there are a number of potential major projects located close to the project.

The projects likely to present the largest cumulative impact in conjunction with the GreenWay In-Corridor Works are those associated with the Potts Hill to Alexandria Transmission line connector project and Sydenham to Bankstown Metro Project, which will be undertaken within the same project area. The Potts Hill to Alexandria project will require trenching work and joint bay installation along Constitution Road. This project involves the installation of a new underground electricity cable from Potts Point to Alexandria. It is unlikely that the construction timeline of this project will match with that of the GreenWay, however there is potential for cumulative impacts on residents that are exposed to both periods of construction.

The Sydenham to Bankstown Metro project involves an upgrade to the T3 Bankstown Line, including making all 11 stations fully accessible. The project also includes upgrades to tracks, stations and signals and opportunities for station improvements including a concourse across Dulwich Hill Station. Construction timeline of this project is also unlikely to align with the GreenWay’s construction, however there is potential for residents within areas in proximity to Hercules Street or Dulwich Hill Station to potentially be subject to both construction periods.

The relocation of the high voltage electricity feeder between Constitution Road and Jack Shanahan Reserve is also planned for 2021, and as above, the construction timeline for these projects are not anticipated to align, residents will likely be exposed to both periods of construction.

The major direct cumulative construction impacts that may be experienced from the project include:

- increased construction vehicle traffic on public roads causing congestion and delays
- increased air pollution and noise for local residents
- cumulative noise impacts associated with multiple construction works, particularly during the night.

5.15.2 Impact Assessment

With the exception of the Sydenham to Bankstown Metro Project, it is unlikely that the construction timeline of the GreenWay will match that of any major projects in the area however, there is potential for cumulative impacts on residents that are exposed to longer periods of construction.

Regarding the Metro Project, GreenWay works in Hercules Street which are proximate to the upgrade of Dulwich Hill station and Bankstown line rail corridor, should consider staging of works in consultation with the Metro project team to limit any cumulative impacts.

Along with the light rail, this project will create an opportunity for active transport to become more attractive to the community by allowing for the greater integration of other modes of public transport which will encourage an active lifestyle and will enable increased use of public transport.

5.15.3 Mitigation Measures

Table 5-49: Mitigation measures for cumulative impacts

Environmental Aspect	Mitigation Measures
Community notification	<ul style="list-style-type: none"> • Ensure a plan for community consultation is developed which outlines the dissemination of information to the community via letter-box drops, websites and newsletters. • Notify sensitive receivers including businesses and schools which are at risk of impacts to day-to-day functioning and trading at least 2 weeks prior to works commencement. • Where multiple projects are occurring within the same vicinity at the same time, undertake communication between construction contractors to ensure that potentially noisy or disruptive activities are not undertaken at the same time.

5.16 Matters of National Environmental Significance

Under the environmental assessment provisions of the EPBC Act, the following MNES and impacts on Commonwealth land are required to be considered to assist in determining whether the project should be referred to the Australian Government Department of Agriculture, Water and the Environment (DAWE). Table 5-50 addresses the MNES for the project.

Table 5-50 Consideration of Matters of National Environmental Significance

MNES	Impact
Any environmental impact on a World Heritage property?	No
Any environmental impact on National heritage places?	No
Any environmental impact on RAMSAR wetlands?	No
Any environmental impact on Commonwealth listed threatened species or ecological communities?	Non-significant impact
Any environmental impact on Commonwealth listed migratory species?	No
Does any part of the project involve nuclear action?	No
Any environmental impact on a Commonwealth marine area?	No
Any impact on Commonwealth land?	No

5.17 Clause 228 of the Environmental Planning and Assessment Act 1979

Clause 228(1) of the EP&A Regulation states:

For the purposes of Part 5 of the Act, the factors to be taken into account when consideration is being given to the likely impact of an activity on the environment include

- a. *for activities of a kind for which specific guidelines are in force under this clause, the factors referred to in those guidelines, or*
- b. *for any other kind of activity—*
 - i *the factors referred to in the general guidelines in force under this clause, or*
 - ii *if no such guidelines are in force, the factors referred to subclause (2).*

No specific or general assessment guidelines for the proposed activity are known to be in force under Clause 228 (1). Therefore, the factors listed in Clause 228(2) of the Act apply. Clause 228(2) of the EP&A Regulation sets out 16 factors that need to be considered when assessing environmental impact under Part 5 of the EP&A Act. These factors are addressed in this report and relevant sections are listed in Table 5-51 below.

Table 5-51 Clause 228 Factors

Clause 228 Factors	Impact
(a) Any Environmental Impact on a Community?	The project has considered the impacts of the proposed development on threatened entities, in particular the impacts of the development on Large Bent-winged Bat and Little Bent-winged Bat. The implementation of an Adaptive Microbat Design Plan and Microbat Management Plan has been recommended, which will allow for the project to identify if

Clause 228 Factors	Impact
	<p>additional conservation measures are required which will benefit this species.</p> <p>Noise and other construction impacts may be felt by members of the community in the short term, though these impacts will be minimised through the implementation of a CEMP.</p>
(b) Any transformation of a locality?	<p>The locality will be altered for the construction of the shared path and all other infrastructure associated with the GreenWay. These changes will be made in line with the strategic plan for the area and will generally confer positive impacts, utilising green infrastructure and biodiversity management measures where possible to improve the site’s visual amenity. The visual impacts are anticipated to be relatively minor due to the proposed construction within the area and further modifications to the light rail that are anticipated to occur in the future.</p>
(c) Any environmental impact on the ecosystems of the locality?	<p>As stated above, there will be impacts to both the Large Bent-winged Bat and Little Bent-winged Bat, and mitigation measures will require implementation to minimise these impacts.</p>
(d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?	<p>The GreenWay In-Corridor Works Package will improve the aesthetic and recreational values of the area by providing local residents with an opportunity for active recreation within the area. The design of the GreenWay is in line with the strategic plan for the area and will improve the overall amenity of the area. The scientific use of the area will not be reduced, and mitigation measures will be implemented to ensure that the environmental qualities of the locality are not negatively impacted.</p>
(e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?	<p>The works will result in negligible impacts to the heritage significance of listed heritage items within the study area.</p> <p>The study area has low potential for significant archaeological features or deposits.</p> <p>The works will enable broader appreciation of cultural heritage values within the precinct for local residents.</p>
(f) Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)?	<p>As stated above, there will be impacts to both the Large Bent-winged Bat and Little Bent-winged Bat, and mitigation measures will require implementation to minimise these impacts.</p>
(g) Any endangering of any species of animal, plant or other form of life whether living on land, in water or in the air?	<p>As stated above, there will be impacts to both the Large Bent-winged Bat and Little Bent-winged Bat, and mitigation measures will require implementation to minimise these impacts.</p>
(h) Any long-term effects on the environment?	<p>Long term negative impacts on the environment are unlikely to occur as a result of the In-Corridor Works if the prescribed mitigation measures are adhered to.</p>
(i) Any degradation of the quality of the environment?	<p>No significant impacts to the quality of the environment will occur if mitigation measures are adhered to. The works will</p>

Clause 228 Factors	Impact
	lead to a positive social impact for residents by aiming to improve the overall useability of the area.
(j) Any risk to the safety of the environment?	A low risk to the environment is associated with the works. Potential for a small chemical spill (e.g. petrol or oil) is possible. There is small potential for issues associated with the remediation of contamination present on site. The risk to the environment is considered minimal if the prescribed mitigation measures are adopted.
(k) 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. The works will provide a useable recreational asset and be constructed primarily on previously disturbed areas. The works have been designed to ensure that negative impacts to threatened species and ecological communities are minimised.
(l) Any pollution of the environment?	No pollution of the environment is proposed or likely. The works will involve some remediation works and contaminant removal, which will have a positive impact on the contamination that is currently present on site. The risk of environmental pollution during construction and operation is minimal if the appropriate mitigation measures are followed.
(m) Any environmental problems associated with the disposal of waste?	All waste is to be taken offsite and disposed of appropriately.
(n) Any increased demands on resources (natural or otherwise) that are or are likely to become in short supply?	No resources that are being utilised as part of this project are likely to become in short supply.
(o) Any cumulative environmental effect with other existing or likely future activities?	Impacts are anticipated to be minor if the appropriate mitigation measures are followed.
(p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?	There are no impacts on coastal processes or hazards that will result as part of the works.

6. Stakeholder Consultation

6.1 State Environmental Planning Policy (Infrastructure) 2007

Division 1 of the Infrastructure SEPP provides guidance on consultation with stakeholders.

Table 6-1 Infrastructure SEPP consultation requirements

Infrastructure SEPP Clause	Clause Relevance	Consultation Undertaken
Clause 13	<p>Impacts on council-related infrastructure or services</p> <p>Consultation is required if the public authority is of the opinion that the development:</p> <ul style="list-style-type: none"> a. will have a substantial impact on stormwater management services provided by a council, or b. is likely to generate traffic to an extent that will strain the capacity of the road system in a local government area, or c. involves connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council, or d. involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council, or e. involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council’s management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential, or f. involves excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the Roads Act 1993 (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath). 	No, Inner West Council is the proponent.
Clause 14	<p>Impacts on Local Heritage</p> <p>Consultation is required if the development:</p> <ul style="list-style-type: none"> a. is likely to have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area, and b. is development that this Policy provides may be carried out without consent. 	Detailed design and construction methodology should be prepared in consultation with Transport for NSW and Sydney Water Heritage Specialists for works to the Battle Bridge and whipple truss.
Clause 15	<p>Impacts on Flood Liable Land</p> <p>In this clause, flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled Floodplain Development Manual: the management of flood liable land published by the New South Wales Government and as in force from time to time.</p>	The Flood Risk Management Plan for the area was put to public exhibition and outlined the major flooding issues in the area. The design of the GreenWay will have negligible impact on flood levels. Improvements to storm water drainage are proposed.

Infrastructure SEPP Clause	Clause Relevance	Consultation Undertaken
Clause 16	<p>Consultation with Public Authorities other than Councils</p> <p>Consultation is required if the development is:</p> <ol style="list-style-type: none"> a. development adjacent to land reserved under the <i>National Parks and Wildlife Act 1974</i>—the Department of Environment and Climate Change, b. development adjacent to a marine park declared under the <i>Marine Parks Act 1997</i>—the Marine Parks Authority, c. development adjacent to an aquatic reserve declared under the <i>Fisheries Management Act 1994</i>—the Department of Environment and Climate Change, d. development in the foreshore area within the meaning of the <i>Sydney Harbour Foreshore Authority Act 1998</i>—the Sydney Harbour Foreshore Authority, e. development comprising a fixed or floating structure in or over navigable waters—the Maritime Authority of NSW, f. development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act)—the NSW Rural Fire Service. g. Note. The Act defines bush fire prone land, in relation to an area, as land recorded for the time being as bush fire prone land on a map certified as referred to in section 146 (2) of the Act. h. Note. When carrying out development of a kind referred to in paragraph (f), consideration should be given to the publication of the NSW Rural Fire Service Planning for Bush Fire Protection 2006. i. (g) (Repealed) 	<p>Consultation with public authorities other than Council was not deemed necessary in relation to Clause 16 of the Infrastructure SEPP.</p>
Clause 85 and 86	<p>Clauses 85 and 86 of the Infrastructure SEPP relate to development involving access via level crossings and excavation in, above, below or adjacent to rail corridors.</p> <p>in both instances, the consent authority (Council) must give the rail authority notice under subclause (2)(a) and allow 21 days for the authority to respond prior to approving the application for development.</p>	<p>Council has engaged with TfNSW throughout the development of the Greenway Master Plan and Concept Design.</p>

6.2 Government Agency and Utility Consultation

6.2.1 Transport for NSW and Transdev

Transdev operate the Inner West Light Rail under licence from TfNSW. TfNSW remain the landowner for much of the Greenway corridor. Council has worked with Transport for NSW and Transdev throughout the development of the Master Plan and Concept Design.

Transport for NSW and Transdev completed a technical review of the Greenway Concept Design in late 2020 to ensure the project is compatible with the continued operation of the light rail and that impacts on TfNSW owned assets are minimised.

TfNSW have indicated that an Interface Works Deed will be required to cover commercial, legal and technical issues relating the design and construction of the Greenway. This will include the review and approval process, and the requirements for track occupations and possessions to enable construction activities. The Works Deed will identify scope items that will be subject to a design review approval process.

TfNSW and Transdev have indicated that constructability should be considered during the next phase of design. This should include accessibility for plant and equipment, and how this might work with the light rail in operation.

Further engagement with TfNSW and Transdev will be required through the development of the detailed design.

Council will be required to enter into a licence with TfNSW for the ongoing use and access of the Greenway Corridor, where on TfNSW managed land.

6.2.2 Sydney Water

The Greenway works are adjacent to and in some cases built over Sydney Water assets. Sydney Water are also a landowner for parts of the Greenway corridor near Longport Street and Parramatta Road. Council has worked with Sydney Water throughout the development of the Master Plan and Concept Design.

Detailed planning has been undertaken to understand the impacts and develop requirements to be considered during the detailed design for impacted assets. This primarily entails works around Parramatta Road and Longport Street, that impact major water mains and the Hawthorne Canal, but also other Sydney Water assets further south such as at Constitution Road.

Further engagement with Sydney Water will be required through the development of the detailed design.

Council will be required to enter into a licence with Sydney Water for the ongoing use and access of the Greenway Corridor, where on Sydney Water managed land.

6.2.3 Jemena

The Greenway works impact Jemena high pressure gas mains at two key locations at Parramatta Road and Constitution Road. Preliminary engagement with Jemena has been undertaken through the development of the Greenway concept design.

Further engagement with Jemena will be required through the development of the detailed design.

6.3 Community Consultation

6.3.1 Development of the draft GreenWay Masterplan

Extensive community engagement informed the development of the Greenway Master Plan. During October and November 2017 Council undertook community engagement with residents and stakeholders across the Inner West area. Information was disseminated to the community via a number of means including:

- Email
- The Council website
- Social media
- Newsletters to residents within 400 m of the GreenWay corridor (around 14,000 properties).

All advertising material provided details for the Inner West Council ‘Your Say Inner West’ website. The site contained information outlining key dates, an overview of the project and a link to an online survey. The survey was open from 13 October to 15 November 2017. 1,100 visited the website and 161 completed the survey.

Fifteen in person engagement sessions were also held from October to December, with nine held on-site along the GreenWay and the remainder with community and agency stakeholders.

Details of community engagement are detailed in the GreenWay Community Engagement Report, which forms Appendix A to the Greenway Master Plan.

The draft GreenWay Master Plan was presented to Council at its 22 May 2018 meeting. Council resolved to place the draft GreenWay Master Plan on public exhibition. The draft Master Plan was subsequently exhibited from 25 May 2018 to 25 June 2018.

The draft plan was exhibited on Council’s consultation website, “Your Say Inner West”. Hard copies of the draft master plan were also made available at Ashfield, Leichhardt and Petersham Service Centres and at Dulwich Hill, Haberfield and Marrickville Libraries

Comments were sought from the community, Council staff and key agencies including Transport for NSW, Sydney Trains, Roads and Maritime Services, Sydney Water and the light rail operator Transdev.

Exhibition of the draft plan was advertised on Council’s consultation website, “Your Say Inner West”, a newsletter was delivered to all properties within 400m of the Greenway, around 12,000 properties, and posters advertising the exhibition were also put up along the corridor in parks and at light rail stops. The draft plan exhibition was also promoted on social media through Council’s Facebook and Twitter accounts.

Comments on the draft master plan were sought through the Your Say Inner West website and also through an interactive online map. Comments were anonymous but users were asked to provide their suburb. Email or written comments were also accepted.

The Your Say Inner West website contained a survey asking “Do you support the GreenWay Master Plan?” and users were asked to nominate either ,“Yes”, “Yes in principle but with changes outline below”, or “No”. Users then had the option to leave written comments directly and/or attach submissions.

The social pinpoint site contained an interactive map of the master plan. Community members, stakeholders and anyone else with an interest in the project could add feedback on the draft master plan to the interactive map by zooming in to an area of interest and dropping a pin to make a comment. Users were able to use themed pins to make comments on specific aspects of the master plan. The pins were aligned with the four main themes of the draft master plan: walking and riding, ecology, recreation, and arts and culture. Users could also give “thumbs up” or “thumbs down” to other users comments.

6.3.1.1 Engagement Response

The Your Say Inner West consultation website was visited over 4200 times during the exhibition period. This included:

- 3269 Aware users who viewed the site
- 757 Informed users who downloaded a document or multiple pages
- 206 Engaged users who participated in the survey.

The video prepared to promote the exhibition received over 3,000 views on Facebook and YouTube.

Around 700 responses were provided through all engagement platforms. Including:

- 206 responses through your say inner west, of which 148 provided written responses
- 480 written responses through the social pinpoint interactive map
- 7 written responses received directly via email.

Responses were overwhelmingly received from residents within the Inner West area and specifically along the GreenWay corridor. The most comments were received from residents in Dulwich Hill (33%), Summer Hill (13%), Haberfield (12%), Marrickville (6%), Leichhardt (5%), Lewisham (5%), Hurlstone Park (5%), Ashfield (4%) and Earlwood (4%) (Figure 6-1).

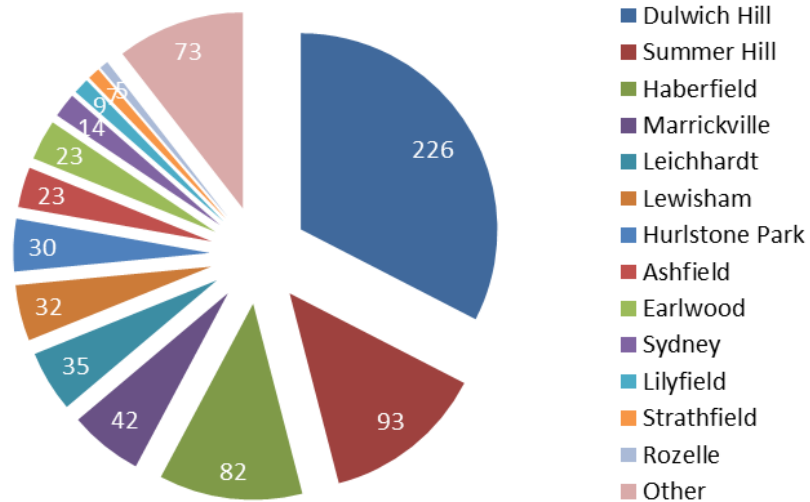


Figure 6-1: Suburbs where engaged users reside

6.3.1.2 Engagement Results

The results of the Your Say Inner West survey showed broad support for the draft plan with 92% of responses either supporting the draft plan or supporting the plan with changes. Only 8% of responses did not support the plan (Figure 6-2).

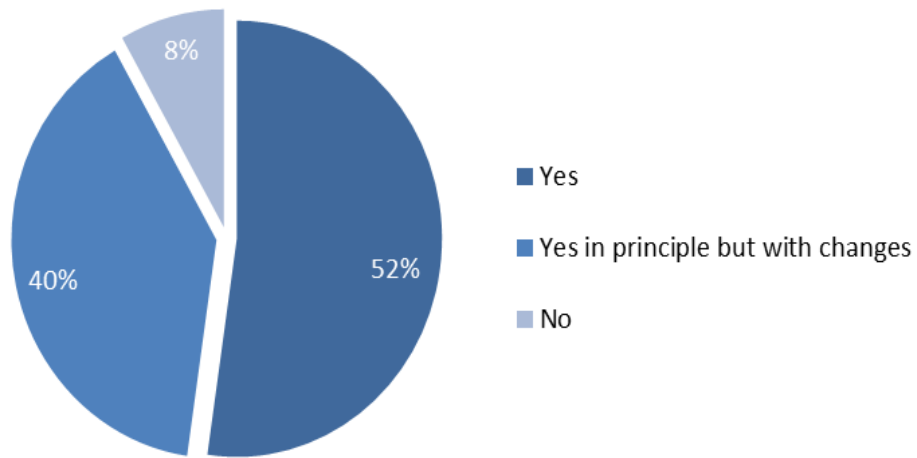


Figure 6-2: Summary of the engagement results

Of the 206 responses through your say inner west, 148 provided written responses. In addition to these, 480 written responses were received through the social pinpoint interactive map and 7 written responses received directly via email.

The written responses overwhelming focused on the theme of walking and cycling (55% of written responses), followed by ecology and recreation (16% of written responses each) and arts and culture (2% of written responses). The remaining responses were general in nature or on multiple themes (11% of written responses) (Figure 6-3).

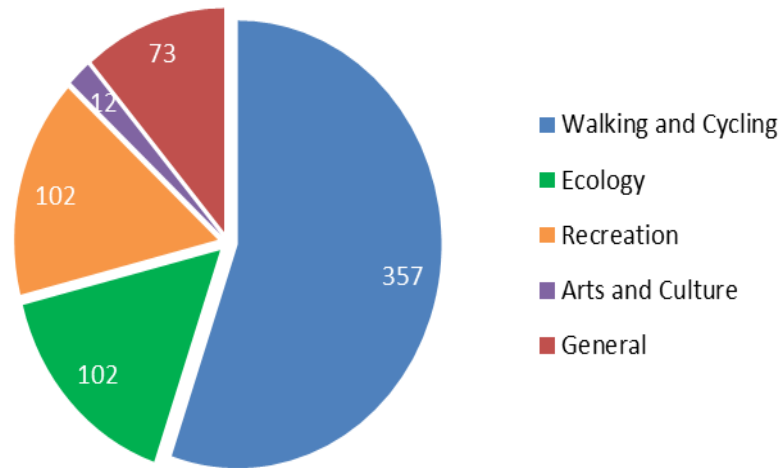


Figure 6-3: Main themes identified from engagement results

6.3.1.3 Outcome of Community Engagement

The results of the public exhibition showed broad support for the draft GreenWay Master Plan. The results of the Your Say Inner West survey showed 92% of responses either supported the draft plan or supported the plan with changes.

Based on the feedback from the community, agencies and staff, as well as Council resolutions, minor amendments to the master plan have been implemented.

6.3.2 Development of the Greenway Concept Design

The draft Greenway Concept Designs were based on the adopted Master Plan with further input from community groups and directly affected residents as well as state agencies and staff.

Prior to the public exhibition of the draft Concept Designs, two rounds of engagement were undertaken in late September and early October 2018; and in late November and early December 2018. This included:

- 8 resident workshops for directly affected residents
- 2 community stakeholder workshops
- Specific meetings with RMS, Sydney Trains and Canterbury Bankstown Council
- Specific engagement with individual residents as requested.

The key changes from the master plan, based on the outcomes of further community and stakeholder engagement or new information, were:

- A raised pedestrian and bicycle crossing was proposed across Ewart Street in lieu of traffic signals at Ewart Street and Terrace Road based on feedback from residents and RMS that traffic signals are not supported due to traffic volumes and amenity

- A bike boulevard was proposed down Garnet Street in lieu of a separated cycle way based on feedback from residents the separated cycle way is not supported due to that the resultant loss of car parking.

6.3.3 Greenway Draft Concept Design

The draft Concept Design for the Greenway was presented to Council on 26 February 2019. At the meeting Council resolved to:

- Relocate of the high voltage electrical feeder along the light rail line which had significantly better outcomes for the Greenway as it enables full ecological restoration of the corridor. This is critical to meet the ecological objectives of the master plan for a connected corridor
- Acquire one property at 43 Hercules Street to provide a gateway and more accessible entrance into the Greenway from Hercules Street. This meets the objective of being accessible and also improves safety and visibility.

The draft concept design was put on exhibition for comment in March 2019. This included a newsletter to all residents within 400 m of the GreenWay corridor informing of the draft Concept Design and seeking feedback, as well as providing the plans and a feedback form on Council's engagement website.

105 written responses were received from residents and businesses as well as written comments from various community groups including Inner West Environment Group and the Inner West Bicycle Coalition.

The Greenway concept design was finalised based on the outcomes of community and stakeholder engagement, with minor changes undertaken. The Concept design was endorsed by Council in May 2019.

Following further consultation, a revised concept design for the Greenway was finalized in July 2020 with local changes around Longport Street to reduce potential impacts on the Large Bent-wing bat colony, reduce impacts on water infrastructure and improve constructability.

6.3.4 Summary of Community Engagement Report

The REF was put on public exhibition from 15 February to 15 March 2021. A newsletter advertising the REF was distributed to 18,750 properties along the GreenWay corridor. Emails were also sent to agencies and community groups including:

- NSW Department of Planning, Industry and Environment
- Transport for NSW
- Sydney Water
- Transdev (operators of the Inner west light rail)
- The Greenway Steering Committee (a community committee)

The REF was exhibited on Councils your say inner west website and submissions were sought via email or post.

6.3.4.1 Submissions

Thirty-four (34) responses were received on the Draft REF, including three (3) responses received after the close of the public exhibition. All responses, including late responses, were considered.

A summary of submissions and Council’s responses can be found within the Community Engagement Report (Appendix L).

7. Mitigation Measures

Table 7-1 Recommended mitigation measures for the proposed works

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
Soil Erosion and Sedimentation	<ul style="list-style-type: none"> Increase in sediment flow into water control Erosion hazard from work 	Prepare a CEMP prior to any construction works to address measures to be adopted to minimise impacts on the environment as a result of the construction works, including sediment erosion and sedimentation.	Contractor	Prior to Construction
		Prepare a Sediment and Erosion Control Plan in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and implement prior to works.	Contractor	Prior to Construction
		Install soil and erosion control measures such as sediment fencing prior to on-ground works. Inspect these regularly (weekly), and more frequently during rain periods to ensure structures are in proper working order.	Contractor	Prior to Construction
		Prior to forecast heavy rain, cease work and remove accumulated material from sediment controls.	Contractor	During Construction
		Schedule the major drainage and earthworks outside of predicted heavy rain periods.	Contractor	During Construction
		Stop work during and following heavy rainfall to reduce risk of mobilising sediment.	Contractor	During Construction
		Inspect erosion controls regularly (daily during workdays) and after rainfall. Fix damaged controls immediately. Remove accumulated sediment or waste material from the sediment controls regularly and dispose of at a licensed waste facility.	Contractor	During Construction
		Bare areas should be mulched following clearance works to prevent erosion or soil damage. Alternatively, erosion prone areas, when not in use, may be covered with biodegradable weed matting or similar product.	Contractor	During Construction
		Monitor sedimentation down slope of excavated areas.	Contractor	During Construction
Leave erosion and sediment controls in place until after the works are completed.	Contractor	During Construction		

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
Soil Contamination	<ul style="list-style-type: none"> Incidental discovery or disturbance of soil contamination. Pollution of soils from chemical spills (e.g. fuel or oil from machinery). 	Undertake works in accordance with recommendations of the Preliminary Site Investigation (GHD, 2020)	Contractor	During Construction
		If contaminated soils are uncovered during the works, cease all works within the vicinity of the find and notify the Council Project Manager immediately.	Contractor	During Construction
		For any excess spoil material which requires offsite disposal, formally classify waste before being taken to an appropriately licensed landfill in accordance with the EPA (2014) Waste Classification Guidelines.	Contractor	During Construction
		Store all chemicals (e.g. fuel, oil) in appropriate bunding/storage systems within the approved storage facility.	Contractor	During Construction
		Develop a site-specific Asbestos Management Plan for the Works.	Contractor	Prior to Construction
		If friable asbestos is deemed to be present or likely on the site, implement the following procedure: <ul style="list-style-type: none"> Cease works and cover the exposed area with substantial plastic sheeting that is securely anchored to the ground surface and enclose within a barrier to prevent access. Notify the Site Manager immediately. The Site Manager is to determine if appropriate signage should be displayed to warn of the presence of these materials. The Site Manager is to contact a suitably qualified Occupational Hygienist to provide further advice. Do not undertake further works on the Site until the Site Manager has provided approval for Low Level Disturbance works to re-commence. 	Contractor	During Construction
		Undertake asbestos removal works in accordance with the requirements of the relevant OH&S regulations and NSW Workcover (Consara, 2016).	Contractor	During Construction
		Obtain a Bonded Asbestos Licence from NSW Workcover (or as superseded at the time of works) to remove, repair or disturb more than 10 m ² of bonded asbestos material such as fibro, corrugated cement sheeting and asbestos cement pipes.	Contractor	During Construction
		If the removal, repair or disturbance of any amount of friable asbestos, such as sprayed limpet, asbestos cloth, millboard and pipe lagging is proposed, obtain a	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing	
Water Quality and Hydrology		Friable Asbestos Licence from NSW Workcover. This licence also allows the removal of bonded asbestos (Consara, 2016).			
		Notify NSW WorkCover seven days before removing bonded asbestos. A work site permit from NSW WorkCover must be obtained before removing any friable asbestos. Applications must be lodged at least seven days before the proposed work is due to start (Consara, 2016).	Contractor	During Construction	
		Ensure appropriate spill kits are carried with the equipment.	Contractor	During Construction	
		Establish dedicated refuelling areas outside environmentally sensitive areas and away from creek lines. These areas are to be bunded to ensure any spills do not enter these sensitive areas.	Contractor	During Construction	
	<ul style="list-style-type: none"> • Increase in sediment flow into waterways • Modification of hydrological flow rate due to concrete pathways • Reduction in water quality and increase in rubbish 		Undertake work from within the Hawthorne Canal in accordance with any requirements of Sydney Water	Contractor	During Construction
			Check weather forecasts daily to ensure that work is not carried out before or during high rainfall.	Contractor	During Construction
			Store all chemicals (e.g. fuel, oil) offsite. If required to be stored onsite, store chemicals in appropriate bunding/storage systems, outside of the riparian zones and only for short periods.	Contractor	During Construction
			Ensure appropriate spill kits, are present onsite.	Contractor	During Construction
			Ensure all equipment is in good working order.	Contractor	During Construction
			Carry associated Safety Data Sheets (SDS) for all chemicals.	Contractor	During Construction
			Do not use any chemicals that are labelled as ‘Class 9 Environmentally hazardous’ as part of the proposed activities.	Contractor	During Construction
			Do not stockpile rubbish or store chemicals near native vegetation or waterways.	Contractor	During Construction
			Limit the use of fuel, chemicals and herbicides near waterways and other sensitive areas.	Contractor	During Construction
			Wash all equipment, including, erosion and sediment control measures and trailers to prevent spread of exotic species. Conduct a visual check for	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		vegetation and seeds on all equipment machinery used in the activities before work commences.		
Biodiversity	<ul style="list-style-type: none"> • Compaction of soil • Accidental damage / clearing • Impacts to known roosts of Threatened microbats and Grey-headed Flying-fox 	Stabilise all disturbed areas and implement vegetation protection measures as required.	Contractor	During Construction
		Ensure revegetation of native vegetation is consistent with the relevant vegetation communities or as set out in the GreenWay Masterplan.	Contractor	Post Construction
		Council staff are to undertake a pre-works briefing advising of sensitive areas and relevant safeguards for these areas.	Inner West Council	Prior to Construction
		Stop works if any previously undiscovered threatened species or communities are discovered during works. An assessment of the impact and any required approvals must be obtained. Works must not recommence until Council has provided written approval to do so.	Contractor	During Construction
		Ensure the site-specific CEMP includes instructions for dealing with orphaned or injured native animals and ensure the CEMP includes the contact details for the NSW Wildlife Information, Rescue and Education Service Inc (WIRES).	Contractor	Prior to Construction
		Install temporary barrier fencing to prevent entry into adjacent vegetation and appropriate 'no-go zone' signage.	Contractor	During Construction
		Install tree protection measures around trees to be retained in the study area. Structures should be adequate to prevent machinery from entering within the drip zone.	Contractor	Prior to Construction
		Maintain temporary fencing to prevent access into the native vegetation.	Contractor	During Construction
		Prepare a Construction Microbat Management Plan and Microbat Management Plan and Adaptive Microbat Design Plan and begin implementation of the relevant actions of all three plans.	Inner West Council	Prior to Construction
		Brief contractors on the presence of threatened species.	Inner West Council	Prior to Construction
	<p>Potential Light Impacts to the Microbat Roost</p> <ul style="list-style-type: none"> • To avoid potential light impacts to the roost, consider conducting investigations into the effect of: 	Contractor and Inner West Council	Prior and During Construction	

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		<ul style="list-style-type: none"> ○ Soft barriers replicating elevated pathway on bat flight paths to inform final design specifications and location. ○ Designing and locating the elevated pathway so that there are minimal impacts to bat flight paths. ○ Scheduling construction for periods when bats are not in residence (Nov to end Feb). ○ Ensuring bat flight paths to / from roost remain open at all times. ○ Monitoring response of bats to elevated pathway during emergence. ● Ensure detailed mitigation measures for design and construction, outlined in the Adaptive Microbat Design Plan and Construction Microbat Management Plan, are adhered to. 		
		<p>Potential Noise Impacts to the Microbat Roost</p> <ul style="list-style-type: none"> ● To minimise potential impacts of noise on the roost, ensure: <ul style="list-style-type: none"> ○ Daily timing of construction activities is undertaken in accordance with Table 1 of the Interim Noise Guidelines (2009). ○ Construction activities in the vicinity of the roost is scheduled to coincide with periods when bats are not in residence (Nov – end Feb) ○ Noise barriers that do not block flight paths of bats during construction are installed. ○ The elevated pathway is constructed with noise buffering / absorbing materials. ○ Baseline background noise levels within the roost and at the roost entrance prior to construction, during construction and post construction is obtained. 	Contractor and Inner West Council	Prior and During Construction
		<p>Potential Vibration Impacts to the Microbat Roost</p> <ul style="list-style-type: none"> ● To avoid potential vibration impacts to the roost, ensure: <ul style="list-style-type: none"> ○ Construction activities for the piling for elevated pathway and construction of jacked box culvert beneath Longport Street coincide with periods when bats are not in residence (Nov – end Feb). 	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		<ul style="list-style-type: none"> Lowest vibration equipment and techniques when excavating / piling / tunnel boring beneath Longport Street are utilised. Active monitoring of vibration levels and bat arousals during piling and tunnel boring is undertaken. Active piling and tunnel boring daily work hours are limited and include stop work periods throughout the day to provide some relief from vibrations if impacts on bats are being detected. No piling or tunnel boring is conducted within 50 m of roost entrance from 1 hour prior to sunset until 1 hour after sunrise daily throughout construction. 		
		<p>Potential Human Impacts to the Microbat Roost</p> <ul style="list-style-type: none"> Ensure fencing is maintained to exclude members of the public from an area within 50 m of the roost entrance. Retain existing locked fencing in the area between southern boundary of Cadigal Reserve beneath main Western Rail Line and Longport Street, so access to microbat roost and area surrounding it remains restricted. Future activation of this area to view historical Whipple Truss is considered high risk as an impact to roosting bats. 	Contractor and Inner West Council	During Construction
		<p>Grey-headed Flying-fox</p> <ul style="list-style-type: none"> Conduct a pre-clearance survey to ensure that no Grey-headed Flying-foxes are present within the study area or adjacent vegetation prior to vegetation removal. If Grey-headed Flying-fox is located during works, stop works and notify the Project Ecologist to provide ecological advice. 	Contractor	Prior and During Construction
		Limit the use of chemicals due to the indirect impacts to threatened fauna and native vegetation.	Contractor	During Construction
		Clean all equipment before exiting the study area.	Contractor	During Construction
Priority Weeds	<ul style="list-style-type: none"> Spread of priority weeds disease into bushland or 	Wash down equipment and vehicles prior to and after use, to manage the introduction and spread of weed propagules.	Contractor	During Construction
		Thoroughly clean all equipment of soil and weed propagules prior to entry into the study area.	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
Trees	threatened species habitat	Remove Priority weeds using best management practices (including appropriate controls to prevent impacts to threatened species) prior to removal of native vegetation. Remove weed propagules offsite.	Contractor	Prior to Construction
		Bag and remove all weed propagules offsite, preferably the same day and dispose of at designated green waste facility.	Contractor	During Construction
		Consider the implementation of a Weed Management Plan and revegetation works following the completion of works for the adjacent riparian corridor.	Contractor	Post Construction
	Minor impacts to trees proposed to be retained if possible	Where possible, relocate services/pathways outside of TPZs.	Contractor	Prior to Construction
		Consider designing pathways so they are above grade, minimising/eliminating excavation within tree protection zones.	Contractor	Prior to Construction
		Consider designing pathways using porous materials (eco-paving, porous asphalt, decomposed granite) to allow water and oxygen to reach the root zone.	Contractor	Prior to Construction
		Consider designing pathways using tree sensitive techniques (pier and beam, suspended slabs).	Contractor	Prior to Construction
		Engage a suitably qualified Project Arborist (minimum AQF Level 5 Diploma of Arboriculture qualification) for the duration of the works. The Project Arborist shall: <ul style="list-style-type: none"> Prepare a project specific tree protection plan. Ensure contractor compliance with specified tree protection measures, including monitoring of trees through the works. Provide advice to the contractor for work near trees, tree work or pruning including advice on alternative construction methods. Supervise works on or near trees, including all works within TPZs, root pruning, dead wooding, aerating, mulching and any temporary irrigation. 	Contractor	During Construction
		Install tree protections.	Contractor	During Construction
		Consider tree sensitive techniques to install services within the TPZ such as NDE.	Contractor	During Construction
Consider tree sensitive techniques during demolition of existing pavements and other work within the TPZ.	Contractor	During Construction		

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		Consider tree sensitive techniques during any works within the TPZ including works to facilitate soft landscaping.	Contractor	During Construction
		Determine the location and distribution of roots through ground-penetrating radar or NDE methods such as hydro-vacuum excavation (sucker truck), air spade and manual excavation. Determine the location and distribution of roots through ground-penetrating radar or NDE methods such as hydro-vacuum excavation (sucker truck), air spade and manual excavation.	Contractor	During Construction
		If any additional trees are proposed to be removed during the design and construction phase that are not identified for removal in this REF (i.e. those in the retain or retain if possible categories), this will require approval by Council’s tree officer.	Contractor	During Construction
		Trees removed are to be replaced with advanced tree stock (min. 200L) at a minimum rate of 1:1 as part of the works. Replacement species will be locally native and selected based on the Greenway Masterplan.	Contractor	Post Construction
Aboriginal Heritage	<ul style="list-style-type: none"> Discovery of unsuspected Aboriginal objects Discovery of human remains Harm to AHIMS sites as well as other area of Aboriginal Significance 	Brief all contractors undertaking works on site on the protection of Aboriginal heritage objects under the NPW Act, and the penalties for damage to these items.	Contractor	Prior to Construction
		Should an unexpected Aboriginal object be identified during construction, stop works in the immediate vicinity of the find and fence the area off with suitable markers (star pickets, flagging or barrier mesh). Notify the Council Project Manager and engage an archaeologist to determine the significance of the find.	Contractor	During Construction
		If required, determine the notification, consultation, and approval requirements. Works must not recommence until Council has provided written approval to do so.		
		If human remains are discovered, cease works immediately and contact the NSW Police. If the remains are suspected to be Aboriginal, consider contacting DPIE to assist in determining appropriate management.	Contractor	During construction
Historic Heritage	<ul style="list-style-type: none"> Impacts to Heritage items 	In accordance with Section 146 of the Heritage Act, cease work if an archaeological relic (such as a deposit or artefact) is uncovered during works and contact a qualified archaeologist to assess the find. Further advice and	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		<p>clarification may be sought from the Heritage Council of NSW, or the Heritage Division under delegation regarding assessment and approvals.</p> <p>Should any unexpected historical archaeology be uncovered during any future excavation works, adhere to the following procedure:</p> <ul style="list-style-type: none"> • Stop all work in the immediate area of the item and notify the Project Manager. • Establish a ‘no-go zone’ around the item. Use high visibility fencing, where practical. Inform all site personnel about the no-go zone. • No work is to be undertaken within this zone until further investigations are completed. • Engage a suitably qualified and experienced Archaeologist to assess the finds. • Notify the Heritage Council if the finds are of local or state significance. Additional approvals will be required before works can recommence on site (s146 permit). 	Contractor	During Construction
		<p>Battle Bridge</p> <ul style="list-style-type: none"> • Erect measures to protect Battle Bridge from inadvertent or accidental harm to heritage fabric such as fencing and covering. • Ensure any permanent or temporary barriers or fixings are not anchored into significant fabric. • Removal of non-significant, intrusive or unsympathetic fabric is acceptable. • Consider interpretation to increase appreciation. <p>Cadigal Reserve including sewage aqueduct, railway viaduct and whipple truss</p> <ul style="list-style-type: none"> • Erect measures to protect the sewage aqueduct, railway viaduct and whipple truss from inadvertent or accidental harm to heritage fabric such as fencing and covering. • Ensure any permanent or temporary barriers or fixings are not anchored into significant fabric. • Removal of non-significant, intrusive or unsympathetic fabric is acceptable. 	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		<ul style="list-style-type: none"> Consider interpretation of these items to increase appreciation. <p>Allied Mills</p> <ul style="list-style-type: none"> Erect measures to protect heritage buildings from inadvertent or accidental harm to heritage fabric such as fencing and covering. Where possible, avoid removal of remnant rail infrastructure or sidings. Consider interpretation of these items to increase appreciation. 		
		Submit a Standard Exemption Notification (8: Non-Significant Fabric s57(2) Heritage Act), to the Heritage Council with the Statement of Heritage Impact Assessment (ELA, 2021) for endorsement for works within the heritage curtilage of the sewage aqueduct and the rail viaduct.	Contractor	Prior to Construction
		Engage a suitable qualified heritage consultant to prepare a Heritage Interpretation Strategy in accordance with the NSW Heritage Interpretation Guidelines (www.environment.nsw.gov.au/resources/heritagebranch/heritage/interpretationpolicy).	Contractor	Prior to Construction
		Consult with TfNSW Heritage Specialists to ensure that significant fabric is appropriately protected at Battle Bridge, the rail viaduct and whipple truss.	Contractor	Prior to Construction
		Engage a suitably qualified heritage consultant to prepare a photographic Archival Record of Battle Bridge and the whipple truss, consistent with the Heritage Office Guidelines Photographic Recording of Heritage Items Using Film or Digital Capture. (environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/).	Contractor	Prior to Construction
Noise and Vibration	<ul style="list-style-type: none"> Noise impacts on sensitive receivers in proximity Site management 	Prepare and implement a CNVMP.	Contractor	Prior to Construction
		Avoid the use of radios or stereos outdoors where neighbours can be affected.	Contractor	During Construction
		Avoid shouting and minimise talking loudly and slamming vehicle doors.	Contractor	During Construction
		Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
Transmission Path	<ul style="list-style-type: none"> • Consultation and Negotiation • Complaints handling • Plant and Equipment • Vibration • On-site considerations • Work Scheduling • Transmission Path 	Ensure consultation outlining building times, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur is undertaken.	Contractor	During Construction
	Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English. A website could also be established for the project to provide information.	Contractor	Prior to Construction	
	Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.	Contractor	During Construction	
	Implement all feasible and reasonable measures to address the source of the complaint.	Contractor	During Construction	
	Keep a register of any complaints, including details of the complaint such as date, time, the person receiving the complaint, complainant’s contact number, the person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate.	Contractor	During Construction	
	Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fracture. The suitability of alternative methods should be considered on a case-by-case basis.	Contractor	During Construction	
	Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric controlled units where feasible and reasonable. Where there is no electricity supply, use an electrical generator located away from residences.	Contractor	During Construction	
	Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber-wheeled tractors can be less noisy than steel tracked tractors.	Contractor	During Construction	
	Pneumatic equipment is traditionally a problem – select super silenced compressors, silenced jackhammers and damped bits where possible.	Contractor	During Construction	
Operate plant in a quiet and efficient manner.	Contractor	During Construction		

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		Reduce throttle setting and turn off equipment when not being used.	Contractor	During Construction
		Regularly inspect and maintain equipment to ensure it is in good working order. Also, check the condition of mufflers.	Contractor	During Construction
		Implement Safe Working Distances specified in Table 5-33.	Contractor	During Construction
		Undertake baseline vibration measurements for vibration generating works to develop site-specific exclusion zones.	Contractor	Prior to Construction
		Undertake detailed vibration impact assessment as part of the CNVMP.	Contractor	Prior to Construction
		Place as much distance as possible between the plant or equipment and residences and other sensitive land uses.	Contractor	During Construction
		Restrict areas in which mobile plant can operate so that it is away from residences and other sensitive land uses at particular times.	Contractor	During Construction
		Avoid the use of reversing alarms by designing site layout to avoid reversing, such as by including drive through for parking and deliveries.	Contractor	During Construction
		In all circumstances, the requirements of the relevant Occupational Health and Safety legislation must be complied with. For information on replacing audible warning alarms on a mobile plant with less annoying alternatives	Contractor	During Construction
		Use temporary site buildings and materials stockpiles as noise barriers	Contractor	During Construction
		Use natural landform as a noise barrier – place fixed equipment in cuttings, or behind earth berms.	Contractor	During Construction
		Consult with affected education facilities to ensure that noise-generating construction works in the vicinity of affected education buildings are not scheduled to occur during examination periods, unless other arrangements (such as relocation to an alternative location) acceptable to the affected parties can be made.	Contractor	During Construction
		Where night work near residences cannot be feasibly or reasonably avoided, restrict the number of nights per week and/or the number of nights per calendar month that the works are undertaken, in consultation with residents who will be most affected.	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing		
		Organise work to be undertaken during the recommended standard hours where possible.	Contractor	During Construction		
		When works outside the recommended standard hours are planned, avoid scheduling on Sundays or public holidays.	Contractor	During Construction		
		Schedule work when neighbours are not present (for example, commercial neighbours, colleges and schools may not be present outside business hours or on weekends).	Contractor	During Construction		
		Schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) where possible to provide masking or to reduce the amount that the construction noise intrudes above the background.	Contractor	During Construction		
		Schedule deliveries to nominated hours only.	Contractor	During Construction		
		Reduce the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers.	Contractor	During Construction		
		Erect temporary noise barriers before work commences to reduce noise from works as soon as possible.	Contractor	During Construction		
		Air Quality	<ul style="list-style-type: none"> Dust generation from vibrating and ground disturbing works Fumes generation from machinery Cumulative impacts of greenhouse gas emissions 	Minimise works during high wind periods.	Contractor	During Construction
				Apply dust suppression as required to limit excessive dust generation.	Contractor	During Construction
				Regularly inspect plant and equipment to ascertain that fitted emission controls are operating efficiently.	Contractor	During Construction
Maintain plant and equipment in accordance with manufacturer’s specifications to ensure that it is in a proper and efficient condition.	Contractor			During Construction		
Do not have machinery running while not in use.	Contractor			During Construction		
Minimise use of machinery for required activity only.	Contractor			During Construction		
Ensure vehicles maintain recommended speed.	Contractor			During Construction		
Look for excessive dust generation and slow down if needed.	Contractor			During Construction		
Minimise site movements.	Contractor	During Construction				

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		Locate stockpiles away from sensitive receptors where possible.	Contractor	During Construction
		Cover or water stockpiles that are not used for extended periods and keep moist to minimise transmission of dust.	Contractor	During Construction
		Apply water cart rotations and misting systems to minimise dust dispersion beyond construction areas.	Contractor	During Construction
		Erect shade cloth surrounding excavation works to suppress dust.	Contractor	During Construction
		Rehabilitate construction sites following completion of the works.	Contractor	During Construction
		Where odour emissions are perceivable and may impact nearby sensitive receivers, consider odour suppression systems.	Contractor	During Construction
Waste Management	<ul style="list-style-type: none"> Excess spoil in the form of excavated material Litter left on-site by staff/contractors 	On site burning of waste of any kind is not permitted	Contractor	During Construction
		Consider resource management options for the project against a hierarchy of the following order embodied in the <i>Waste Avoidance and Resource Recovery Act 2001</i> : <ul style="list-style-type: none"> Avoid unnecessary resource consumption; Recover resources (including reuse, reprocessing, recycling and energy recovery); and Dispose (as a last resort). 	Contractor	During Construction
		Classify all wastes and excess spoil in accordance to the Waste Classification Guidelines (DECC, 2009) prior to disposal and transported to a licensed waste disposal facility.	Contractor	During Construction
		Remove all waste from the site on completion of the works.	Contractor	During Construction
		Upon completion of waste disposal, retain all original weighbridge / disposal receipts issued by the receiving waste facility in a waste register as evidence of proper disposal.	Contractor	During Construction
		Ensure an adequate number of bins are placed at the site for workers and that all litter is placed in these bins. Ensure work areas of the project site are kept clean and free of litter, including cigarette butts, at all times.	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
Traffic	<ul style="list-style-type: none"> Disruption to traffic flows Temporary road closures Safety 	Position vehicles, materials and equipment to minimise impacts to public access and parking.	Contractor	During Construction
		If required, restrict heavy vehicles to specified routes.	Contractor	During Construction
		Implement a Traffic Management Plan prior to the commencement of any construction works to ensure that traffic disruptions are mitigated, and commuters are notified of detours and closures through signage.	Contractor	Prior to Construction
		Consider night works where road closures are required on large classified roads such as Parramatta Road to avoid traffic impacts.	Contractor	During Construction
		Undertake consultation, in accordance with Section 138 of the Roads Act, with TfNSW for any road closures required on classified Roads.	Contractor	Prior to Construction
		Notify nearby businesses and sensitive receivers and give opportunity to comment on temporary road closures prior to commencement of construction.	Contractor	Prior to Construction
		Maintain a project complaint register as part of the Traffic Management Plan.	Contractor	Prior to Construction
		Do not undertake closures of Constitution Road and Longport Street simultaneously	Contractor	Prior to Construction
Infrastructure	<ul style="list-style-type: none"> Potential impacts to Sydney Water and Transport for NSW infrastructure Potential impacts to private and public buildings and infrastructure 	Ensure that truck movements and construction material delivery is not undertaken during school pick up/drop off times near Dulwich Hill Public School (Hercules Street)	Contractor	Prior to Construction
		Further investigations are essential to inform detailed design in line with the findings of the Concept Design Report (2020).	Contractor	Prior to Construction
		Where significant groundworks (such as tunnelling or soldier pile walls) are proposed in close proximity to structures (both public and private buildings and infrastructure), undertake pre and post work dilapidation surveys prior to the commencement of works.	Contractor	Prior to Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
Visual Amenity and Landscape	<ul style="list-style-type: none"> Impact on the community 	Notify community or neighbours where light impacts are anticipated.	Contractor	Prior to Construction
		Position lighting in residential areas to direct light away from houses wherever possible.	Contractor	During Construction
		Ensure all access restrictions are removed following construction.	Contractor	Post Construction
		Consider mitigating potential visual impacts through increased planting of trees and shrubs concentrated around the light rail stations.	Contractor	During Construction
		To reduce light spill to adjacent residences, consider location of pole as well as luminaire type and angle during the detailed design stage.	Contractor	Prior to Construction
		Where possible, consider additional revegetation to further reduce impact of light spill on residences.	Contractor	During Construction
		If possible, retain the large fig tree branches which overhang the Hawthorne Canal to reduce the overall visual impact of the project.	Contractor	During Construction
		The entry to the tunnel will be visible from Waratah Mills Light Rail Station. It is recommended that this sightline remains clear in the interests of safety and in line with Crime prevention through environmental design guidelines, and to ensure user experience is one of perceived safety.	Contractor	During Construction
		Take into consideration the principles of CPTED in the design of all aspects of the GreenWay	Contractor	Prior to Construction
		Implement a cohesive signage and wayfinding strategy for the corridor.	Contractor	During Construction
Community	<ul style="list-style-type: none"> Perceived safety Visual, traffic, noise and dust impacts 	Ensure all recommended mitigation measures for noise and vibration, amenity, traffic and air quality are adhered to.	Contractor	During Construction
		Prepare a CEMP to include the required management and mitigation measures. The CEMP will provide a framework for establishing how these measures will be implemented and who will be responsible for their implementation. The CEMP will be prepared prior to the proposal's construction and must be reviewed and certified by Council, prior to the start of any on site work. The CEMP will include sub plans for all impacts identified within this REF.	Contractor	Prior to Construction
		The Contractor is required to prepare a community engagement plan to keep residents informed of progress and specific construction activities.	Contractor	During Construction

Impact On	Reasons	Safeguards/Mitigation Measures	Responsibility	Timing
		Where there are private properties near the proposed works and there is no established vegetation, provide shade cloth to reduce impacts on privacy as required.	Contractor	During Construction
Cumulative Impacts	<ul style="list-style-type: none"> Notifying community members 	Ensure a plan for community consultation is developed which outlines the dissemination of information to the community via letterbox drops, websites and newsletters	Council	Prior to Construction
		Notify sensitive receivers including businesses and schools which are at risk of impacts to day-to-day functioning and trading at least 2 weeks prior to works commencement.	Council	Prior to Construction
		Where multiple projects are occurring within the same vicinity at the same time, undertake communication between construction contractors to ensure that potentially noisy or disruptive activities are not undertaken at the same time.	Contractor	During Construction

8. Conclusion

The project has been subject to assessment under Division 5.1, Part 5 of the EP&A act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. This has included consideration of other environmental planning instruments as well as other NSW and Commonwealth legislation.

The proposal will aid in the delivery of multiple objectives identified both in the Eastern City District Plan and Inner West Local Strategic Planning Statement such as providing improved and accessible transport infrastructure, creating a diverse and increasing urban forest that supports connected habitats of flora and fauna and providing accessible facilities and spaces that support active, healthy communities.

The project as described in the REF best meets the project objectives, however, would still result in some impacts. Environmental impacts associated with the project would generally be limited to contamination, noise and vibration, visual and biodiversity. Appropriate mitigation measures to be undertaken both during the detailed design stage and during construction have been recommended to ensure such impacts are minimised. This include the recommendation for the following management plans:

- Construction Environmental Management Plan
- Sediment and Erosion Plan
- Asbestos Management Plan
- Acid Sulphate Soils Management Plan, if known areas are disturbed
- Microbat Management Plans
 - Construction Microbat Management Plan
 - Adaptive Microbat Design Plan
 - Microbat Monitoring Plan
- Noise and Vibration Management Plan
- Traffic Management Plan

The REF has considered and assessed these impacts in accordance with clause 228 of the EP&A Regulation and the requirements of the EPBC Act. Based on the assessment contained in this REF, it is considered that the proposal is not likely to have a significant impact upon the environment or any threatened species, populations or communities. Accordingly, an Environmental impact Statement (EIS) is not recommended.

The project has also taken into account the principles of ecologically sustainable development and the objects of the EP&A Act. The proposal would be delivered to the maximum benefit for the community, be cost effective and minimise any adverse impacts on the environment. On balance, the project is considered justified and in the public interest.

8.1 Assessor Declaration

This REF provides a true and fair review of the activity in relation to its likely effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the project and provides sufficient information to determine whether there is likely to be a significant impact on the environment as a result of the Project.

I have considered all environmental impacts and safeguards to the best of my knowledge and have sought advice where required.

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