



North Sydney Wharf Upgrade

Review of Environmental Factors

Transport for NSW

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Transport for NSW | October 2020

Prepared by Cardno (NSW/ACT) Pty Ltd and Transport for NSW



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Signed:	
Dated:	20 October 2020

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Executive summary

The proposal

Transport for NSW proposes to upgrade the North Sydney Wharf (the proposal) as part of the Transport Access Program (TAP) which includes both waterside and landside upgrade works.

The water based features of the proposal would include:

- Installation of a new 3.3-metre long by 3.3-metre wide concrete jetty, supported by three new piles, including minor modifications to the top of the seawall
- Installation of a new 12-metre by 27-metre pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with pivot piles (to assist vessel berthing) provided at either end of the pontoon
- Installation of a new 18-metre uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- Installation of two protection piles on the northern side of the gangway
- Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- Safety and security features on the pontoon including an emergency help point, lighting, closed circuit television (CCTV), ladders to the water and a life buoy and tactile indicators where required.

The land based features of the proposal would include:

- One accessible parking space at the cul-de-sac end of High Street
- One kiss-and-ride space or zone at the cul-de-sac end of High Street
- Three new bicycle parking hoops
- Footpath regrading to produce a *Disability Standards for Accessible Public Transport 2002* (DSAPT) compliant grade
- Installation of a new accessible ramp between the existing footpath and the new gangway
- One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- Installation of new wayfinding signage, information boards, and opal card readers
- Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter
- Removal and replacement of up to four trees to construct the accessible pathway.

The proposal would be constructed over a duration of up to six months starting in early 2021.

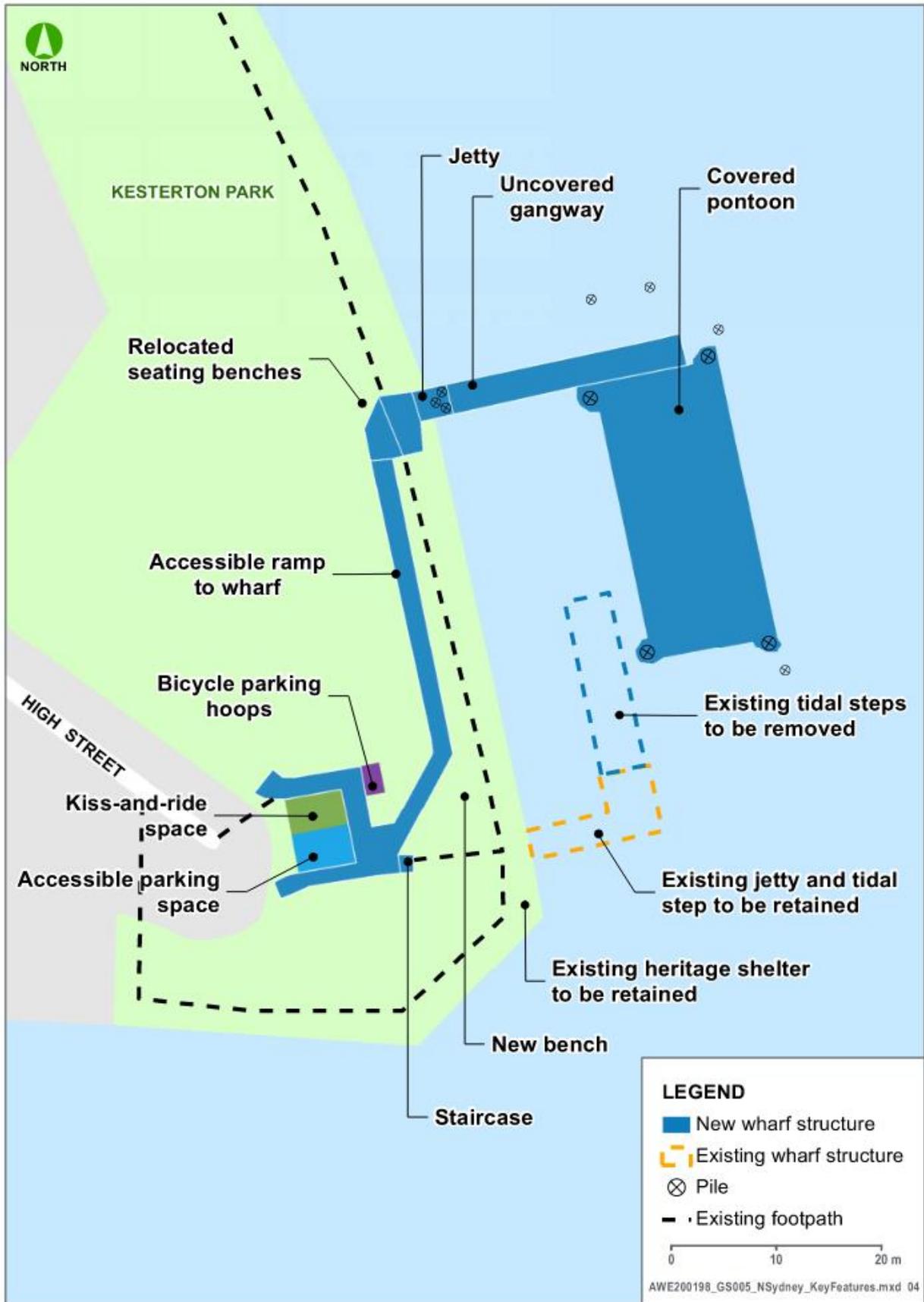


Figure E-1: Overview of proposal

Need for the proposal

The need for the proposal was identified in response to the Transport for NSW TAP which is an initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure.

The primary objective of the TAP program is to achieve 100 per cent DSAPT compliance for all assets, access paths and transport services within the wharf interchange.

The DSAPT and *Disability Discrimination Act 1992* (DDA) standards require all public transport infrastructure, including wharves, to have fully compliant disabled access by 2022.

Therefore, North Sydney Wharf needs upgrading due to the lack of a fully compliant accessible pathway from High Street to the pontoon and non-compliant pontoon and gangway for less mobile passengers.

Proposal objectives

The objectives of the proposal are:

- To ensure compliance with legislative, functional and operational requirements, in particular DSAPT and DDA standards that require all public transport infrastructure, including wharves, to have fully compliant disabled access by 2022
- To maximise equity of access for all customers
- To improve accessibility, passenger safety and comfort for future patronage
- To maximise the use of the ferry wharf Kit-of-Parts (standardised design elements) to provide continuity across Sydney Harbour wharves
- To accommodate forecast growth in patronage and changes to travel patterns
- To provide safe berthing and mooring of ferry vessels
- To minimise walking distances, conflict and crowding points and queuing
- To maximise the perception of security and safety
- To minimise cost of ownership and maintenance.

Options considered

Three concept design options were presented to stakeholders as follows:

- 'Do nothing' – no upgrade, regular maintenance would continue
- Option 1 – new pontoon, gangway and accessible ramp along southern seawall. Located at existing wharf site, includes removal of existing wharf
- Option 2 – new pontoon, gangway and switchback footpath through Kesterton Park. Located at existing wharf site, includes removal of existing wharf.

Although it would present the lowest initial capital cost and environmental impact, the 'do nothing option' was discounted as it would not meet the objectives of the proposal to improve accessibility, passenger safety and comfort for future patronage.

While Option 2 was the preferred option following the initial stakeholder engagement, stakeholders (Transport for NSW, Roads and Maritime Services and TransDev) and North Sydney Council recommended further design refinements, particularly to reduce impact to Kesterton Park and the landscaped mound at the end of High Street. In response to these stakeholder comments, the concept design was further refined as follows:

- Retention of the existing wharf for potential recreational fishing use
- Construction of a jetty so that the gangway would not be attached to the seawall

- Relocation or replanting of existing trees and seating benches in Kesterton Park.

Further refinements were made to the design to increase the clearance in the navigational channel. These refinements resulted in the following changes:

- Relocation of the pontoon to the southern side of the gangway
- Removal of three of the four tidal steps of the existing wharf.

Statutory and planning framework

The proposed facility is a wharf or boating facility within the meaning of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP).

The proposal is for a wharf or boating facility and is to be carried out by Transport for NSW and can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Development consent from North Sydney Council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974*.

Community and stakeholder consultation

The community and key stakeholders were invited to provide feedback on the proposal's concept design in February 2020.

Consultation with the Department of Planning, Industry and Environment (DPIE) Housing and Property Group (formerly the Foreshores and Waterways Planning and Development Advisory Committee), Ausgrid, Sydney Water, Port Authority of NSW, Department of Primary Industries (DPI) Fisheries and DPIE Crown Land has been undertaken during the preparation of this REF. Consultation with North Sydney Council is ongoing.

Stakeholder consultation will continue during the public display of this document, with a community information session planned during the Review of Environmental Factors (REF) public display period to capture community feedback. Should the proposal proceed to construction, consultation with the community and stakeholders would continue throughout the construction phase.

Environment impacts

The main environmental impacts of the proposal and the safeguards and management measures to address the impacts are summarised below:

Land surface, hydrology and water quality

The proposal involves activities that would cause physical disturbance to the seabed sediments including piling, use of barges (including jack-ups/anchors) and removal of the existing tidal steps and associated piles. Additionally, sediments within the proposal footprint have elevated concentrations of heavy metals and pesticides which may be disturbed.

The construction footprint may impact up to 0.06 hectares of the green space in Kesterton Park. Construction works would include the disturbance of topsoil, bulk earthworks, build up works and regrading for construction of the accessible ramp and parking spaces. Additionally, the potential for contaminated sub-surface soils was identified during the preliminary site investigation.

Accidental spills within the compound area may occur from storing, handing and/or transferring the required small volumes of welding materials, lubricants, solvents, fuels, oils and diesels. These risks would be greater when undertaking work over, or in, the waterway.

A Soil and Water Management Plan (SWMP) would be prepared to mitigate the risks associated with sedimentation, soil erosion and water pollution including silt curtains, erosion

and sediment control plans, waste classifications, intrusive soil investigations (landside), unexpected finds protocols and spill management plans and procedures.

During operation, there would be negligible impacts to the land surface or hydrology as the operation of the proposal would be consistent with current ferry wharf operations.

Biodiversity

A biodiversity assessment has been completed which investigates the existing coastal and marine environment within the study area to assess impacts to coastal and marine biodiversity as a result of construction and operation of the proposal.

The study area is located in Neutral Bay, an embayment on the northern foreshore of Sydney Harbour. The terrestrial (land) portion of the study area includes Kesterton Park and is likely to be on reclaimed land. The marine (water) portion of the study area is comprised of a vertical sandstone seawall bound by a corridor of subtidal low-medium relief rocky reef and soft sediment habitat in deeper areas. There was no remnant native vegetation in the study area but rather a landscaped park with native and exotic plantings thus, no native plant community types occurred within or next to the study area. There were no mangroves, saltmarsh or seagrass in or next to the study area. The subtidal rocky reef (Type 2 Key Fish Habitat, KFH) and large debris/rubble in soft sediment habitats (Type 3 KFH) were colonised by a mosaic of macroalgae.

The proposal would remove up to 0.06 hectares of landscaped gardens and parks which includes the removal of up to three juvenile Wildfire (*Corymbia ficifolia*) and one Smooth-barked Apple (*Angophora costata*) plantings. Of this, 0.05 hectares would be landscaped and reintegrated into Kesterton Park following construction. Proposal impacts on vegetation and terrestrial habitat are considered to be largely temporary and would not substantially fragment or isolate existing habitat. The risks associated with vegetation clearing and construction activities would be managed during construction in accordance with the relevant Transport for NSW guidelines. Replacement tree planting (species and number) would be determined in consultation with North Sydney Council.

Three piles to support the jetty would be drilled into low-medium relief rocky reef, close to the existing seawall. Four pontoon piles, two pivot piles and two protection piles would be driven into subtidal soft sediment habitat in deeper water. The area of low-medium relief rocky reef and soft sediment habitat under the footprint of the piles would be permanently impacted. Areas used for anchoring of the barge during construction would be temporarily impacted. This would include the direct removal of macroalgae and sessile marine fauna from subtidal rocky reefs and epifauna and infauna from soft sediment habitats. The new wharf structures would shade less than 0.01 hectares of subtidal rocky reef habitat and about 0.05 hectares of soft sediment habitat and a small section of vertical intertidal rocky reef habitat. These are not considered substantial impacts to marine biodiversity as the type of rocky reef and soft sediment habitats in the study area constitutes the majority of subtidal habitat in the harbour. These community assemblages are abundant and are quick to recolonise temporarily disturbed areas.

The removal of part of the intertidal steps and associated piles would result in the removal of marine vegetation, habitat and sessile/less mobile fauna currently colonising the piles and concrete steps (about 0.01 hectares). However, the majority of these species are common in subtidal rocky reefs and would quickly colonise the piles of the new wharf and pontoon. About 0.02 hectares of submerged surface area would be available for recolonisation as part of the new wharf to replace the areas removed during construction.

The proposal is not likely to significantly impact threatened terrestrial or aquatic species, populations or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation 2016* (BC Act) or the *Fisheries Management Act 1994* (FM Act) and therefore a species impact statement (SIS) is not required.

The proposal is also not likely to significantly impact threatened species, populations, ecological communities or migratory species within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A referral to the Australian Department of the Agriculture, Water and the Environment (DAWE) is therefore not required for biodiversity matters.

Noise and vibration

A noise and vibration impact assessment has been carried out to predict construction and operational noise impacts on nearby sensitive receivers.

Construction noise was assessed in accordance with *the Interim Construction Noise Guidelines* (ICNG) which provides the methodology for deriving recommended noise management levels (NML) from the proposed construction activities. The assessment concluded that:

- Construction noise levels are predicted to exceed the NMLs at nearby residential receivers for all construction stages
- There would be exceedances of the night time noise NMLs at times, particularly during the hammering in of piles. These piling works are required to be undertaken during night-time hours due to the need for calm water conditions
- There is potential for vibration impacts at the seawall (located within the curtilage of the locally heritage listed Kesterton Park) and the existing heritage shelter due to works being undertaken within the theoretical safe working limits recommended for heritage structures.

A Construction Noise and Vibration Management Plan would be prepared prior to construction and implemented throughout the construction period. This management plan would incorporate the best practice mitigation measures outlined in Chapter 7 of this REF.

General noise and vibration impacts on the local community would be mitigated by restricting construction works to daytime hours wherever possible. However, due to the requirement for calm water conditions during pile installation and for intricate lifts, some activities would need to be carried out at night, with about 30 night shifts (from 11pm to 7am) proposed across the construction period of up to six months.

To minimise potential noise impact from the piling installation, the noisiest activity of hammering in piles has been restricted to be carried out from 5am to 7am only. During hammering, it is anticipated that each pile would be hammered for one minute (about 10 hits with a hammer within one minute). For each pile the activity is likely to occur about five times over a period of one hour.

There would be no expected increases in operational noise from the proposal.

The community would be kept informed of night-time construction activities at least five days before they are undertaken, with a community information email and phone line provided throughout the work to take enquiries and follow up on complaints

Landscape character and visual impact

A landscape character and visual impact assessment (LCVIA) was prepared to identify the overall impact of the proposed works on each of the Landscape Character Zones (LCZ) and to identify the visual changes and impacts on the site and its surroundings when viewed from key vantage points.

With regards to landscape character, the assessment concluded that the proposal would have a moderate impact on the surrounding LCZs. The landscape character within the proximity of the proposal generally consists of recreation/foreshore area adjoining residential uses and Sydney Harbour. The proposal would introduce a new visual element to the existing landscape character of the area. However, any potential impact would be mitigated

during detailed design through the use of a coordinated palette of materials and colours to respond to the existing maritime and foreshore character of the area.

With regards to visual impact assessment, the proposal would be visible from a number of viewpoints within the vicinity of the site. The visual impact generated by the proposed wharf varies from viewpoint to viewpoint, however overall the impact is considered moderate with the proposal forming part of a broader harbour context with minimal impact on existing views.

The proposal is directly overlooked from Kesterton Park and the existing footpath along the foreshore. This is a highly sensitive area as the park is identified as a local heritage item and moderately utilised by the public. Visual impact from Kesterton Park is considered high-moderate. Kurraba Point and Neutral Bay Wharf are considered moderate-low sensitivity viewpoints. Due to the distance from North Sydney Wharf, the new structure would be minor in scale when compared to nearby industrial and residential buildings. It is not identified as the dominant element within these viewpoints. Additionally, the proposed structure would not result in any view loss.

Non-Aboriginal heritage

A Statement of Heritage Impact (SOHI) has been prepared to assess the potential impacts to listed heritage items and potential archaeological remains as a result of the proposal. The assessment concluded:

- Impacts on the identified heritage items within the construction footprint are as follows:
 - Minor to moderate direct and indirect and negligible potential direct impacts to Kesterton Park (*North Sydney Local Environmental Plan 2013* (LEP) no. I0858)
 - Negligible indirect and neutral direct and potential direct impacts to the North Sydney Bus Shelter (LEP no. I0407)
- The proposed works would not impact the overall significance of the heritage items adjacent to the construction footprint, or heritage items within the visual buffer zone
- The preliminary archaeological assessment identified low to moderate potential for archaeological remains of local significance to be present in the construction footprint including evidence of a former nineteenth century weighbridge. However, due to the shallow nature of the proposed excavations there is limited risk of archaeological impacts and therefore impacts to identified archaeological resources would be negligible
- It is not expected that the proposed works would impact potential maritime archaeological remains of the former wharves, since piling would be located further north than the documented location of the former wharves. Furthermore, the removal of the existing tidal step piles, which are located in proximity to the former northern wharf, would not involve excavations of the surrounding sediment
- There is potential for vibration impacts to the seawall in Kesterton Park (LEP no. I0858) and to the North Sydney Bus Shelter (LEP no. I0407) during piling works.

Safeguards to minimise impacts to heritage are outlined in Chapter 7 of this REF.

As the proposed works would not impact upon the Commonwealth heritage values of Customs Marine Centre (Commonwealth Heritage List (CHL) ID 105249), or the World heritage values of the Sydney Opera House (World Heritage List (WHL) 166rev), a referral to the Commonwealth in accordance with the EPBC Act would not be required.

Traffic Transport and Access

North Sydney Wharf would be closed for up to six months during construction with no access to the wharf or ferry services. Generally, there would be impacts from the proposal due to disruption of commuting for users, increased construction traffic, increased vessel movements and restricted pedestrian and cyclist access around Kesterton Park.

Where feasible, plant, equipment and materials would also be transported to the construction work site by barge or boat so as to limit impacts to the local road network. Alternative pedestrian and cyclist access around the construction area in Kesterton Park would be provided. A Traffic Management Plan (TMP) and Maritime TMP would be prepared to manage and mitigate impacts to traffic, access, pedestrian movement and vessel movement

It is anticipated that no alternate transport would operate during construction (due to the inability for buses to turn around at the end of High Street) and existing bus services along Clark Road and existing train services or private vehicles would be used by ferry commuters.

Following construction, the proposal would result in the improvement of efficiency and user experience of ferry services from the wharf.

Cumulative Impacts

Cumulative impacts relate to any combined impact resulting from multiple individual sources. The proposal is part of a broader program of work to upgrade the commuter ferry wharves in Sydney, referred to as the Ferry Wharf Upgrade Program (FWUP). There is potential for cumulative impacts if there is an overlap in construction schedules from other wharves included in the FWUP.

Minor cumulative impacts associated with the increase in marine traffic and reduced amenity may be experienced during the construction phase if other development projects in the area proceed at the same time.

Justification and conclusion

The need for the proposal was justified under the TAP as the existing structure does not provide access that complies with DDA and DSAPT standards. The assessment of the environmental and social impacts has determined the proposal is not likely to have a significant impact and therefore assessment under Division 5.2 of the EP&A Act is not required.

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1 Introduction

This chapter introduces the proposal and provides the context of the environmental assessment. In introducing the proposal, the objectives and project development history are detailed and the purpose of the report provided.

1.1 Proposal identification

Transport for NSW proposes to construct a new wharf interchange at North Sydney (the proposal) as part of the NSW Government's Transport Access Program (TAP, <https://www.transport.nsw.gov.au/projects/tap>, refer to section 2.1).

The proposal is located within the local government area (LGA) of North Sydney Council. North Sydney wharf interchange is located in Neutral Bay, at the tip of a small peninsula to the east of the Warringah Freeway on Sydney's Lower North Shore. North Sydney wharf interchange sits at the water's edge of Kesterton Park. The wharf is accessed through the park from High Street, which runs along the ridge of the peninsula terminating at the wharf interchange.

Figure 1-1 shows the regional setting and Figure 1-2 shows the local setting and existing conditions. The wharf is part of the F5 Ferry Service that operates between Circular Quay and Neutral Bay. The proposal is to improve access to the wharf, and upgrade and install a gangway and floating pontoon to allow for more efficient passenger services.

The water based features of the proposal would include:

- Installation of a new 3.3-metre long by 3.3-metre wide concrete jetty, supported by three new piles, including minor modifications to the top of the seawall
- Installation of a new 12-metre by 27-metre pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with pivot piles (to assist vessel berthing) provided at either end of the pontoon
- Installation of a new 18-metre uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- Installation of two protection piles on the northern side of the gangway
- Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- Safety and security features on the pontoon including an emergency help point, lighting, closed circuit television (CCTV), ladders to the water and a life buoy and tactile indicators where required.

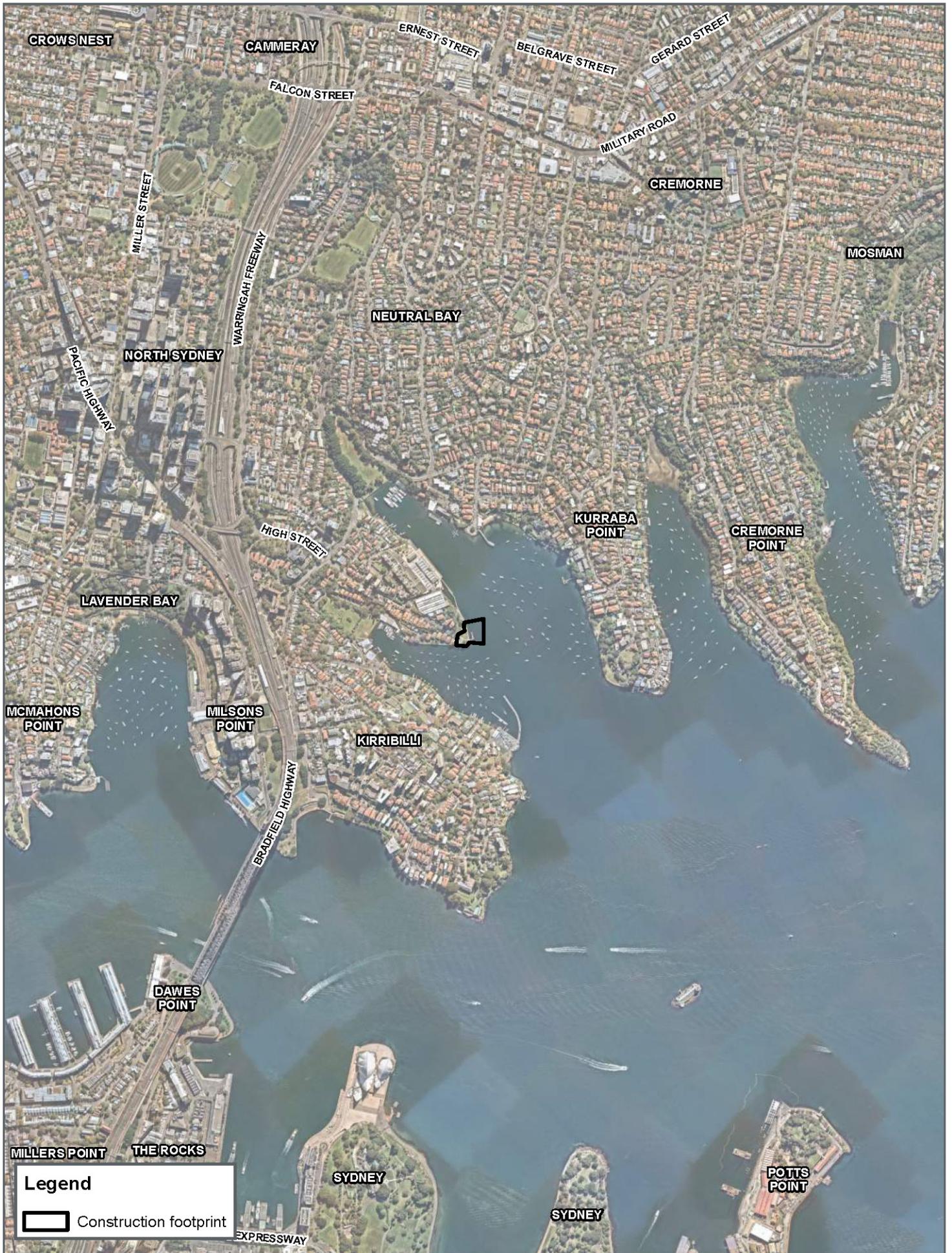
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- One accessible parking space at the cul-de-sac end of High Street
- One kiss-and-ride space or zone at the cul-de-sac end of High Street
- Three new bicycle parking hoops
- Footpath regrading to produce a *Disability Standards for Accessible Public Transport 2002* (DSAPT) compliant grade

- Installation of a new accessible ramp between the existing footpath and the new gangway
- One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- Installation of new wayfinding signage, information boards, and opal card readers
- Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter
- Removal and replacement of up to four trees to construct the accessible pathway.

The key features of the proposal are shown in Figure 1-3. Chapter 3 describes the proposal in more detail.

The proposal would be constructed over a duration of up to six months starting in early 2021.



Legend
 Construction footprint

FIGURE 1-1
 1:15,000 Scale at A4
 0 100 200 300 400
 m

Regional setting
 NORTH SYDNEY



Map Produced by Carinno NSW/ACT Pty Ltd (WOL)
 Date: 2020-08-07 | Project: AIME200198
 Coordinate System: GD A 1994 MGA Zone 56
 Map: AIME200198_GS016_NSydney_RegionalSetting_REF.mxd 01
 Aerial imagery supplied by Nearmap (April, 2020)



Legend

 Existing wharf structure

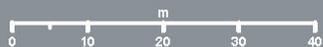
PARKING AREA

WAYFINDING SIGN FOR FERRY

WAITING SHELTER

FIGURE 1-2

1:1,000 Scale at A4

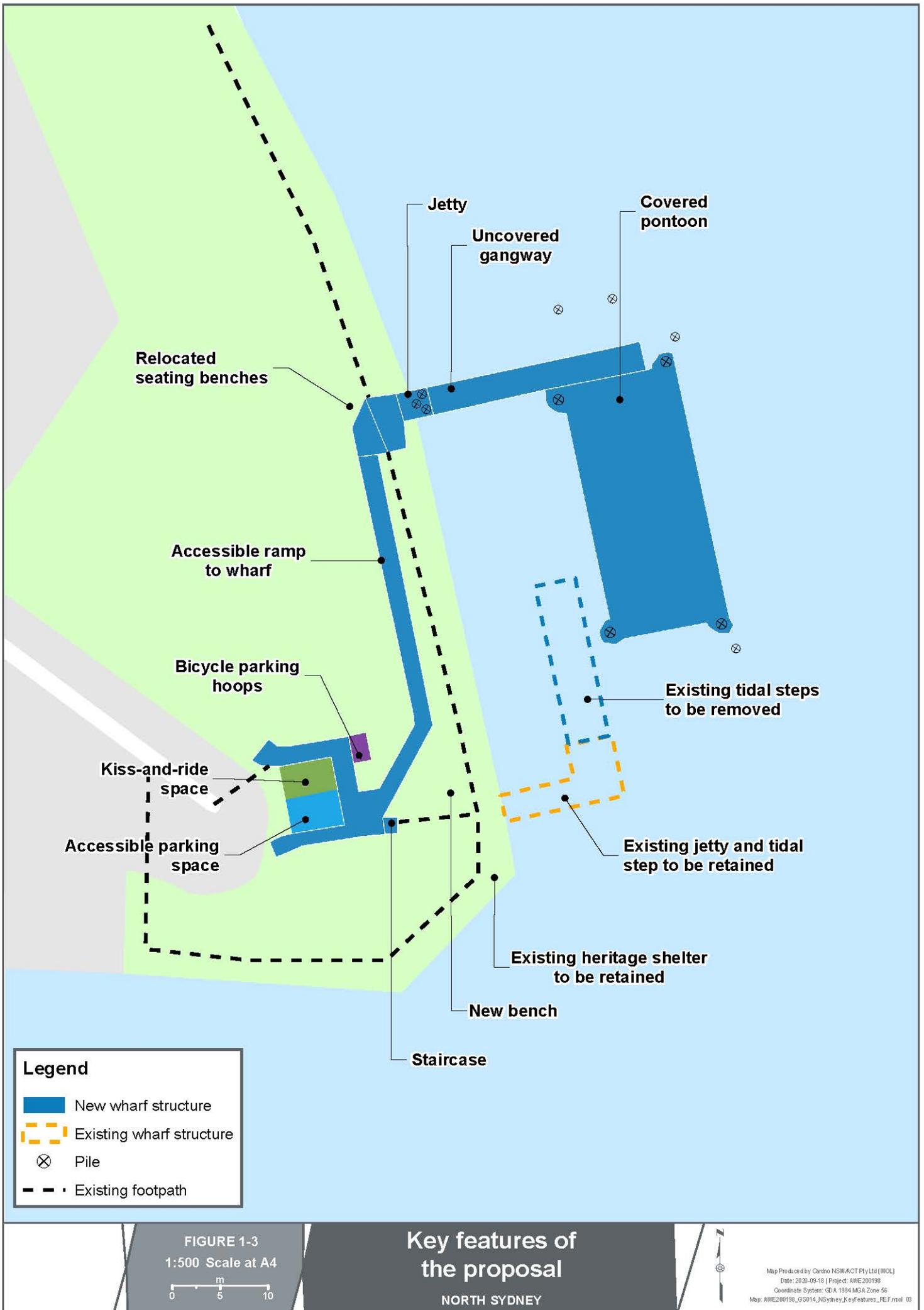


Local setting

NORTH SYDNEY



Map Produced by Cardno NSW /ACT Pty Ltd (W/CL)
 Date: 2020-06-07 | Project: AW E200196
 Coordinate System: GDA 1994 MGA Zone 56
 Map: AW E200196_G5017_NSydney_LocaSetting_REF.mxd 01
 Aerial Imagery supplied by Nearmap (April, 2020)



1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Cardno (NSW/ACT) Pty Ltd on behalf of Transport for NSW. For the purposes of these works, Transport for NSW is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail mitigation and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines) (DUAP, 1995/1996), and the *Marinas and Related Facilities EIS Guideline* (DUAP, 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act including that Transport for NSW examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in Section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The potential for the proposal to significantly impact any matter of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of Agriculture, Water and Environment (DAWE) for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

2 Need and options considered

2.1 Strategic need for the proposal

The Transport Access Program (TAP) is an ongoing 'initiative to deliver modern, safe and accessible transport infrastructure' in NSW (Transport for NSW, 2015). The focus of the program is improving access to the transport network for less mobile passengers. As a result, Roads and Maritime Services (Roads and Maritime, now Transport for NSW) assessed the condition of all ferry wharves across the transport network in 2009 in terms of:

- Safety and structural integrity
- Access for less mobile and disabled passengers
- Existing and predicted future patronage and use.

The *Disability Standards for Accessible Public Transport 2002* (DSAPT) and *Disability (Access to Premises – Buildings) Standards (2010)* (Disability Standards 2010) made under the *Disability Discrimination Act 1992* (DDA), require all public transport infrastructure, including wharves, to have fully compliant disability access by 2022.

It was concluded that the North Sydney wharf needed upgrading or relocating due to its lack of accessible pathway for passengers on and around the wharf.

The proposal was also developed to respond to the objectives of various Government policies as described below.

2.1.1 Transport Access Program (TAP)

The TAP aims to provide the following benefits:

- Improve the accessibility for passengers who use wheelchairs and prams by removing stairs and supplying ramps
- Build facilities for all transport modes to meet the needs of a growing population
- Provide an effective and seamless interchange that supports an integrated transport network
- Deliver safety and signage improvements to help with the customer user experience
- Provide other aesthetic improvements.

Ferry Wharf Upgrade Program

The Ferry Wharf Upgrade Program forms part of the TAP. Its objectives are to:

- Improve access for less mobile people
- Improve passenger amenity
- Improve passenger embarking/disembarking times
- Develop an iconic design across the commuting wharf network
- Cater for current and future passenger numbers
- Minimise customer and wharf operator impacts during any refurbishment and upgrade work
- Minimise ownership and maintenance costs

- Ensure the design complies with current safety laws
- Discourage inappropriate activities on public wharves
- Aim to comply with the DDA by 2022.

This proposal has been developed to respond to, and comply with, these objectives.

2.1.2 Sydney's Ferry Future

Published in 2013, the Sydney's Ferry Future plan acknowledges, and builds on, TAP and the ferry wharf upgrade program by outlining the short and long term initiatives for getting the most out of the "ferry network today while investing in the infrastructure and services to attract more passengers in the future" (Transport for NSW, 2013). The plan:

- Focuses on short term timetable, service and infrastructure improvements and the long-term expansion of the network
- Reinforces the need to upgrade wharf infrastructure and make it more accessible in line with TAP.

The proposal directly responds to this by analysing how improvements could be made to best achieve the objectives of this plan in relation to the wharf facilities at North Sydney.

2.1.3 Future Transport Strategy 2056

The Future Transport Strategy 2056 (Transport for NSW, 2018) is an update of the Long Term Transport Master Plan for NSW (Transport for NSW, 2012). It is a 40-year strategy, supported by plans for Greater Sydney and Regional NSW, which sets the vision, directions and outcomes for customer mobility. The Future Transport Strategy sets six state-wide outcomes to guide investment, policy and reform and service provision, which includes:

- A customer focus
- Successful places
- Growing the economy
- Safety and performance
- Accessible services
- Financial and environmental sustainability.

The upgrading and expanding the ferry wharf network, as part of the Ferry Wharf Upgrade Program, would support meeting the above objectives of this Strategy.

2.1.4 Supporting NSW Strategies and policies

The proposal is also supported under the policies, goals, objectives and targets of several other strategic planning documents as summarised in Table 2-1.

Table 2-1: Supporting NSW strategies and policies

Strategy / Policy	Description
State Infrastructure Strategy 2018-2038	The strategy identifies the NSW Government’s infrastructure vision for the state over the next 20 years, across all sectors. It is supported by the Future Transport Strategy 2056. As passenger numbers are expected to notably increase in the future, this proposal responds to the above by improving the wharf infrastructure and access provisions at North Sydney.
Disability Inclusion Action Plan 2018-2022	The <i>Disability Inclusion Action Plan 2018–2022</i> is Transport for NSW’s plan for delivering high quality services to all customers including those with disability, including compliance with the disability standards outlined below.
Disability Standards	The <i>Disability Standards for Accessible Public Transport (DSAPT, 2002)</i> and <i>Disability (Access to Premises – Buildings) Standards (2010)</i> form part of the DDA. Each prescribe the minimum accessibility standards for disabled access to public transport services and infrastructure, including a timetable for implementation. The proposal meets the above requirements within the timeframes specified in both standards by providing suitable access for people with a disability.
State Priorities: Making it Happen 2015	<p>The proposal would:</p> <ul style="list-style-type: none"> • Improve the existing transport infrastructure, consistent with the building infrastructure priority • Be built and would operate under environmental safeguards and management measures to avoid and minimise environmental impacts consistent with the keeping our environment clean priority.
A Plan for Growing Sydney	Focused on the concept of growth centres and transit corridors, the above Plan realises the need to strengthen transport connections into and out of central Sydney. A key action of the Plan is to deliver a vision for Sydney Harbour including enabling opportunities to improve ferry services. The proposal therefore responds to this action.
A Metropolis of Three Cities – The Greater Sydney Region Plan	<p><i>A Metropolis of Three Cities – The Greater Sydney Region Plan (DP&E, 2018)</i> is the NSW Government’s regional plan for Greater Sydney which provides key directions and actions to rebalance growth and deliver its benefits equally to residents across Greater Sydney. The plan coordinates with the <i>Future Transport Strategy 2056</i> and <i>State Infrastructure Strategy 2018-2038</i> to align land use, transport and infrastructure planning to establish Greater Sydney as three distinct but connected cities.</p> <p>The project would directly address the following directions outlined by the plan:</p> <ul style="list-style-type: none"> • Infrastructure use is optimised • Infrastructure aligns with forecast growth • Services and infrastructure meet communities’ changing needs

Strategy / Policy	Description
	<ul style="list-style-type: none"> Integrated land use and transport creates walkable and 30-minute cities. <p>The NSW Government has prepared five district plans that guide the implementation of <i>A Metropolis of Three Cities – The Greater Sydney Region Plan</i>. The district plans outline objectives and actions for the future development of the relevant district and are structured around the strategies for infrastructure and collaboration, liveability, productivity, sustainability and implementation. The North District Plan is the relevant district plan for North Sydney LGA.</p>
North District Plan	<p>The North District covers Hornsby, Hunter’s Hill, Ku-ring-gai, Lane Cove, Mosman, North Sydney, Northern Beaches, Ryde and Willoughby LGAs. The North District Plan 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. It contains the planning priorities and actions for implementing A Metropolis of Three Cities – The Greater Sydney Region Plan at a district level and is a bridge between regional and local planning. Planning priorities that are relevant to the upgrade include:</p> <ul style="list-style-type: none"> Priority N1: Planning for a city supported by infrastructure (particularly prioritising infrastructure investment to support the vision of A Metropolis of Three Cities) Priority N3: Providing services and social infrastructure to meet people’s changing needs (particularly in relation to accessibility, inclusion and safety). <p>The project would support these priorities by providing improved ferry facilities, with a design that provides efficient embarking and disembarking. One of the objectives of the project is also to provide DSAPT compliance - and includes accessible parking space and accessible ramp to the pontoon.</p>

2.1.5 North Sydney Community Strategic Plan 2018-2028

North Sydney falls under North Sydney Community Strategic Plan 2018-2028 which outlines the community’s main priorities and aspirations for the future. To achieve the vision of “shaping a progressive, vibrant and diverse North Sydney community” the plan focuses on five community directions, including those identified in Table 2-2.

Table 2-2: North Sydney Community Strategic Plan Strategic Directions

Strategic Direction	Desired Outcome
Our Living Environment	North Sydney is sustainable. The natural environment is able to sustain the effects of population growth, now and into the future.
Our Built Infrastructure	North Sydney has adequate infrastructure to support population growth. Our existing assets are well maintained and new assets are constructed to meet

Strategic Direction	Desired Outcome
	community needs. The community has pride in our assets.
Our Future Planning	North Sydney is a great place to do business. North Sydney enjoy strong economic growth, and balances it with environmental and social wellbeing.
Our Social Vitality	North Sydney's social wellbeing continues to improve. Residents enjoy a good quality of life and the fantastic lifestyle that North Sydney offers. Community members have access to the information and support services they need.
Our Civic Leadership	The community feels confident about the direction North Sydney is heading. North Sydney Council plans to do this by taking into account not just what the community needs now, but also what will be needed by generations to come.

2.2 Existing infrastructure

The existing infrastructure at North Sydney includes the wharf and land-based infrastructure. The existing North Sydney Wharf does not currently meet the DSAPT or DDA requirements, as it does not allow for equitable access to the wharf or boarding the ferry. The wharf currently enables Transdev to operate a ferry service for passengers between Circular Quay and Neutral Bay.

Table 2-3 summarises the existing wharf elements and descriptions of current infrastructure.

Table 2-3: Existing wharf infrastructure

Element	Description
Existing infrastructure	<p>Existing wharf, comprising:</p> <ul style="list-style-type: none"> • A concrete jetty about nine metres long by three metres wide • An unsheltered concrete wharf structure about 24 metres long and four metres wide including four tidal steps • Mooring piles (widespread surface rust and cracking). <p>Land based infrastructure, including:</p> <ul style="list-style-type: none"> • A covered waiting area with seating (eight seats), including main switchboard • Wayfinding signs • On street parking on High Street • Pole lighting along waterfront and at wharf entrance.
Operation	<ul style="list-style-type: none"> • North Sydney operates as part of the F5 Neutral Bay to Circular. Quay ferry route, travelling in a circular direction from Circular Quay to Kirribilli, North Sydney, Neutral Bay, Kurraba and back to Circular Quay. • Ferry services typically operate every 30 minutes during weekdays, and every hour on weekends and public holidays.

Element	Description
Ancillary Services	<ul style="list-style-type: none"> • On-street parking on High Street. • Bus stops located on Clark Road about 550 metres away (269 and 263 bus routes). • Milsons Point train station is located 1.1 kilometres away, North Sydney train station is located 1.2 kilometres away and are both on the T1 North Shore and Western Line. • Local access is provided through High Street with available (restricted) kerbside parking.
Land ownership	<p>Public owned land and assets owned by Transport for NSW:</p> <ul style="list-style-type: none"> • Wharf and jetty • Opal readers, and wayfinding signs. <p>Public owned land and assets owned by North Sydney Council:</p> <ul style="list-style-type: none"> • Covered waiting area • High Street, on-street parking • Kesterton Park, including pedestrian walkways • Lighting is owned by Ausgrid.

2.2.1 Patronage

North Sydney wharf has a dual function, providing access for local commuters and facilitating access for recreational users travelling during off-peak periods and weekends.

Based on patronage data collected in 2017 the North Sydney wharf had the lowest number of total passengers boarding and alighting compared with other TAP ferry wharves. The wharf is used by 11 passengers in the busiest peak hour and 38 passengers in the case of a special event from 2017 data.

Future patronage at North Sydney wharf in 2036 was forecast to be 17 passengers in the busiest peak hour and 58 passengers in the case of a special events. The patronage was based on population and employment forecasts for areas surrounding the wharf and an additional 15 per cent increase. The North Sydney wharf's patronage potential is constrained as a result of the following:

- The wharf has minimal connectivity to other transport modes
- The surrounding area is predominately residential and has steep topography.

The current redevelopment of Sub Base Platypus may attract further visitors to the area.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal are to:

- To ensure compliance with legislative, functional and operational requirements, in particular DSAPT and DDA standards that require all public transport infrastructure, including wharves, to have fully compliant disabled access by 2022
- To maximise equity of access for all customers
- To improve accessibility, passenger safety and comfort for future patronage
- To maximise the use of the ferry wharf Kit-of-Parts (standardised design elements) to provide continuity across Sydney Harbour wharves
- To accommodate forecast growth in patronage and changes to travel patterns
- To provide safe berthing and mooring of ferry vessels
- To minimise walking distances, conflict and crowding points and queuing
- To maximise the perception of security and safety
- To minimise cost of ownership and maintenance.

2.3.2 Development criteria

The design development criteria for the proposal include:

- Key architectural objectives:
 - Ensure compliance with functional and operational requirements
 - Balance core operations and customer needs
 - Design all elements for easy maintenance with an appropriate human scale.
 - Maintain elegant simplicity in architectural planning and detailing
 - Respond sensitively to current and likely future built environment around the wharf
 - Consider sustainable design features such as reusable materials and minimising the use of concrete
 - Use Kit-of-Parts elements where practical in designing the wharf
- Key engineering objectives:
 - Maximise equity of access for all customers
 - Minimise walking distances
 - Minimise pedestrian conflict points and crowding points
 - Maximise stability (and therefore safety) of the berthing arrangements by taking into consideration the wind, waves and swell that the wharf will experience in its proposed location.
 - Use Kit-of-Parts elements in designing the wharf
 - Minimise queuing at wharf facilities
 - Maximise the perception of security and safety

- Minimise cost of ownership and maintenance
- Accommodate potential for growth in patronage and changing travel patterns
- Consider sustainable design features such as reusable materials and minimising the use of concrete.

The proposal has also been developed against the following priorities (Ferry Wharf Upgrade Program: Business Requirements Specification, Transport Access Program, 2014):

- Pedestrian access
- Bicycle access and storage
- Bus access
- Taxi access
- Private car:
 - Kiss and ride (drop off and pick-up)
 - Park and ride, with accessibility priority.

2.3.3 Urban design objectives

Urban design objectives for the proposal include:

- Integrate the wharf within its local area, taking into consideration the nature of the site, local context and the surrounding biodiversity
- Integrate the wharf with its future urban context
- Create a high quality, secure and positive addition to the public domain.

2.4 Alternatives and options considered

This section describes the alternatives and options considered to deliver the proposal.

2.4.1 Methodology for selection of the preferred option

The method by which Transport for NSW developed options for replacing the wharf considered:

- Existing and future passenger use and service demand
- Engineering design requirements and current structural integrity
- Passenger safety
- Environmental and social constraints
- Build cost
- Stakeholder feedback.

2.4.2 Identified options

Three concept design options were considered for the North Sydney wharf interchange (refer Figure 2-1). These options were based on the strategic design, future needs analysis and the site-specific requirements.

The following options were presented to stakeholders:

- 'Do nothing' – no upgrade, regular maintenance would continue
- Option 1 – new pontoon, gangway and accessible ramp along southern seawall. Located at existing wharf site, includes removal of existing wharf
- Option 2 – new pontoon, gangway and switchback footpath through Kesterton Park. Located at existing wharf site, includes removal of existing wharf.



Figure 2-1: Identified options

2.4.3 Analysis of options

Do nothing

The option of ‘do nothing’ would be to limit the scope of work to carrying out activities consistent with those required to maintain operation of the existing wharf, including undertaking regular maintenance. The structure is currently in poor condition, and is not DDA compliant. Undertaking regular maintenance would not correct these issues, and the wharf is not currently suitable for long-term operation.

Although it would present the lowest initial capital cost and environmental impact, the ‘do nothing option’ was discounted as it would not meet the objectives of the proposal to improve accessibility, passenger safety and comfort for future patronage.

Option 1 and Option 2

Advantages and disadvantages of Options 1 and 2 are presented in Table 2-4.

Options 1 and 2 were presented to key stakeholders from Transport for NSW, Roads and Maritime and TransDev at a workshop on 12 December 2018 and their relative performance was assessed using a multi-criteria analysis process, which included consideration of:

- Accessibility
- Infrastructure
- Wharf interchange operation
- Wharf interchange maintenance
- Deliverability
- Customer experience
- Transport integration
- Urban design and precinct planning
- Environment, sustainability and heritage.

Table 2-4: Options analysis

Option	Advantages	Disadvantages
Option 1	<ul style="list-style-type: none"> • Avoids impacts to Kesterton Park • Good connectivity to kiss-and-ride and accessible parking space • The accessible ramp follows the alignment of an existing pathway • Scenic views from accessible ramp over the harbour 	<ul style="list-style-type: none"> • Wharf closed during construction • Loss of two existing parking spaces • The accessible ramp is not clearly visible from High Street, making wayfinding difficult • The accessible ramp provides a less direct route to the wharf than the steps • The accessible ramp is more complex to design and construct • Accessible ramp results in more handrails to be maintained by Council • The accessible ramp would be a substantial concrete structure

Option	Advantages	Disadvantages
		<p>that requires piles to provide support independent of the sea wall</p> <ul style="list-style-type: none"> • May require removal of a small tree
Option 2	<ul style="list-style-type: none"> • The switchback footpath has a very gentle gradient – retaining wall unlikely to be required, there are several landscaping opportunities • Good connectivity to kiss-and-ride and accessible parking space • The switchback footpath is clearly visible from High Street, making wayfinding easy • The gentle gradient of the switchback means it would be a simple structure, a handrail is not required • Construction of the switchback footpath has few risks 	<ul style="list-style-type: none"> • Wharf closed during construction • Loss of two existing parking spaces • The switchback footpath impacts Kesterton Park, reducing the grassed area • The switchback footpath provides a less direct route to the wharf than the steps (which would be upgraded)

Preferred option

Option 2 was identified as the preferred option as it was considered more equitable, met the objectives of the proposal and provided value for money. Option 2 limited construction risk compared to Option 1 while also reducing the need for maintenance. Option 2 provided a clearly visible route to the wharf and good connectivity to parking. Although the preferred design resulted in impacts to Kesterton Park, landscaping opportunities were available to improve the urban design. Option 2 was developed as the Concept Design.

2.5 Design refinements

2.5.1 Refinements of Option 2

While Option 2 was the preferred option following the initial stakeholder engagement, stakeholders and the Council recommended further design refinements, particularly to reduce impact to Kesterton Park and the landscaped mound at the end of High Street.

Stakeholder comments on the preferred option included:

- The design did not provide equitable distance for accessible and non-accessible pathways
- The design should relocate kiss-and-ride car space to a location where there is a concrete footpath to the wharf so that both the kiss-and-ride car space and the accessibility car space would be accessibility compliant
- The switchback footpath/ramp should be reduced in length

- Design should integrate with the existing infrastructure around Kesterton Park which is to remain once the existing wharf is decommissioned.

The concept design of the preferred option was refined to address these comments. The refined concept design was presented to North Sydney Council, who were supportive of the design.

The refined concept design was again presented to the key stakeholders (Transport for NSW, Roads and Maritime and TransDev) at a second workshop on 6 March 2019. Stakeholder comments on the refined concept design included:

- To review the retaining walls and terraced landscaping, with consideration of a mounded landscape instead
- Whether there is sufficient space at the wharf entry to avoid conflicting movements between users of the foreshore footpath and customers tapping on and off at the Opal readers
- Piles for the gangway abutment should be located in the water rather than on the seawall
- Due to level change on land and along the accessible ramp, further consideration of hand rails was required
- Relocating the bicycle hoops to make better use of space and reduce the impact on the park
- Consideration should be given to retaining the existing old wharf for recreational fishing use.

In response to stakeholder comments, the concept design was further refined as follows:

- Retention of the existing wharf for potential recreational fishing use
- Construction of a jetty so that the gangway would not be attached to the seawall
- Relocation or replanting of existing trees and seating benches in Kesterton Park.

Further refinements were made to the design to increase the clearance in the navigational channel. These refinements resulted in the following changes:

- Relocation of the pontoon to the southern side of the gangway
- Removal of three of the four tidal steps of the existing wharf.

The final concept design is provided in Figure 2-2.

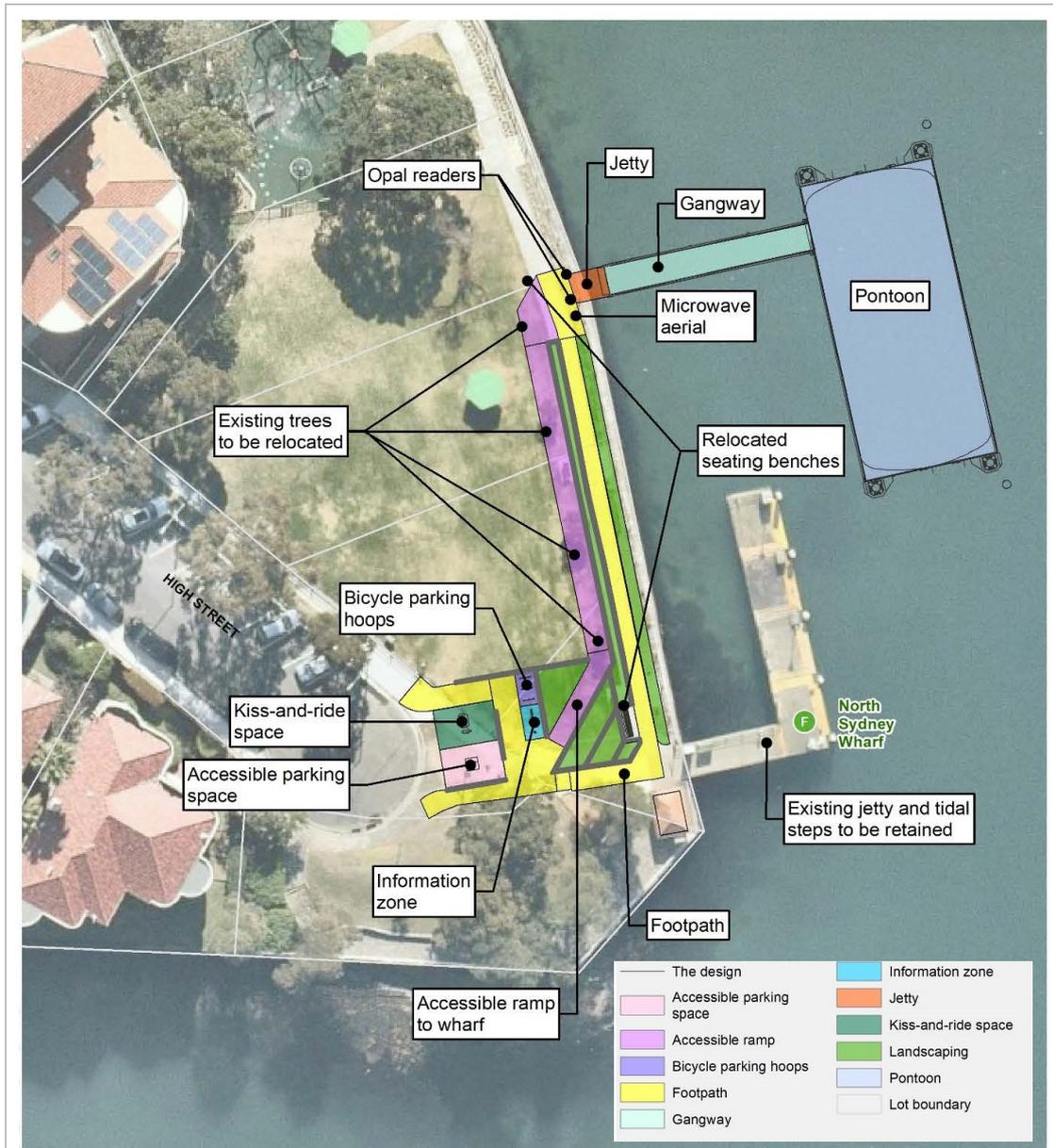


Figure 2-2: Concept design (Source: Aurecon, 2019a)

2.5.2 Refinements to concept design

Following the concept design two changes to the waterside configuration were proposed to increase the width of the navigational channel from 32 metres to 37 metres. The changes to the concept design were:

- The gangway would attach to the short back side of the pontoon
- Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf.

The final design is described in detail in Chapter 3.

3 Description of the proposal

This chapter describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

3.1 The proposal

The proposal is to upgrade the North Sydney Wharf as part of the TAP.

The water based features of the proposal would include:

- Installation of a new 3.3-metre long by 3.3-metre wide concrete jetty, supported by three new piles, including minor modifications to the top of the seawall
- Installation of a new 12-metre by 27-metre pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with pivot piles (to assist vessel berthing) provided at either end of the pontoon
- Installation of a new 18-metre uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- Installation of two protection piles on the northern side of the gangway
- Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- Safety and security features on the pontoon including an emergency help point, lighting, closed circuit television (CCTV), ladders to the water and a life buoy and tactile indicators where required.

The land based features of the proposal would include:

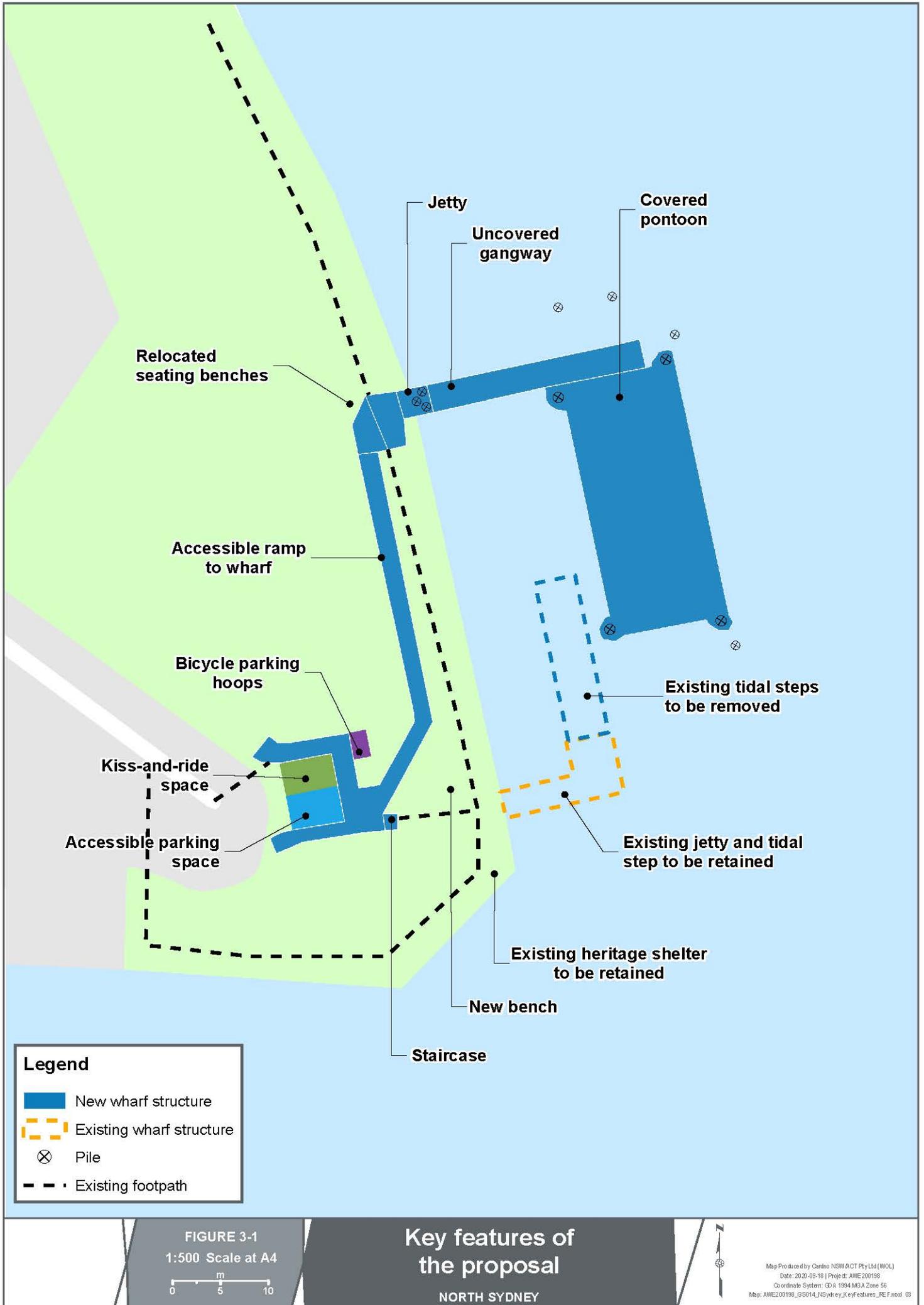
- One accessible parking space at the cul-de-sac end of High Street
- One kiss-and-ride space or zone at the cul-de-sac end of High Street
- Three new bicycle parking hoops
- Footpath regrading to produce a *Disability Standards for Accessible Public Transport 2002* (DSAPT) compliant grade
- Installation of a new accessible ramp between the existing footpath and the new gangway
- One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- Installation of new wayfinding signage, information boards, and opal card readers
- Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter
- Removal and replacement of up to four trees to construct the accessible pathway.

Figure 3-1 shows the key features of the proposal including the water-based and land-based features.

For the purposes of the REF the proposal footprint, construction footprint and compound area have been defined as follows (refer Figure 3-2):

- Proposal footprint –The area directly impacted by proposed works, including the installation and removal of structures
- Construction footprint – Area around the proposal footprint required for construction including the compound area
- Compound area - Temporary facility required for construction, including for example an office and amenities compound, construction compound and materials storage compound.

Study areas for specialist disciplines are defined in Chapter 6.





3.2 Design

3.2.1 Design criteria

The proposal has been designed to NSW and Australian engineering and safety standards, including:

- Roads and Maritime: *Guidelines for the Assessment of Public Ferry Wharf Safety 2016*
- DSAPT and amendments
- *Disability Discrimination Act 1992 (DDA)*
- *National Construction Code (NCC) 2016 Volumes 1, 2 and 3* (Formerly Building Code of Australia- BCA)
- Australian Maritime Safety Authority (ASMA): navigation and safety
- Standards Australia: *AS4997: 2005 Guidelines for the Design of Maritime Structures*.

These standards provide guidance on:

- Overall height of the wharf above the water to allow for operation during extreme low and high tide, whilst also considering climate change impacts
- Maintaining vessel navigational channel
- Access and safety requirements
- Operation and stability during extreme storms, accounting for wind, wave and current conditions
- Sufficient water depths at extreme low tide to allow ferries to safely berth without the risk of either grounding or causing notable sediment disturbance and scour from propeller wash
- Appropriate materials selection and durability to support the operational design life of the wharf for a minimum of 50 years
- Additional safety and security measures consistent with the provisions of Crime Prevention through Environmental Design (DP&E, 2001).

Overall, the wharf has been designed:

- With a 50-year design life, where achievable and on structural elements
- To cater for low mobility passengers and expected passenger growth in the future
- To operate in different tidal conditions over its design life and take into account climate change and possible sea level rise
- To be regarded as an attractive, safe and secure piece of public transport infrastructure.

Figure 3-3, Figure 3-4 and Figure 3-5 show views of the proposal from various angles.



Figure 3-3: View of proposal from landside perspective (Kesterton Park)



Figure 3-4: View of proposal from landside perspective (High Street cul-de-sac)



Figure 3-5: View of proposal from waterside perspective

3.2.2 Engineering and development constraints

Table 3-1 lists the main constraints to development and describes how they have been addressed in the concept design.

Table 3-1: Engineering and development constraints

Constraint	Concept design provision
Local heritage items: Kesterton Park and the adjacent bus shelter	Various design options were considered. Impact to the adjacent bus shelter would be avoided, impacts to Kesterton Park would be minimised
Wind, wave, current and climate change	The design allows the wharf to be used in all tidal 'states' (i.e. Highest Astronomical Tide (HAT) and Lowest Astronomical Tide (LAT), with an additional allowance and climate change adaptation and sea level rise)
Disabled access	The new wharf and landside infrastructure upgrades are required to be accessible to people with a disability to meet the standards of the DDA, DSAPT and current legislative standards for disabled access
Narrow navigational channel and rock shelf at the North Sydney Wharf	Orientation and location of new waterside elements have considered the constraints of the navigational channel and rock shelf.

3.2.3 Major design features

This section describes the proposals main design features.

Major water based features

Jetty

The new jetty would consist of a concrete deck entirely supported by concrete headstock(s) on three steel piles. The jetty would be about 3.3 metres wide and 3.3 metres long. The deck level would be +1.975 metres AHD to account for future sea level rise. The jetty would provide support to the gangway, and extend over the seawall. Minor cut back to the top of the seawall would be required to allow the top of the jetty to be level with the existing path.

Gangway

The aluminium gangway (about 18 metres long and 2.5 metres wide) would connect the jetty and the floating pontoon. A transition plate would be installed over the join between the landside connection and the gangway. The gradient of the gangway would vary according to the tides. The gangway gradient would vary according to the tides to be almost horizontal at high tide, and to be a maximum of 1-in-14 for 80 per cent of the tide levels to comply with DSAPT requirements.

Two steel protection piles would be installed to the north of the gangway.

Pontoon

The pontoon is a rectangular shaped steel floating structure 27 metres long and 12 metres wide. The pontoon would be used as both ferry embarking and waiting area and would be held in place by four steel piles. The pontoon comprises several cells

which would be ballasted to provide a freeboard of about one metre to match the ferry still level. The pontoon cells are independent of one another to ensure redundancy within the structure, such that if one cell is punctured or damaged, the pontoon is not compromised for stability.

The pontoon would be located on the southern side of the new gangway, about 14 metres from the seawall. Three of the tidal steps from the existing wharf would be demolished to provide sufficient space for the new pontoon structure.

The berthing position on the new pontoon is in deeper water (from -5 metres to -7.5 metres depth at LAT) than the existing wharf, which would reduce the risk of seabed disturbance and turbidity from ferry wash during low tides.

Pontoon mounted bollards are provided for ferry mooring lines. The berthing and mooring loads are ultimately resisted by the four pontoon guide piles, which also act to restrain the pontoon.

The pontoon would comprise glass screens and a curved roof structure, supported by steel columns fixed to the pontoon deck, to provide weather protection for the waiting area. The pontoon would be fitted with steel handrails.

A services pod would contain waste bins, customer information, life buoy, data/electrical cabinet.

Major land based features

Pedestrian access

The footpath along the cul-de-sac end of High Street leading to the wharf is at a wheelchair accessible grade (1:40), although further north along High Street, the grade becomes relatively steep. The concept design includes an accessible walkway and ramp from the accessible parking space to the gangway, which also provides access to High Street. This new walkway would tie-in to the existing foreshore footpath at the same grade.

Cyclist facilities

The concept design includes three new bicycle parking hoops at the southern edge of Kesterton Park, near the accessible walkway and ramp and accessible parking space and kiss-and-ride space. This location was chosen to cluster all parking in the one location and to discourage cycling on the footpath and accessible ramp.

Parking

The concept design includes provision for one accessible kiss-and-ride space on the east side of the High Street cul-de-sac.

The concept design includes one accessible parking space at the cul-de-sac end of High Street (adjacent to the proposed kiss-and-ride space) leading to an accessible ramp that connects to the wharf.

Supporting infrastructure

While the specifics of the supporting infrastructure, lighting, signage, and furniture would be confirmed during the detailed design, they would be consistent with the provisions included on the other wharves on the network. It would therefore include:

- Opal fixed location readers (tap on/off machines) to be relocated at the entrance to the wharf
- Safety and security lighting in the waiting shelter and on the pontoon wharf

- Passenger information boards, notices, and (electronic and display board) timetables
- Safety ladders around the walkway and wharf pontoon
- Strung cabling and ducting to provide power and communications
- Closed circuit television (CCTV)
- Passenger facilities
- Tactile flooring
- New signage to assist with information and navigation (wayfinding).

The above would be developed in accordance with Transport for NSW design specifications.

3.3 Construction activities

The appointed contractor would confirm the final construction activities in discussion with Transport for NSW. As such, this section only indicates a likely method and work plan as it may vary due to the identification of additional constraints before work starts, detailed design refinements, community and stakeholder consultation feedback, and contractor requirements/limitations. Should the work method differ from what is proposed in this REF, the contractor would consult Transport for NSW to determine if additional assessment is needed. Some additional land would be needed temporarily to support construction, as described in Section 3.4.

3.3.1 Work methodology

The proposal would be built under Transport for NSW specifications as managed by a contractor under a construction environmental management plan (CEMP). These specifications cover environmental performance and management supplemented by aspects such as materials storage and management, and erosion and sediment control.

The delineation between water side and land side construction works is fairly clear given the good access to land side works from High Street and Kesterton Park. The land side and water side works could be procured separately or as a single contract package with minimal interface issues.

The proposal would likely comprise a sequence of work activities similar to that summarised in Table 3-2.

Table 3-2: Construction activities

Activity	Associated work
Site establishment	<ul style="list-style-type: none"> • Land-side works <ul style="list-style-type: none"> ○ Establishment of a temporary site compound (erect site offices, amenities and plant/material storage areas etc.) on the land. The site compound would be located in Kesterton Park ○ Site entry and exit points, and haul roads would be established for the construction work site ○ Traffic control measures (including for vehicles, watercraft, pedestrians and cyclists) would be established in accordance with the traffic management plan. Appropriate

Activity	Associated work
	<p>wayfinding signage would be installed advising of alternative transport options where necessary</p> <ul style="list-style-type: none"> ○ Environmental controls would be established in accordance with the CEMP. <ul style="list-style-type: none"> • Water-side works <ul style="list-style-type: none"> ○ Establishment of a construction work area using floating booms to delineate this area. This would make allowance for the outward reach of the construction barge's four anchorage points, over which marine vessels may not cross for safety reasons. The anticipated size of the barges is up to about 20 metres by 30 metres ○ Environmental controls would be established in accordance with the construction environmental management plan.
Construction of land side works	<ul style="list-style-type: none"> • Land side works would involve the installation of retaining walls, ramps, earthworks, a new accessible parking space, kiss-and-ride space, footpaths and landscaping • Clear and grub the site and demolish existing pavements • Install new storm water system including new drainage along the western side of the new accessible walkway and replacement of the existing kerb and gutter at the High Street cul-de-sac with new dish drain • Construct new jetty (about 3.3 metres by 3.3 metres) including minor modifications to the top of the seawall • Construct a new retaining wall along the eastern side of the new accessible ramp. The grassed area of Kesterton Park on the western side of the retaining wall and accessible ramp would be regraded to suit the new ramp and sub-soil drainage. There would be a height difference between the accessible ramp and the existing footpath. The retaining wall would be approximately 0.25 metre wide and would vary in height between 0.45 and 1.47 metres. The retaining wall materials would be consistent with the existing urban design and landscape character (e.g. local stone) • Retaining walls would also be constructed along the northern side of the bicycle hoop and kiss and ride space, and along the southern side of accessible parking space • Build up earthworks levels and construct new ramps • Construct new parking area • Construct new pavement and kerbs • Finishing works (architectural, landscaping, street furniture, etc.).
Demolition and removal of existing wharf structure	<ul style="list-style-type: none"> • The existing wharf would be closed when safe navigable access to the wharf cannot be maintained • Three of the four tidal steps would be demolished • The six piles and three fender piles associated with the three tidal steps would be removed. Removal would be via vibration while pulling with a crane barge. If piles cannot be removed using this methodology, then a water blaster would be used to clear to rock to allow the piles to be then to be cut and capped.

Activity	Associated work
Installation of steel piles within the waterway	<ul style="list-style-type: none"> • Steel locator piles for the pontoon, foundation piles for the jetty, and protection piles would be installed into bedrock. These piles would be transported by barge to the site from the off-site facility • The installation of the piles for the jetty would likely be undertaken by a barge mounted piling rig. The piles would be installed near to the wall but without impacting the existing seawall. The jetty would be an independent structure to the seawall. • Guide piles required for the pontoon would be installed via a barge mounted piling rig • Typically pile foundation systems would be piled into bedrock as follows: <ul style="list-style-type: none"> ○ Teeth welded to the bottom of the piles ○ Positioning steel pile with crane mounted driving unit ○ Driving the steel pile casings into position ○ Cutting the steel pile casings to length and backfilling with concrete.
Installation of the pontoon and gangway	<ul style="list-style-type: none"> • The existing wharf would be closed when navigable access to the wharf cannot be maintained • Lifting and placement of components for the new wharf would be carried out using a barge-mounted crane • The new pontoon structure would be constructed at an off-site facility and floated to site. The pontoon would be secured to the locator piles and packing plates used to trim the plan position • The new gangway would be fabricated at an off-site facility and floated to site by barge. The gangway would be lifted into position by the crane • Finishing works completed (architectural, services, handrails, etc.).
Installation of new or improved facilities	<ul style="list-style-type: none"> • Provision for new Opal readers • Installation of new microwave aerial and removal of the existing aerial • Installation of bicycle parking hoops adjacent to the wharf • Installation of wayfinding signage • Landscaping of the construction areas.
Site clean up	<ul style="list-style-type: none"> • The site would be cleaned up and restored to its previous state • Sedimentation controls and temporary structures would be removed.

3.3.2 Construction hours and duration

This section describes the time it would take to build the proposal and the working hours.

Start date and length of construction

The proposal would be built over a duration of up to six months starting in early 2021. Construction may not be continuous as it would rely on materials delivery and the manufacture of the prefabricated components. The construction program would be affected by the need to coordinate with Council, residents, and other key stakeholders (refer to Chapter 5).

Working hours

The work would take place within and outside of standard working hours. Standard working hours are as follows:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm.

For safety reasons the piling, lifting and concrete work in the harbour may need to take place at night or early in the morning when the water is calm and still and the harbour is least busy. Piling is estimated to occur intermittently over an eight week period and outside standard working hours. During piling activities, a work schedule similar to the following may be adopted:

- Drilling of piles (preferred method):
 - Setup: 11pm to 12am (approximately)
 - Drilling: 12am to 6am (approximately)
 - Pack up: generally, 6am to 7am (approximately)
- Hammering of piles (alternative method):
 - Setup: 4am to 5am (approximately)
 - Hammering: 5am to 7am (approximately).

Pile drilling or hammering, and lifting would take place intermittently during the above periods. On average, a pile would be drilled or hammered for about 10 minutes followed by a relatively quiet period for the next 30 minutes or more before the next stage is progressed.

Due to the requirement for calm water conditions, the new pontoon and gangway would be lifted into position by a barge-mounted crane over a two to three day period between approximately between 11pm and 7am.

3.3.3 Workforce

While about 25 people would be needed to carry out the main construction activities it is expected that there would be about 10-15 people onsite at any time on average.

3.3.4 Plant and equipment

The plant and equipment needed to build the proposal would be typical of any construction site. It would vary depending on the construction activity. The largest and most complex equipment needed would be to lift and install the prefabricated units and

undertake the piling work. Table 3-3 indicates the plant and equipment that would be likely used to build the proposal, however this would be confirmed by the contractor.

Table 3-3: Indicative plant and equipment

Activity	Equipment
Water based construction	<ul style="list-style-type: none"> • Barge mounted crane • Barge mounted piling rig • Excavator • Concrete truck • Concrete pump • Floating boom • Hand tools • Generator • Oxey Acet Cutting • Workboat • Daymaker • Pneumatic drill/hammer • Rock breaker (mounted) • Tug boat
Land based construction	<ul style="list-style-type: none"> • Excavator • Chainsaw • Trucks • Jack hammer • Pavement profiler • Generator • Vibratory roller • Franna crane • Hand tools • Bobcat • Elevated Work Platform

3.3.5 Earthworks

There would be limited earthworks associated with the proposal. A small amount of riverbed sediment would be disturbed during the piling work, and demolition of the existing wharf; however, no sediment would be removed. Earthworks during construction of the land based elements would include demolition of existing pavements and build up earthworks for the construction of the new ramps. Construction of the new parking area, pavement and kerbs may also involve limited earthworks. Earthworks are expected to be minimal.

Any materials collected would be tested and waste classified. Where possible, the materials would be reused under an exception, unless they classify as a non-exempt waste, in which case they would be shipped (barged) offsite for collection and disposal at a licenced waste management facility.

3.3.6 Source and quantity of materials

Various standard construction materials that are readily available across the Sydney Metropolitan region would be needed to build the proposal. They would be either transported or shipped (barged) to site as prefabricated units ready for installation, or delivered in small quantities for use as needed. The main materials needed to build the proposal would comprise:

- Marine-grade steel, aluminium and zinc for the superstructure (floating pontoon and wharf, barriers and roof), substructure (piles) and land side work (stairs)
- Precast concrete
- Prefabricated signage, light fittings, barriers and fencing
- Prefabricated glazing units
- Electrical cabling and other electronic infrastructure

- Additional materials such as relatively small quantities of paint, oils, fuels and other materials.

Materials would be sourced from overseas and local commercial suppliers, using local suppliers wherever feasible and cost effective.

3.3.7 Traffic management and access

Maritime and road traffic management would be required while certain elements of the proposal are being built and installed. This may involve:

- Creation of a maritime navigation exclusion zone around the proposal footprint for the water-side construction works to prevent both commercial and recreational traffic entering the area
- Pedestrian and cyclist access around the wharf and park during construction
- Temporary traffic lights or stop-go provisions on High Street if major deliveries take place by road
- There would be a large number of heavy vehicles accessing site via High Street during earthworks, retaining wall and ramp construction
- Closure of the wharf, with no ferry services running from North Sydney wharf. Bus and train services would be used by commuters. No additional bus and train services would be required during the construction period to accommodate the increase in passengers
- Changes to the F5 Neutral Bay route to avoid the construction site
- Potential temporary partial closure of the High Street cul-de-sac in accordance with a site-specific Traffic Management Plan
- Potential loss of some parking spaces on High Street during construction
- Limited access for pedestrians and cyclists to some parts of Kesterton Park
- Pedestrian and cyclist access to the foreshore around Kesterton Park could be restricted.

Up to five heavy vehicles would be used for construction and a maximum of ten light and heavy vehicles would be used for deliveries to site.

No private property access would be impacted during construction.

Where feasible, materials and equipment for water based elements of the proposal would be shipped (barged) into and out of the area to limit any impact on High Street and surrounds. This would provide the best method to build the marine components. It may also be the best method to deliver materials to the land based areas providing there is adequate access for loading and unloading, however it is anticipated that most materials and equipment required for land based elements of the proposal would be delivered by road. The amount of materials shipped to site, over being delivered by road, would be confirmed during detailed design.

3.4 Ancillary facilities

Given the limited space and road access, the preference would be to ship any major machinery, equipment and prefabricated units to site, potentially making use of an offshore storage barge. However, it is also likely that a small site compound (to be confirmed by the contractor) would be needed within the proposal footprint to store

equipment, machinery and some limited materials. The preferred location for the proposed site compound is shown in Figure 3-2. While the specific requirements for this site would be confirmed by the contractor, it would most likely comprise a shipping container with a supporting site office and toilet.

The marshalling and storage of most waterside construction equipment, plant and materials, and the pre-fabrication of parts, pre-casting of headstocks and fit outs for the wharf, would be carried out by a contractor at an approved off-site facility. The operation of this off-site facility does not form part of this proposal but would have the necessary approvals in place for such activities to be undertaken.

3.5 Public utility adjustment

A preliminary assessment of existing utilities near the wharf was undertaken through a Dial Before You Dig (DBYD) search in February 2019 (Aurecon, 2019a). Some impacts to existing electricity infrastructure may occur. Potential impacts are identified in Table 3-4.

The closest water mains connection at North Sydney wharf is located about 40 metres away from the wharf entrance (based on DBYD information). A new water connection at the new jetty is proposed to be extended from existing water main infrastructure. This new connection will be developed during detailed design.

Table 3-4: Public utility adjustments

Area of work	Affected services	Mitigation	Likelihood of impact
New accessible parking space and kiss-and-ride space	Existing low voltage (LV) street Light Pillar on High Street (SL Pillar 3.0)	Relocation	High
	Existing LV cable mains	Relocation	High
New access path to wharf	LV cable mains	Protection or relocation	High

3.6 Property acquisition

No property would be acquired under the proposal. The additional land needed to support construction would be either leased from, or used under agreement with North Sydney Council.

4 Statutory planning framework

This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 68(4A) of ISEPP permits development on any land for the purposes of associated public transport facilities for a public ferry wharf to be carried out on any land may be carried out by or on behalf of a public authority without consent. However, such development may only be carried out on land reserved under the *National Parks and Wildlife Act 1974* if the development is authorised by or under that Act.

As the proposal is for the purposes of associated public transport facilities for a public ferry wharf and is to be carried out by Transport for NSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required. The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974*.

The proposal does not trigger an approval or development consent under *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP) or *State Environmental Planning Policy (State Significant Precincts) 2005*.

State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) identifies development that is State significant infrastructure and critical State significant infrastructure.

Clause 14(1) of the SRD SEPP declares development to be State significant infrastructure if the development is, by the operation of a State environmental planning policy, permissible without development consent and the development is specified in schedule 3 of the SRD SEPP.

Schedule 3 specifies that development for the purpose of port and wharf facilities or boating facilities (not including marinas) by or on behalf of a public authority that has a capital investment value of more than \$30 million is State significant infrastructure.

The proposal has a capital investment value of less than \$30 million so does not become State significant infrastructure as declared by the SRD SEPP.

State Environmental Planning Policy (Coastal Management) 2018

The Coastal Management SEPP aims to update and consolidate into one integrated policy, a series of previous SEPPs including *State Environmental Planning Policy 14 (Coastal Wetlands)*, *State Environmental Planning Policy 26 (Littoral Rainforests)* and *State Environmental Planning Policy 71 (Coastal Protection)*. The Coastal Management SEPP gives effect to the objectives of the new *Coastal Management Act*

2016 from a land use planning perspective, specifying how development proposals are to be assessed if they fall within the coastal zone.

The proposal does not fall within land identified as coastal wetlands under clause 10 of the Coastal Management SEPP. As such, the provisions of the Coastal Management SEPP have not been considered further.

State Environmental Planning Policy (Sydney Harbour Catchment) 2005

The proposal is located within the Sydney Harbour Catchment and is subject to the *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005* (Sydney Harbour SREP), which is a deemed SEPP. The aims of the Sydney Harbour SREP from clause 2 are considered in Table 4-1.

Table 4-1: Aims of the Sydney Harbour SREP

Aim	Comment
<p>(a) To ensure that the catchment, foreshores, waterways and islands of Sydney Harbour are recognised, protected, enhanced and maintained:</p> <p>(i) as an outstanding natural asset</p> <p>(ii) as a public asset of national and heritage significance, for existing and future generations.</p>	<p>Chapter 7 of this REF includes safeguards and management measures to protect and maintain the area's natural and heritage values, including those associated with the existing wharf and associated structures (refer to section 6.6). This would ensure the values of Sydney Harbour are recognised, protected, enhanced and maintained.</p>
<p>(b) To ensure a healthy, sustainable environment on land and water.</p>	<p>Providing relevant standard controls are implemented and monitored, as set out in Transport for NSW guidelines (refer to Chapter 7), the proposal's environmental impact is expected to be minimised.</p>
<p>(c) To achieve a high quality and ecologically sustainable urban environment.</p>	<p>The proposal's urban design includes high quality, durable and low impact materials to minimise ongoing maintenance requirements.</p> <p>The design also provides thematic consistency across the entire network (refer to Chapter 3). Both factors provide for a sustainable urban environment over its 50-year design life.</p>
<p>(d) To ensure a prosperous working harbour and an effective transport corridor.</p>	<p>With a 50-year design life, the proposal would allow for the operation of a ferry wharf at North Sydney for future generations. The work also forms part of a network-wide upgrade program to help sustain the ferry service in its role as part of an effective and integrated transport corridor and system.</p> <p>The existing wharf would be closed during the construction of the proposal. Existing nearby bus and train transport would be available. Land transport is discussed further in section 6.8.</p> <p>Passengers would be notified ahead of time as detailed in Chapter 5.</p>

Aim	Comment
(e) To encourage a culturally rich and vibrant place for people.	The proposal would continue to provide North Sydney residents with access to the ferry network and interchange with other public transport provisions. This would sustain North Sydney as a vibrant place to live.
(f) To ensure accessibility to and along Sydney Harbour and its foreshores.	<p>The upgrade would ensure that North Sydney residents and other users are provided with ongoing access to Sydney Harbour and its foreshore areas over the next 50 years. It would also improve access for low mobility passengers.</p> <p>The existing wharf would be closed during the construction of the proposal. Passengers would be notified ahead of time about the works as detailed in Chapter 5.</p>
(g) To ensure the protection, maintenance and rehabilitation of watercourses, wetlands, riparian lands, remnant vegetation and ecological connectivity.	The proposal would not have a significant impact on notable terrestrial or marine environments or values in the area. Additional standard controls would be implemented to prevent any indirect impact on the wider ecological environment from spills and sediment disturbance, mobilisation and smothering.
(h) To provide a consolidated, simplified and updated legislative framework for future planning.	The proposal is being delivered under the relevant planning provisions covering waterfront and marine development set at a State and Commonwealth level.

The proposal has been considered in respect of the objectives from clause 17 of the SREP Sydney Harbour zones W1 Maritime Waters in Table 4-2.

Table 4-2: Zone W1 Maritime Waters objectives

Objective	Comment
(a) To give preference to and protect waters required for the effective and efficient movement of commercial shipping, public water transport and maritime industrial operations generally.	<p>Navigational exclusion zones would be installed while the work is taking place.</p> <p>No commercial shipping activity, or maritime industrial operations occur near the North Sydney wharf, and no impact is anticipated. Water transport is discussed further in section 6.8.</p> <p>The Port Authority of NSW as the Harbour Master would be consulted prior to and during the works. Where required, nautical charts would be updated once the wharf is upgraded.</p> <p>Operation of the proposal would allow for more effective and efficient public water transport for its 50-year design life.</p>

Objective	Comment
(b) To allow development only where it is demonstrated that it is compatible with, and will not adversely affect the effective and efficient movement of, commercial shipping, public water transport and maritime industry operations.	<p>Navigational exclusion zones would be installed while the work is taking place.</p> <p>The existing wharf would be closed during the construction of the proposal. Public transport ferries would be unable to access the wharf.</p> <p>The Port Authority of NSW as the Harbour Master would be consulted during the works.</p>
(c) To promote the equitable use of the waterway, including use by passive recreation craft.	<p>Minor disruption would be caused during construction, which would be communicated to water users before starting work.</p> <p>The proposal would involve the construction of a new wharf at North Sydney, retaining part of the existing wharf for public recreation use. The new wharf would allow for more effective and efficient public water transport for its 50-year design life.</p>

Under clause 18 of the Sydney Harbour SREP, the proposal is permissible as a public water transport facility with consent in the W1 zone. In any case, the development is permissible without development consent pursuant to the provisions of ISEPP which override the zoning provisions of the Sydney Harbour SREP (see clause 7(5) of the Sydney Harbour SREP).

The matters for consideration listed in Division 2 at clauses 21-27 of the Sydney Harbour SREP are provided in Table 4-3.

Table 4-3: Division 2 matters

Division 2 matter	Comment
Clause 21 Biodiversity, ecology and environment protection	Chapter 6 describes the terrestrial and marine environmental impacts associated with the proposal. With the implementation of the environmental management measures, impacts would be minimised and/or managed.
Clause 22 Public access to, and use of, foreshores and waterways	<p>The wharf would be closed during the construction period.</p> <p>Access to the foreshore would be impeded during construction works including the foreshore footpath. The local community, park users and ferry passengers would be notified ahead of the commencement of work.</p>
Clause 23 Maintenance of a working harbour	The upgrade would ensure that North Sydney residents and other users would be provided with access to a ferry service (and public transport) over the next 50 years.
Clause 24 Interrelationship of waterway and foreshore uses	The upgrade would allow the social and cultural association of there being a wharf in this location to

Division 2 matter	Comment
	be retained, including the relationship it provides for people between the harbour and foreshore.
Clause 25 Foreshores and waterways scenic quality	<p>Upgrading the wharf in a similar location as the existing wharf would limit the visual impact of introducing infrastructure in a new location, including any impact on areas zoned as 'scenic waters'.</p> <p>There would be a minor adverse visual impact from increasing the mass, scale, form, composition, design and structure of the wharf, as discussed in section 6.5.</p>
Clause 26 Maintenance, protection and enhancement of views	<p>Section 6.5 describes the landscape character and visual impacts associated with the proposal. As described above, the new wharf would have a low-moderate visual impact for the surrounding properties that overlook this part of the harbour. However, the overall impact is likely to be less compared to building a new structure in a different location.</p>
Clause 27 Boat storage facilities	There is no boat storage works associated with, or impacted by, the proposal.

Clause 31 of the Sydney Harbour SREP requires consultation for certain development proposals not requiring development consent. Consultation, including under the Sydney Harbour SREP, is discussed in Chapter 5 of this REF.

Part 5 of the Sydney Harbour SREP contains heritage provisions that are to be taken into account in respect of Division 5.1 activities. Heritage items near the proposal include:

- Kesterton Park
- North Sydney Bus Shelters
- Rockcliff Mansions
- House (145 High Street, North Sydney)
- House (165 High Street, North Sydney)
- Careening Cove slipways and seawall, east end
- Gaswork remains,
- HMAS Platypus
- "Heatherlie"
- Careening Cove.

Heritage items are discussed further in section 6.6 and section 6.7. The heritage objectives from the Sydney Harbour SREP in clauses 53(1) and (2) are considered in Table 4-4.

Table 4-4: Heritage objectives

Objective	Comment
1(a) To conserve the environmental heritage of the land to which this Part applies.	<p>The proposal has been designed to be sympathetic to the area's heritage values.</p> <p>A statement of heritage impact (SOHI) prepared to support this REF concludes that the proposal would have a direct impact on two local heritage items, however these impacts would not affect the overall significance of the items (refer to section 6.6).</p>
1(b) To conserve the heritage significance of existing significant fabric, relics, settings and views associated with the heritage significance of heritage items.	As above, the proposal has been designed to preserve the heritage and conservation values of surrounding heritage items.
1(c) To ensure that archaeological sites and places of Aboriginal heritage significance are conserved.	As described in section 6.7, the proposal would not impact known archaeological site or places of Aboriginal heritage.
1(d) To allow for the protection of places which have the potential to have heritage significance but are not identified as heritage items.	There is almost little to no potential for in situ sites to exist in the vicinity of the study area, due to its highly disturbed nature.
2(a) To establish a buffer zone around the Sydney Opera House so as to give added protection to its world heritage value.	The proposal is not located in the Sydney Opera House buffer zone.
2(b) To recognise that views and vistas between the Sydney Opera House and other public places within that zone contribute to its world heritage value.	The proposal would not impact on the views and vistas from the Sydney Opera House.

Clause 54 to Clause 60 of the Sydney Harbour SREP provide for the protection of heritage items and places, including requirements for development consent. Due diligence assessment of the *Stage 1 Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) for the proposal was prepared in accordance with Clause 54 to Clause 60 of the Sydney Harbour SREP. As noted above, the proposal would have only minor to moderate impacts to some heritage items and the overall significance of the items would not be affected. It would not impact on known archaeological sites or places of Aboriginal heritage. As such, there is no need to either seek permission or secure development consent for the work on heritage related grounds.

Part 6 of the Sydney Harbour SREP relates to wetlands protection. The SREP identifies 'wetlands protection areas' to conserve and protect any wetland habitats. In Sydney Harbour these include mangroves, seagrasses, saltmarshes, sedgeland, wet meadows and mudflats and the wetlands protection areas cover a 40 metre buffer around these to account for movement, growth and seasonal variation.

The construction footprint is identified as being located within a Wetland Protection Area under the SREP. The vegetation and habitat in this area does not include any of the features defined as 'wetland habitat' in the SREP. There is no remnant vegetation and the vegetation that occurs is planted on reclaimed land and is characteristic of parks and open areas in the Sydney Metropolitan area. The original shoreline has been modified and retained by a sandstone seawall, and this and the landfill limits saltwater intrusion to the terrestrial portion of the construction footprint. Thus, the terrestrial section of the study area is not considered 'wetland habitat'.

Although the foreshore is highly modified and no mangroves, seagrasses or saltmarshes occur in the study area or the area mapped as a wetlands protection area, the entire Parramatta Estuary is considered an estuarine wetland (estuarine waterbody) by Kingsford et al. (2004). A precautionary approach has been adopted to address the objectives in relation the estuarine habitat in the wetlands protection area within the study area. The wetlands objectives from the Sydney Harbour SREP in clause 61 are considered in Table 4-5.

Table 4-5: Wetland objectives

Objective	Comment
<p>(a) To preserve, protect and encourage the restoration and rehabilitation of wetlands.</p>	<p>Potential impacts of the proposal to the wetland include (refer section 6.3):</p> <ul style="list-style-type: none"> • Loss of habitat under the footprint of the piles to be installed • Mobilisation of fine and coarse debris (e.g. sediments) and mobilisation of contaminants known to persist in the sediments • Scour from vessel and barge movements during construction • Shading of macroalgal communities on rocky reefs. <p>These were not considered to substantially impact the estuarine habitat as any habitat lost would be reinstated by the installation of the new wharf structures providing similar or better habitat than that removed.</p> <p>Mitigation measures would be implemented to avoid or minimise the mobilisation of fine and coarse debris and the habitat in the area are currently exposed to substantial scouring from an ambient level of vessel traffic in Neutral Bay. Thus, the proposal is unlikely to interfere with the preservation and protection of the wetland and the reinstatement of any lost habitat features promotes restoration and rehabilitation.</p> <p>The piles and substructure have been designed to reduce any long-term scour and erosion risks in the wider marine environment, while the floating pontoon has been located offshore to ensure there are no associated propeller wash or scour impacts.</p> <p>Refer to section 6.3 for more information.</p>

Objective	Comment
(b) To maintain and restore the health and viability of wetlands.	Refer (a). The reinstatement of any lost habitat features maintains the habitat condition, availability and viability in the estuarine wetland. Also, providing relevant standard controls are implemented and monitored as set out in Transport for NSW guidelines and quality assurance specifications (refer to section 7.2), the proposal's environmental impacts during construction are expected to be safeguarded and minimised thus affording protection of the wetlands in the local area.
(c) To prevent the fragmentation of wetlands.	The proposal would not impact on the connectivity of the broader Parramatta Estuary hence, would not fragment any wetland habitat.
(d) To preserve the scenic qualities of wetlands.	The location and construction of the wharf has been selected to minimise impacts upon wetlands, and the overall visual impact of the proposal is low (refer section 6.5).
(e) To ensure that wetlands continue to perform their natural ecological functions (such as the provision of wetland habitat, the preservation of water quality, the control of flooding and erosion).	As described above, the proposal's design in combination with the proposed safeguards described in Chapter 7 are aimed at protecting the ecological marine environment to ensure the wetland's ecological function is preserved. Safeguards are being implemented as a matter of precaution to avoid and minimise impacts as described in section 7.2.

The matters to be considered for works within a wetland protection area from clause 63(2) of the Sydney Harbour SREP are considered in Table 4-6.

Table 4-6: Clause 63(2) matters

Objective	Comment
(a) The development should have a neutral or beneficial effect on the quality of water entering the waterways.	The proposal would have a neutral effect if relevant standard safeguards in Transport for NSW guidelines, and quality assurance specifications are implemented and monitored. The proposal is expected to have minimal environmental impact and protect the marine environment and water quality (refer to Chapter 6.2).
(b) The environmental effects of the development, including effects on: (i) the growth of native plant communities,	Proposed impacts on vegetation and terrestrial habitat are minimal and would not fragment or isolate existing habitat. The proposal is unlikely to significantly impact threatened species. Disturbances to potential habitat would largely be temporary and constitute a very small proportion of available

Objective	Comment
<p>(ii) the survival of native wildlife populations,</p> <p>(iii) the provision and quality of habitats for both indigenous and migratory species,</p> <p>(iv) the surface and groundwater characteristics of the site on which the development is proposed to be carried out and of the surrounding areas, including salinity and water quality and whether the wetland ecosystems are groundwater dependent</p>	<p>habitat. The proposal would not fragment or isolate threatened species populations or substantially impact any species' lifecycle.</p> <p>The removal of three of the four tidal steps and associated piles would result in the removal of marine vegetation, habitat and sessile/less mobile fauna currently colonising the piles and concrete steps. However, the majority of these species are common in subtidal rocky reefs and would quickly colonise the piles of the new wharf and pontoon. In addition, the new wharf structure would create habitat for aquatic vegetation to establish.</p> <p>Sediment mobilisation from piling and other water-based construction activities and vessel wash and scour were also identified as potential proposal impacts. However, the study area is likely to be frequently exposed to elevated levels of sediment, associated with rainfall, sea conditions and vessel traffic in Neutral Bay. Thus, with the appropriate controls, a slight, temporary increase in these impacts is not expected to substantially impact marine biodiversity. Vessel traffic to the new wharf during operation would likely be similar to current conditions.</p> <p>There are no aquatic or terrestrial groundwater dependent ecosystems in or next to the study area.</p> <p>Providing the relevant safeguards described in Chapter 7 are implemented and monitored, the proposal's environmental impacts on the area's surface and groundwater quality are expected to be safeguarded and minimised.</p>
<p>(c) Whether adequate safeguards and rehabilitation measures have been, or will be, made to protect the environment.</p>	<p>Chapter 7 sets out the safeguards and management measures to protect the local environment. The chapter also includes post-construction measures, and corrective actions needed during an accident or emergency to manage any impacts.</p>
<p>(d) Whether carrying out the development would be consistent with the principles set out in The NSW Wetlands Management Policy (as published in March 1996 by the then Department of Land and Water Conservation).</p>	<p>The Policy lists five principles for wetland protection (clauses 61a-e). The proposal is located in a similar area to the existing wharf and ferry wash impacts to near-shore habitat would be minimal. A CEMP would be implemented during construction to minimise impact to shallow habitat (e.g. use of floating mooring lines). As such, the proposal aims meets the Policy's principles by:</p>

Objective	Comment
	<ul style="list-style-type: none"> • Protecting adjacent wetland habitat during construction and operation • Promoting wetland recovery by moving impact further away by establishing no-go zones during construction which would prevent impact to mangroves • Providing hard pile surfaces to maintain habitat connectivity • Retaining scenic values by retaining underwater habitat connectivity • Avoiding unnecessary impact to habitat to allow ecosystem functions to be maintained.
<p>(e) Whether the development adequately preserves and enhances local native vegetation.</p>	<p>The proposal would not affect aquatic vegetation. Submerged structures, such as piles and the pontoon, would provide habitat availability for aquatic vegetation to establish. The proposal has also been designed to minimise impacts to vegetation. Refer to section 6.3 for further detail.</p>
<p>(f) Whether the development adequately demonstrates:</p> <p>(i) how the direct and indirect impacts of the development will preserve and enhance wetlands,</p> <p>(ii) how the development will preserve and enhance the continuity and integrity of the wetlands,</p> <p>(iii) how soil erosion and siltation will be minimised both while the development is being carried out and after it is completed,</p> <p>(iv) how appropriate on-site measures are to be implemented to ensure that the intertidal zone is kept free from pollutants arising from the development</p> <p>(v) that the nutrient levels in the wetlands do not increase as a consequence of the development,</p> <p>(vi) that stands of vegetation (both terrestrial and aquatic) are protected or rehabilitated,</p> <p>(vii) that the development minimises physical damage to aquatic ecological communities,</p>	<p>(i) Section 6.1 and Table 4-5 describe how the proposal has been designed and environmental safeguards have been proposed to protect the area in which the proposal would be built.</p> <p>(ii) See Table 4-5</p> <p>(iii) The proposed piles and substructure components described in Chapter 3 have been designed to minimise scour, erosion or any sediment transport, hydrodynamic and/or physical impact on the marine environment. During construction work, a silt boom and curtain would be used to prevent any sediment dispersion and siltation, while additional erosion management controls have been identified in the safeguards and management measures in Chapter 7.</p> <p>(iv) Chapter 7 includes a range of standard pollution management controls that would be implemented and monitored during construction as set out in Transport for NSW guidelines and quality assurance specifications (refer to Chapter 7). If implemented, then the proposal's environmental impact on the intertidal zone are expected to be safeguarded and minimised. As such, safeguards identified in section 6.1.4 would be implemented to prevent contamination of the waterway as a result of the excavation required for the seawall modification.</p> <p>(v) The proposed standard pollutant management and sediment disturbance controls</p>

Objective	Comment
(viii) that the development does not cause physical damage to aquatic ecological communities.	<p>included in Chapter 7 help prevent any nutrient loading into the marine environment.</p> <p>(vi) Refer to Clause 63 (2b).</p> <p>(vii) The proposal's direct impact to aquatic ecological communities would be limited to the removal and installation of piles, as described in section 6.3. This would be insufficient to have any material physical impact on marine ecological communities and their supporting habitat. Also, as described in section 6.1, the operational wharf would not alter the hydrodynamic or physical environment, to the extent to indirectly impact on aquatic ecological values.</p> <p>(viii) As above</p>
(g) Whether conditions should be imposed on the carrying out of the development requiring the carrying out of works to preserve or enhance the value of any surrounding wetlands.	Chapter 7 includes safeguards and mitigation measures that Transport for NSW, and its contractor(s), would commit to implementing and monitoring during construction to prevent any impact on the surrounding wetland values. Table 4-5 describes this in more detail.

4.1.2 Local Environmental Plan

North Sydney Local Environmental Plan 2013

The landside component of the proposal is located within the North Sydney local government area (LGA). Local development control and land use zoning and planning in this LGA is currently governed under the *North Sydney Local Environmental Plan 2013* (LEP).

As development without consent, the proposal is not subject to local environmental planning policy or development control. However, the LEP is useful in identifying the proposal's consistency with its land use and planning policy as described in Table 4-7.

Table 4-7: Relevant North Sydney LEP land use zoning policies

Objective	Proposal consistency
RE1 Public Recreation (Kesterton Park, existing wharf and waterfront)	
<ul style="list-style-type: none"> 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 ensure sufficient public recreation areas are available for the benefit and use of residents of, and visitors to, North Sydney. 	<ul style="list-style-type: none"> No significant loss of recreational land Short-term impacts to Kesterton Park (including partial closure) when the wharf is being built Introduction of new wharf infrastructure leading to a change in visual amenity (refer to section 6.5).

Objective	Proposal consistency
R4 High Density Residential (High Street and nearby residential properties)	
<ul style="list-style-type: none"> To provide for the housing needs of the community within a high density residential environment. To provide a variety of housing types within a high density residential environment. To enable other land uses that provide facilities or services to meet the day to day needs of residents. To encourage the development of sites for high density housing if such development does not compromise the amenity of the surrounding area or the natural or cultural heritage of the area. To ensure that a reasonably high level of residential amenity is achieved and maintained. 	<ul style="list-style-type: none"> No impacts to housing Provides improvement to public transport services to meet the day to day needs of residents.

4.2 Other relevant NSW legislation

Table 4-8 lists the NSW legislation relevant to the proposal or the land on which the proposal would be built.

Table 4-8: Other relevant NSW legislation

Legislation and application	Relevance to proposal and further requirements
<p><i>National Parks and Wildlife Act 1974:</i> provides for the protection of Aboriginal heritage values, national parks and ecological values. Makes it an offence to harm Aboriginal objects, places or sites without permission.</p>	<p>A Stage 1 PACHCI assessment confirmed that the proposal would avoid impacts to known Aboriginal heritage items (Appendix H). An Aboriginal heritage impact permit (AHIP) is not required for the proposal. Section 6.7 provides further details.</p>
<p><i>Heritage Act 1977:</i> provides for the protection of conservation of buildings, works, maritime heritage (wrecks), archaeological relics and places of heritage value through their listing on various State and local registers. Makes it an offence to harm any non-Aboriginal heritage values without permission.</p>	<p>The proposal includes impacts to local heritage item 'Kesterton Park', including introduction of new structures (wharf, parking spaces, retaining wall), and loss of about five per cent of the public green space. Overall, the proposed works would result in a minor to moderate direct impact, but these impacts would not affect the overall significance of the heritage item.</p> <p>The locally listed shelter within the construction footprint would be retained with minor modifications which would not affect the overall significance of the heritage item.</p>

Legislation and application	Relevance to proposal and further requirements
	Section 6.6 provides further details.
<p><i>Roads Act 1993</i>: provides for the construction and maintenance of public roads. Requires consent to dig up, erect a structure or carry out work in, on or over a road.</p>	<p>The proposal would include impacts to High Street, a local road managed by North Sydney Council.</p> <p>Notification to, and consent from, North Sydney Council is required for works on High Street.</p>
<p>Fisheries Management Act 1994 (FM Act): provides for the protection of fishery resources and values for current and future generations. Makes it an offence to harm fisheries and resources without an appropriate assessment, inclusion of safeguards and/or the appropriate permissions to carry out certain work.</p>	<p>The aquatic ecology assessment (refer section 6.3) carried out to support the REF, noted removal of the existing wharf structure is expected to impact less than 0.01 hectares of marine vegetation on subtidal rocky reefs as well as about 0.01 hectares of vertically colonised marine vegetation. The assessment concluded that the proposal would trigger the need for a permit to harm marine vegetation under section 205 of the FM Act, however, consultation with DPI Fisheries has confirmed that no permit is required (refer Table 5-4).</p> <p>The aquatic ecology assessment identified two threatened species under the FM Act were considered to have a moderate to high likelihood of occurrence in the study area. Assessments of significance concluded the proposal is unlikely to significantly impact the threatened species and an SIS is not required.</p> <p>A permit under section 37 of the FM Act to relocate Syngnathids collected during targeted pre-clearance surveys would be required (refer Table 5-4). Alternatively, a provision can be added to a permit under section 205 of the FM Act for Syngnathid relocation.</p> <p>A permit to carry out dredging or reclamation is not required. Notification has occurred in accordance with Section 199 of the FM Act and a response from DPI Fisheries has been provided (refer Table 5-4).</p>
<p><i>Biodiversity Conservation Act 2016</i>: provides for a strategic approach to conservation in NSW. It includes provisions for risk based assessment of native plant and animal impacts,</p>	<p>Under the BC Act, an assessment of significance must be completed to determine the significance of impacts to</p>

Legislation and application	Relevance to proposal and further requirements
<p>including a Biodiversity Assessment Method (BAM) to assess the impact of actions on threatened species, threatened ecological communities and their habitats.</p>	<p>threatened species, populations and/or communities or their habitat.</p> <p>The aquatic ecology assessment (refer to section 6.3), carried out to support the REF, identified that six threatened species under the BC Act were considered to have a moderate to high likelihood of occurrence in the study area. As such, assessments of significance under the BC Act were prepared for these species. The assessments concluded the proposal is unlikely to significantly impact the threatened species and an SIS is not required.</p> <p>The proposal would remove up to 0.06 hectares of landscaped gardens and parks. Of this, 0.05 hectares would be landscaped and reintegrated into Kesterton Park following construction completion. Proposed impacts on vegetation and terrestrial habitat are considered to be largely temporary and would not substantially fragment or isolate existing habitat. The proposal does not require further assessment under the Biodiversity Assessment Method.</p> <p>Refer to section 6.3 for detailed assessment.</p>
<p><i>Protection of the Environment Operations Act 1997</i>: focuses on environmental protection and provisions for the reduction of water, noise and air pollutions and the storage, treatment and disposal of waste. Introduces licensing provisions for scheduled activities that are of a nature and scale that have potential to cause environmental pollution. Also includes measures to limit pollution and manage waste.</p>	<p>The proposal would not involve undertaking or carrying out a scheduled activity.</p> <p>If standard controls set out in Transport for NSW guidelines and quality assurance specification are implemented and monitored, there is unlikely to be any material water, noise or air pollution impact (refer to Chapter 7). Appropriate waste management controls would be introduced to classify, store, transport, and dispose of all construction and work-generated waste.</p>
<p><i>Marine Pollution Act 2012</i>: sets out provisions to prevent pollution in the marine environment.</p>	<p>The proposal is unlikely to result in any oil, noxious liquid, pollutant, sewage or garbage discharge as controlled under this Act, providing relevant standard</p>

Legislation and application	Relevance to proposal and further requirements
	controls are implemented and monitored (refer to Chapter 7).
<i>Ports and Maritime Administration Regulations 2012</i> : requires Harbour Master permissions to alter any structure of disturb the harbour floor within Sydney Port	The proposal is likely to disturb sediment within Sydney Harbour (section 67ZN of the Regulation). Written permission of the Harbour Master is required. Chapter 5 details the consultation that has taken place.
<i>Marine Safety Act 1998</i> and <i>Marine Safety Regulation 2016</i> : sets out the requirements for marine safety and the roles of the Harbour Master and marine pilots. Includes provisions relating to marine and navigational safety including: collision prevention, spill limits, no-wash zones, shipping operations, and controls on reckless, dangerous or negligent navigation.	<p>The proposal is located in the harbour (a navigable water under the terms of the Act) and would restrict its used by the public, it is subject to licensing under the terms of section 97 of the Regulation.</p> <p>Navigational exclusion zones would be installed while the work it taking place. This would include updating the Port Authority of NSW. Where required, nautical charts would be updated once the wharf is upgraded.</p>
<i>Crown Lands Management Act 2016</i> : to provide for the ownership, use and management of the Crown land of New South Wales, to provide clarity concerning the law applicable to Crown land, to require environmental, social, cultural heritage and economic considerations to be taken into account in decision-making about Crown land, to provide for the consistent, efficient, fair and transparent management of Crown land for the benefit of the people of NSW, and to provide for the management of Crown land having regard to the principles of Crown land management.	<p>Part of Kesterton Park (Lot 1124 DP752067) located south-west of the wharf. The land is a reserve within the meaning of the <i>Crown Lands Management Act 2016</i>. Management of the reserve is devolved to North Sydney Council as per the provisions of Section 48 of the <i>Local Government Act 1993</i> (refer Table 5-4 regarding consultation with DPIE Crown Land). A licence from DPIE Crown Land is not required and Council is to be consulted.</p> <p>Land below mean high water mark in the harbour is Crown land. DPIE Crown Land has indicated that works below mean high water mark are the responsibility of the Maritime Authority (refer to Table 5-4).</p>
<p><i>Contaminated Land Management Act 1997</i>: Must report to EPA if contaminated land is encountered during the works that meets the duty to report contamination requirements under Section 60 of this Act</p> <p>Aims to establish a process for investigating and (where appropriate) remediating land that the EPA considers to be contaminated significantly enough</p>	The proposal may have impacts on contaminated land. A Preliminary Site Investigation (PSI) details the site history and potential contaminants of concern. Further details are provided in section 6.1.

Legislation and application	Relevance to proposal and further requirements
<p>to require regulation under Division 2 of Part 3.</p> <p>The Act aims to set out accountabilities for managing contamination if the EPA considers the contamination is significant enough to require regulation under Division 2 of Part 3.</p>	

The proposal is mapped as Coastal Use Area and Coastal Environment Area under the Coastal Management SEPP. The Coastal Management SEPP gives effect to the objectives of the *Coastal Management Act 2016*.

Table 4-9 lists the objectives of the *Coastal Management Act 2016* and whether the proposal is consistent with the objectives.

Table 4-9: *Coastal Management Act 2016* Clauses 8 and 9 objectives

Objectives	Relevance to proposal
8 (2)(a) to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity	The proposal would not significantly impact on the coastal environmental values and natural processes of coastal waters. Biological diversity and ecosystem integrity are unlikely to be impacted.
8 (2)(b) to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change	The proposal would have a neutral impact to coastal waters and estuaries.
8 (2)(c) to maintain and improve water quality and estuary health	The proposal would maintain the long term water quality and ecological environment provided the safeguards and management measures in this Chapter 7 of this REF are implemented.
8 (2)(d) to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons	Social and cultural values have been considered in the design process by providing safe and equitable access to public transport on coastal waters.
8 (2)(e) to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place	Beaches and dunes would not be impacted by the proposal.
8 (2)(f) to maintain and, where practicable, improve public access,	The proposal would have short term impacts to public access to the foreshore, however the proposal would

Objectives	Relevance to proposal
amenity and use of beaches, foreshores, headlands and rock platforms	provide long term improvements to access and amenity.
9(2)(a) to accommodate both urbanised and natural stretches of coastline. (i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and	The proposal is appropriate for the location.
(ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and	Heritage impacts have been considered in Section 6.6 and 6.7, and safeguards and management measures are detailed in Chapter 7.
(iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and	Urban design has been considered during the design process.
(iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and	The proposal would impact a small section of Kesterton Park. Part of the existing wharf would be retained for recreational use.
(v) the use of the surf zone is considered	The proposal would not impact the surf zone.
9 (2)(b) to accommodate both urbanised and natural stretches of coastline.	The proposal would retain a coastline similar to the existing environment.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed 'actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land'. These are considered in Appendix A and Chapter 6 of the REF.

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of Agriculture, Water and Environment under the EPBC Act.

4.3.2 Disability Discrimination Act 1992

The *Disability Discrimination Act 1992* (DDA) is the Commonwealth legislation that seeks to provide equity for people with disabilities. The main objects of the DDA include the elimination, as far as possible, of discrimination against persons on the grounds of disability in relation to access to premises and the provision of facilities and services. The proposal has been designed to respond to the requirements of this Act.

Disability Standards for Accessible Public Transport (DSAPT) 2002

The *Disability Standards for Accessible Public Transport 2002* (DSAPT), made under the DDA, prescribes minimum standards of accessibility in relation to both public transport buildings and conveyances to remove discrimination from public transport services. The proposal has been designed to respond to the development standards identified under the DSAPT.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a public ferry wharf and is being carried out by or on behalf of a public authority. Under clause 68(4A) of the ISEPP, the proposal is permissible without consent. The proposal is not State significant infrastructure and is subject to environmental impact assessment under Division 5.1 of the EP&A Act.

Accordingly, Transport for NSW is the determining authority for the proposal, with this REF fulfilling the obligation under Section 5.5 of the EP&A Act 'to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity'.

5 Consultation

This chapter discusses the consultation undertaken to date for the proposal and the consultation proposed for the future.

5.1 Communications and Stakeholder Engagement Plan

A community and stakeholder engagement plan (Cardno, 2020f) has been prepared for the proposal in accordance with the International Association for Public Participation Spectrum and the Stakeholder Engagement Toolkit. The overall objectives are:

- To keep the local community and other key stakeholders regularly informed
- To provide the community and stakeholders with regular and targeted information to build awareness
- To be transparent in all that we do
- To encourage participation from communities and other stakeholders
- To listen to feedback, investigate suggestions and report back
- To engage in a manner that is collaborative, innovative, adaptive and sustainable
- To increase stakeholder understanding of the program and its objectives
- To ensure that community and stakeholder enquiries are managed and resolved effectively
- To ensure that project information is distributed in an effective and timely manner.

5.2 Community involvement

The community and key stakeholders were invited to provide feedback on the proposal's concept design from Monday 2 February 2020 to Friday 28 February 2020.

The purpose of this consultation was to:

- Display the proposed concept design (site plan and artist impression)
- Obtain feedback from the community on the proposal
- Consider and provide responses to feedback and questions received.

Community members and stakeholders were encouraged to provide feedback, leave comments and make submissions via phone, email, or online.

Two drop-in sessions were held at North Sydney Wharf on Friday 14 February from 7am to 10am and Saturday 15 February from 11am to 2pm. The project team spoke to 55 customers, residents and local community members at these sessions.

Around 700 community updates were distributed to residents and businesses in the area.

Fifty-two submissions from individuals were received. The comments received have been summarised and responded to in Table 5-1.

Table 5-1: Summary of issues raised by the community: concept design (NSW Government, 2020)

Issue raised	Response
Wharf design	
<p>The wharf should be located closer to High Street.</p>	<p>We have chosen the position of the new wharf to accommodate the new land-side accessible ramp. The new ramp would provide access for people with assisted mobility and would comply with DSAPT (Disability Standards for Accessible Public Transport) legislation.</p> <p>To achieve the required slope and to allow customers to travel safely up and down the ramp, it has to be 30 metres long, starting from the footpath at the end of High Street, connecting to the top of the gangway.</p> <p>The proposed alignment of the ramp minimises the impact on the park and requires the gangway to be located further North away from High Street. Locating the gangway closer to High Street would require a zig-zag ramp that would have a greater impact on the park.</p> <p>We did not choose the position of the new wharf to allow the existing jetty to be retained, but as a result of the proposed pontoon location, it also allows space for the existing jetty to remain.</p>
<p>The existing wharf and path should be modified to accommodate for accessibility instead of building a new wharf and path.</p> <p>Can the existing wharf be upgraded instead of replacing it with a new pontoon?</p>	<p>The existing wharf has tidal steps and cannot be cost-effectively modified to meet accessibility standards.</p> <p>A new wharf structure, including a floating pontoon is required to meet accessibility standards. The floating pontoon allows for movement up and down with the tide to provide safe and level access between the ferries and wharf platform.</p>
<p>The gangway should be covered in the wharf design to protect ferry users from wind, sun and rain.</p> <p>Why is the gangway at Neutral Bay Wharf covered but the proposed design at North Sydney does not include a covered gangway?</p>	<p>The current proposal includes an uncovered gangway because it leads to an uncovered park area on the foreshore.</p> <p>Covered gangways are provided when the customer is already under cover when they arrive at the wharf interchange, for example Neutral Bay Wharf, Cremorne Point Wharf and Mosman Bay Wharf.</p> <p>With the upgrade, shelter would be provided for customers waiting for the ferry on the wharf pontoon itself.</p> <p>Wharves similar to North Sydney like Drummoyne Wharf, Balmain East Wharf and Pyrmont Bay Wharf have uncovered gangways.</p>

Issue raised	Response
<p>Why is the wharf larger than the existing structure when the number of people who use it is low?</p> <p>The existing waiting shelter is not used, there is no need to expand the wharf as patronage is low.</p>	<p>The size of the pontoon at North Sydney was determined by the maritime (wind and wave) conditions in this location. Pontoons are sized to provide a stable waiting area, a safe platform for customers to board and a safe berth for ferries. A smaller pontoon would move around too much at this location for safe boarding and would also be uncomfortable for waiting passengers.</p>
<p>The metal finishing for the wharf at Neutral Bay is rusting. Consider using a more durable finish in the design such as graphene.</p>	<p>The metal finish that would be used on the new North Sydney Wharf differs from what was used at Neutral Bay. We are aware of the rusting that has occurred at Neutral Bay and have updated the materials used since this upgrade was carried out.</p> <p>The use of graphene in maritime applications is still in trial and is not yet a proven product for harsh maritime environments.</p>
<p>There are many elderly residents in the area and the proposed accessible parking space is needed near the wharf interchange.</p>	<p>The upgrade would provide North Sydney with facilities that all members of the community can access. Accessible parking at the primary wharf entry is provided in the proposed design.</p>
<p>Include a small café or food/coffee cart on the wharf for commuters and people waiting for the ferry.</p>	<p>The primary objective of the upgrade is to make the wharf accessible. Adding retail facilities to the wharf is not part of the scope for an accessibility upgrade.</p>
<p>Neutral Bay is at capacity particularly for manoeuvring sailing crafts. Why move the pontoon out into an already cluttered area?</p>	<p>We will further investigate the final position of the pontoon during detailed design to ensure it does not impact on the navigational channel.</p> <p>Maintaining access to the existing navigational channel in front of the wharf is a key requirement and this will be considered during detailed design. The navigational channel may be reduced at times during construction.</p>
<p>The pontoon design should cater to smaller vessels.</p>	<p>Recreational berthing may be provided at the rear of the pontoon. This will be assessed during detailed design.</p>
<p>Can the final finish tie in with the existing design/materials and paths in Kesterton Park?</p>	<p>We will consider the incorporation of surrounding design elements to tie in to the area during detailed design. A Landscape Character and Visual Impact Assessment will be carried out during detailed design which looks at the materials and finishes chosen for the final design. The landside upgrade will be designed to fit in with the urban landscape of Kesterton Park. Sandstone blocks will be used in the urban landscape design with respect to the earlier use of the area as a quarry.</p>

Issue raised	Response
The proposed roof will impact the view from the park.	<p>The Wharf Upgrade Program has been designed to create a distinctive theme for Sydney Harbour. The design aims to unify and identify the harbour wharves and the ferry commuter transport system.</p> <p>The roof is required for protection from the weather for customers waiting on the ferry wharf. The proposed wharf design minimises impact to the visual amenity in the area through the use of glass walls for wind protection. The curved roof is designed to be low profile and minimise the impact on the views to and from the water.</p>
Install a bin near the shelter to reduce waste.	<p>Bins would be provided on the new pontoon where customer wait for the ferries.</p> <p>For concerns or questions in regards to the installation of additional bins around the park, please contact North Sydney Council.</p>
Project justification	
<p>Why is there an upgrade when there is low use of the ferry?</p> <p>What is the justification for this upgrade?</p>	<p>The tidal steps and steep paths at North Sydney Wharf make it difficult for customers with poor mobility to access ferry services. North Sydney Wharf upgrade is a part of a Transport for NSW program across Sydney to make public transport accessible.</p>
Why is this wharf being prioritised over other wharves?	<p>The Wharf Upgrade Program has been ongoing for a number of years and has delivered multiple upgrades prior to North Sydney Wharf. North Sydney Wharf is part of the program's third package of wharves being investigated as part of the Transport Access Program. Of package three, Woolwich Wharf and Kissing Point Wharf will be built first.</p> <p>The program for the Wharf Upgrade Program is developed based on funding availability and complexity of the site. North Sydney, along with Kissing Point and Woolwich Wharves are relatively straightforward upgrades and are being delivered first.</p>
The resources proposed for the North Sydney Wharf would be much better utilised for the upgrade of the Kirribilli Wharf.	Kirribilli Wharf has been identified as part of package three of this program and is being investigated.
The current waiting shelter provides protection from the elements.	The new pontoon provides a waiting area with seating that is protected from the wind and the rain. A screen is also provided to provide information about the next and following services.

Issue raised	Response
	<p>Announcements are made on the pontoon regarding approaching and berthed ferry services.</p> <p>The lights are turned on automatically in the evening when the sun sets and are turned down to half-light after the last ferry service at night. The lights go off in the morning when the sun rises. During winter when the first ferry service is scheduled to arrive before the sun rises, the lights go on fully before the sun rises.</p> <p>There is also CCTV coverage and an emergency button on the pontoon for the security of waiting passengers.</p>
Existing wharf structure	
<p>The existing wharf structure should be retained.</p> <p>The existing wharf structure should be removed.</p>	<p>The decision to retain or remove the existing wharf will be further investigated during detailed design.</p> <p>Comments received during consultation will be used to further refine the design of the upgrade.</p>
<p>The steps are dangerous and slippery when they are wet.</p> <p>The tidal steps are difficult to use for the elderly.</p> <p>The steps on the existing wharf are difficult to access with prams and luggage.</p>	<p>The new wharf design includes an accessible ramp to the wharf, including an uncovered gangway for prams and customers with assisted and unassisted mobility needs. There would be no tidal steps on the new wharf.</p>
Fishing activities at the wharf	
<p>There should be no fishing on the new wharf, keep the existing wharf for these activities.</p> <p>A review is needed on the current fishing practices at the wharf.</p> <p>Remove the existing wharf to minimise recreational activities on the wharf interchange.</p> <p>There needs to be more signage and education on fishing guidelines.</p>	<p>Signage would be installed as part of the upgrade to inform and remind the fishing community of the requirements of responsible fishing at North Sydney Wharf, which includes consideration of nearby residents, other wharf and park users, keeping noise to a minimum and not leaving hooks, bait and fishing lines at the wharf.</p> <p>Recreational fishing in Sydney Harbour is regulated by the NSW Department of Primary Industries and is currently permissible at North Sydney Wharf.</p>
Existing waiting shelter	
<p>The waiting shelter is a period piece, do not remove it.</p>	<p>The existing waiting shelter on the foreshore will not be removed as part of the North Sydney Wharf Upgrade.</p>

Issue raised	Response
<p>The waiting shelter is easily flooded when there is a lot of rain.</p> <p>Can the existing shelter include a book shelf for the community, similar to the waiting area at Birchgrove Wharf?</p>	<p>The waiting shelter is managed by North Sydney Council.</p> <p>For suggestions and feedback around a community bookshelf or concerns with flooding, please contact North Sydney Council.</p>
Ferry services and timetable	
<p>Will ferry services be stopped during the construction of the wharf?</p>	<p>Ferry services to North Sydney Wharf may be impacted during the construction of the proposed upgrade. Alternative transport options would be considered and presented to the community when the Review of Environmental Factors is put on display for community comment.</p>
<p>Will this upgrade support more frequent ferry services?</p>	<p>The upgrade would provide the capacity for one ferry to berth at the wharf at a time. The primary purpose of the wharf upgrade is to create accessibility for customers using public transport.</p> <p>Transdev manage the timetabling of ferry services and should be contacted regarding the frequency of services.</p>
<p>Why does the current ferry route visit Kirribilli Wharf twice?</p>	<p>Due to the location of the Kirribilli Wharf, the F5 Ferry goes past the wharf on the way out to Neutral Bay and also on the way back to Circular Quay. It is a courtesy to passengers at Kirribilli Wharf to stop on the way back if they are waiting at the wharf, rather than making them wait for the next F5 service. The ferry does not go past any other wharves on the F5 route twice.</p>
Alternative transport during construction	
<p>What are the alternative transport options during construction?</p> <p>Will a replacement bus be provided during the closure?</p> <p>During the closure of the wharf, provide an alternative route that goes from High Street to the city or a shuttle boat to take passengers from North Sydney to Neutral Bay.</p> <p>Will small boats such as Captain Cook be considered as an option for alternative</p>	<p>Local bus services, North Sydney train station and Neutral Bay wharf are possible alternatives for some customers in the catchment area of North Sydney wharf.</p> <p>There may be alternative transport options provided for those who use the ferry. As we are still in the concept design phase of the project we will be reviewing the available options during detailed design. Every effort will be made to minimise disruption to the community.</p> <p>The berthing facilities at Sub-Base Platypus do not provide the required freeboard (height) for the public ferries under all tide conditions and would not be a suitable alternative wharf during construction.</p>

Issue raised	Response
<p>transport during the closure of the wharf?</p> <p>Consider a temporary wharf during construction as bus services are unable to access High Street.</p> <p>Can the Sub-Base Platypus be considered as an alternative wharf for the ferry service during construction?</p> <p>It will be disruptive to stop the ferry service for six months.</p>	<p>Feedback received will be considered and further consultation with providers would be carried out to understand alternative transport options for the area.</p> <p>Alternative transport options would be addressed in the Review of Environmental Factors which will be placed on public display.</p>
Construction impacts	
<p>When will construction start?</p>	<p>Construction is expected to start in 2021 pending the completion of the final design and outcome of the Review of Environmental Factors and its public display.</p>
<p>What will be done in relation to the construction impact for the residents? That is, noise and access.</p> <p>Do not construct in the summer, it will impact tourism.</p> <p>Avoid construction in the early morning, due to noise pollution.</p>	<p>We would make every effort to minimise disruption to residents and customers during construction.</p> <p>The project team would work with the directly impacted and further information would be made available closer to the start of construction.</p> <p>Some construction activities may require work to be carried out during early mornings when the tide is most calm however work would be planned to minimise disruption to residents.</p>
<p>Do not increase the number of CCTV cameras in the area.</p>	<p>CCTV cameras would be provided on the new pontoon and gangway. These are installed to improve safety and security for the ferry service, the wharf structure and customers.</p>
<p>Parking spaces should be maintained in the area during construction.</p>	<p>Every effort would be made to reduce the impact to parking in the area. If there is a need to temporarily impact parking the community would be notified.</p>
<p>What will happen to the water-based recreational activities in the area during construction?</p>	<p>We will continue to work with local clubs and recreational providers in the area to minimise disruption during construction.</p> <p>Some exclusion areas may need to be established to maintain the safety of people using the park and water in the area during construction.</p>
<p>Will the park be affected by construction impacts?</p>	<p>Construction impacts will be identified and assessed through the REF process.</p> <p>A site compound may be required near the wharf and possibly in the park. At the end of construction,</p>

Issue raised	Response
	<p>the site compound would be removed and the area made good.</p> <p>The community will have the opportunity to review the proposed arrangements for a construction site compound during the REF process.</p>

5.3 Aboriginal community involvement

Aboriginal heritage impacts have been considered under the four-stage *Procedure for Aboriginal Heritage Cultural Heritage Consultation and Investigation* (PACHCI, Roads and Maritime, 2011). The PACHCI is outlined in Table 5-2 below.

Table 5-2: Summary of Transport for NSW PACHCI

Stage	Description
Stage 1	Initial Transport for NSW assessment
Stage 2	Site survey and further assessment
Stage 3	Formal consultation and preparation of a cultural heritage assessment report
Stage 4	Implement environmental impact assessment recommendations

Stage 1 of the PACHCI process was completed for the proposal, which confirmed that there is unlikely to be any impact on Aboriginal cultural heritage (refer to section 6.7). The Transport for NSW Aboriginal Cultural Heritage Officer has issued a Stage 1 clearance letter for the proposal in accordance with PACHCI (refer to Appendix H). An Aboriginal heritage impact permit (AHIP) under the *National Parks and Wildlife Act 1974* is not needed for the proposal.

5.4 ISEPP consultation

Appendix B contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered. In the case of this proposal, it triggers the notification requirements with North Sydney Council under Clauses 13 and 14 as it:

- Would involve the installation of a temporary structure on, or the enclosing of, a public place
- Would involve excavation of a road or adjacent footpath
- Would involve works affecting a local heritage item.

Transport for NSW have been consulting with North Sydney Council since 2019 to develop a design which is acceptable to Council as owners and operators of the landside elements of the proposal. North Sydney Council will be further consulted about the proposal (including this REF and SOHI) and as per the requirements of clauses 13 and 14 of ISEPP. The consultation will be undertaken during the public exhibition of the REF. Any issues raised as a result of the consultation will be responded to in the submissions report

5.5 SREP (Sydney Harbour Catchment) 2005 consultation

The Department of Planning, Industry and Environment (DPIE) Housing and Property Group (formerly Foreshores and Waterways Planning and Development Advisory Committee) and Ausgrid have been consulted about the proposal as per the requirements of clause 31 of the SREP (Sydney Harbour Catchment). Appendix B contains a SREP (Sydney Harbour Catchment) consultation checklist that documents how the SREP consultation requirements have been considered.

In the case of the proposal, it triggers the consultation provisions of Part 3: Division 3, clause 31 of the SREP (Sydney Harbour Catchment) due to the following reasons, it:

- Involves the development of public water transport facilities (Schedule 2)
- Would require the provision of services in the form of electricity and water, as required by the existing wharf.

Accordingly, the DPIE Housing and Property Group, Ausgrid and Sydney Water were consulted in regards to the proposal.

Issues that have been raised as a result of this consultation are outlined below in Table 5-3.

Table 5-3: Issues raised through SREP (Sydney Harbour Catchment) consultation

Agency	Issue raised	Response/where addressed in REF
Ausgrid (22 July 2020)	<p>Ausgrid doesn't appear to have any major assets that would be impacted by the proposal. We currently supply the lighting on the existing wharf and this would be impacted if the existing wharf is removed or modified.</p> <p>The project team will need to make an application to Ausgrid for connection of grid power (if required for the new wharf).</p> <p>General feedback we give in this scenario is as follows:</p> <p>"In consultation with relevant agencies prepare a services and utilities impact assessment which:</p> <ul style="list-style-type: none"> • assesses the capacity of existing services and utilities and identify any upgrades required to facilitate the development • assesses the impacts of the proposal on existing utility infrastructure and service provider assets and describe how any potential impacts would be managed." 	Noted. An application will be made for connected to the grid for the new wharf at a later stage in the project.
DPIE Housing and Property Group	No response received at this time.	
Sydney Water	No response received at this time.	

5.6 Government agency and stakeholder involvement

Various government agencies and stakeholders have been consulted about the proposal, including:

- DPIE Crown Land
- DPI Fisheries
- Port Authority of NSW (Harbour Master).

Issues that have been raised as a result of consultation with these agencies and stakeholders are outlined below in Table 5-4.

Table 5-4: Issues raised through government agency and stakeholder consultation

Agency	Issue raised	Response/where addressed in REF
DPI Fisheries (12 June 2020)	DPI Fisheries would like to see the following matters addressed: <ul style="list-style-type: none"> • Mapping of any marine vegetation within the proposed works area. 	<ul style="list-style-type: none"> • Marine vegetation and habitat are mapped in Figure 6-2 and Appendix D.
	<ul style="list-style-type: none"> • Hydrographic modelling showing water depths across the work area. 	<ul style="list-style-type: none"> • Water depths are described in Section 6.1 and have been considered during design.
	<ul style="list-style-type: none"> • Surveys for Syngnathid species on the existing wharf or in the vicinity of the new wharf. Proposed management of Syngnathid species including the endangered Whites Seahorse which is endemic to this location. 	<ul style="list-style-type: none"> • Pre-clearance surveys and targeted surveys for Black Rockcod and White's Seahorse would be undertaken and it is recommended that a White's Seahorse relocation plan be developed in consultation with DPI Fisheries. Details are provided in Section 6.3 and Appendix D.
	<ul style="list-style-type: none"> • Marine fauna including any threatened species. 	<ul style="list-style-type: none"> • Marine fauna and threatened species are discussed in Section 6.3 and Appendix D.
	<ul style="list-style-type: none"> • Management of sediments, including any potential contamination 	<ul style="list-style-type: none"> • Management of sediments and contamination is addressed in Section 6.1 and Appendix C
	<ul style="list-style-type: none"> • Impacts of ferry use at the new wharf, including any changes to vessel size or power, frequency of services, and potential for erosion of the seabed or surrounding shorelines. 	<ul style="list-style-type: none"> • The impacts of ferry use and erosion are discussed in Section 6.1 and 6.3. The size and frequency of the ferries would not change as a result of the proposal.
	<ul style="list-style-type: none"> • Provide details of the proposed construction methodology. 	<ul style="list-style-type: none"> • The proposed construction methodology is provided in Section 3.3.

Agency	Issue raised	Response/where addressed in REF
DPI Fisheries (18 August 2020 and 9 September 2020)	DPI Fisheries reviewed the draft Biodiversity Assessment Report and provided the following feedback: <ul style="list-style-type: none"> • Notification has occurred in accordance with section 199 of the FM Act and Fisheries has provided feedback on the proposal. 	<ul style="list-style-type: none"> • Noted. No permit is required for dredging or reclamation.
	<ul style="list-style-type: none"> • A permit to harm marine vegetation under section 205 of the FM Act is not required in this instance. 	<ul style="list-style-type: none"> • Noted. No permit is required for harm to marine vegetation.
	<ul style="list-style-type: none"> • A permit under section 37 of the FM Act is required to relocate seahorses. Alternatively, a provision can be added to a permit under section 205 of the FM Act to include approval for Syngnathid relocation. 	<ul style="list-style-type: none"> • Noted. The requirements for a permit to relocate seahorses would be considered in consultation with DPI Fisheries.
	<ul style="list-style-type: none"> • For asset maintenance/upgrade proposals where the work site contains potential habitat for Syngnathids an inspection dive must be undertaken within 24 hours of commencing construction or any activity involving habitat disturbance. 	<ul style="list-style-type: none"> • The requirement for a pre-clearance survey is provided in Table 6-5.
	<ul style="list-style-type: none"> • DPI Fisheries provided advice on Syngnathid relocation including: <ul style="list-style-type: none"> ○ Distance relocation requirements ○ Habitat relocation requirements (including preferential order of habitats) ○ Stocking density. 	<ul style="list-style-type: none"> • Noted. These requirements would be considered in the White's Seahorse relocation Plan (refer Table 6-5).
Port Authority of NSW (Harbour Master) (2 July 2020)	<ul style="list-style-type: none"> • The Port Authority have no issues at this stage of the project. The Port Authority would like to a Disturbance of Seabed Application and Traffic Management Plan at a later stage. 	Noted
DPIE Crown Land	<ul style="list-style-type: none"> • Management of the subject reserve is devolved to North Sydney Council as per the 	Noted. North Sydney Council has been and will continue to be

Agency	Issue raised	Response/where addressed in REF
(15 and 16 July 2020)	<p>provisions of section 48 of the <i>Local Government Act 1993</i>. The Department is currently in the process of appointing Council formally as Crown Land Manager over the subject reserve. Comment should be sought from Council regarding the impact of the proposed works on the subject reserve. The Department can offer no comment on the proposal as there is no land affected under its direct management</p>	consulted with regards to this proposal.
	<ul style="list-style-type: none"> • Works below mean high water mark (MHW) are the responsibility of the Maritime Authority. 	Noted.

5.7 Ongoing or future consultation

This REF would be placed on public display for comment by Government agencies, stakeholders and the community. Following the public display period, Transport for NSW would collate and consider the submissions received then determine whether the proposal should proceed as described or whether any changes are needed are required. It would also decide if any additional environmental assessment, safeguards or management measures are needed.

A submissions report would be published, which would respond to the comments received. Transport for NSW would notify those who made submissions and distribute a community update. The update would summarise the submissions report process and the actions Transport for NSW took to address these comments. Transport for NSW would also meet with affected residents, businesses and other stakeholders.

6 Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of the factors specified in the guidelines *Is an EIS required?* (DUAP, 1995/1996) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2000 and the *Marinas and Related Facilities EIS Guideline* (DUAP, 1996). The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Land surface and hydrology

This section describes the existing land surface and hydrology and potential impacts associated with the proposal.

6.1.1 Methodology

Water based

Published mapping and data were used to define the hydrodynamic and physical characteristics of the aquatic environment. This included:

- Hydrographic and bathymetric mapping and data, including navigational charts
- NSW Tide Tables (BoM, 2020a)
<http://www.bom.gov.au/oceanography/projects/ntc/monthly/>
- Climate data (BoM, 2020b)
- Ocean and Tidal Summary 2018-2019 (MHL, 2019)
<https://mhl.nsw.gov.au/Publications/publications.php?content=oeh2019annualsummary>
- Geotechnical Desktop Investigation (Aurecon, 2019a)
- Preliminary Site Investigation (Cardno, 2020a)
- Stage 2 Contamination Assessment (Coffey, 2016b)
- Tidemap: Sydney Harbour (Tidetech 2020)
https://maps.tidetech.org/?layer=tidal_currents_sydney

Land based

Published mapping and data were used to define physical characteristics of the terrestrial environment. This included review of:

- Sydney 1:100,000 Geological Series Sheet 9130 (Herbert, 1983)
- NSW Planning Portal
- NSW EPA online contaminated land register
- Environmental Protection Licences (EPL) under the *Protection of the Environment Operations Act 1997*
- Concept Design Report (Aurecon, 2019a)

- Geotechnical Desktop Investigation (Aurecon, 2019b)
- Preliminary Site Investigation (PSI) (Cardno, 2020a), provided as Appendix C
- Geotechnical Assessment (Coffey, 2016a)
- Stage 2 Contamination Assessment (Coffey, 2016b).

Construction assessment

The assessment considered how the proposed construction activities, work methods, and required management controls (refer to section 3.3) would temporarily affect the physical characteristics of the aquatic environment including localised sediment and pollutant disturbance and dispersion.

Operational assessment

The operational assessment considered how the final aquatic infrastructure would potentially result in hydrodynamic changes in terms of erosion, scour and water quality changes.

6.1.2 Existing environment

Water based

The proposal is located within Port Jackson. Port Jackson is a tide dominated drowned valley estuary with an open entrance.

Tides

The proposal is located on the northern side of Port Jackson. Water levels of Port Jackson are subject to ocean tides and the site has similar tides to Fort Denison where the conditions are as follows (BoM, 2020a):

- Tides are semi-diurnal meaning that two high and two low tides normally occur each day
- Chart datum (0.0 m CD) is 0.925 metres below Australian Height Datum (AHD)
- Mean sea level is 0.936 metres AHD (between 1914 and 2020)
- Maximum recorded sea level of 2.4 metres AHD
- Minimum recorded sea level of -0.19 metres AHD
- Highest astrological tide (HAT) is 2.07 metres AHD (1.15 metres CD) (period 1995-2014) (MHL, 2019)
- Lowest astrological tide (LAT) is 0.03 metres AHD (-0.9 metres CD) (period 1995-2014) (MHL, 2019).

Currents

The main tidally influenced water movement in the harbour occurs in the main channel. Closer to the edge of the harbour, tidal-generated current speeds reduce due to the shallower waters. As such, the tidal-generated current speeds close to the foreshore, and the proposal footprint, are very low (i.e. the waters are typically calm).

Local currents may be attributed to tidal flows, wind shear, propeller wash and localised flows at stormwater outlets. Currents may also be generated by the passing of other vessels nearby. Wind shear on the water surface generates the strongest currents in the location of the proposal.

Waves

The location of the existing North Sydney Wharf is most exposed to the south-east with fetch lengths of about 3100 metres (Aurecon, 2019a). The proposal footprint would be subjected to wind waves. Primary wind waves are likely to emanate from the north-west and secondary waves from the north-east with 1 in 5 year average recurrence interval (ARI) heights of up to 0.5 metres (Aurecon, 2019a). The proposal area is also subjected to vessel waves.

Swell waves are not likely to propagate at this location in Sydney Harbour (Aurecon, 2019a).

Storm surge

During extreme events, the water level can be elevated higher than the predicted tidal level due to barometric pressure, and wind and wave setup. This increase in water level due to reduced barometric pressure and wind setup is known as storm surge. The 100 year ARI storm surge level at Fort Denison in Sydney Harbour is 2.4 metres CD (or 1.5 metres AHD), based on measurements taken during the severe 1974 storms (Aurecon, 2019a).

Bathymetry (water depth)

The bathymetry at the proposed ferry wharf site slopes steeply down from 0 metres CD at the seawall to -7.5 metres CD about 25 metres off the seawall at the eastern side of the proposed pontoon location. The maximum depth away from the seawall is about 8.5 metres below CD as recorded in the provided bathymetric survey (Aurecon, 2019a).

Wind conditions

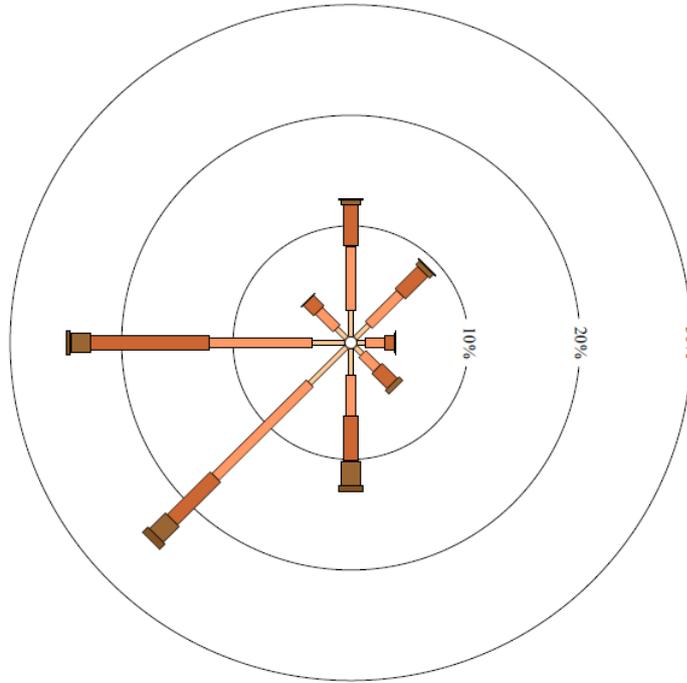
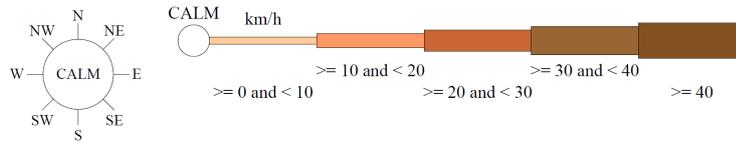
Three common wind patterns are known on Sydney Harbour. The strongest of the three originate from the south (southerlies) and occur about 17 per cent of the time. The most frequent of the three (about 22 per cent of the time) are north-easterlies while the least common of the three patterns are westerlies which usually occur during the winter months (Sydney Institute of Marine Science, 2014).

Sydney Harbour (Wedding Cake West) weather station (station number 066196) is located about 4 kilometres to the east of the proposal footprint. Morning and afternoon wind rose directional data is summarised in Table 6-1 and shown on Figure 6-1. Afternoon winds are generally stronger than morning winds tending towards 20-40 kilometres per hour with morning winds generally 10-30 kilometres per hour (BoM, 2020b).

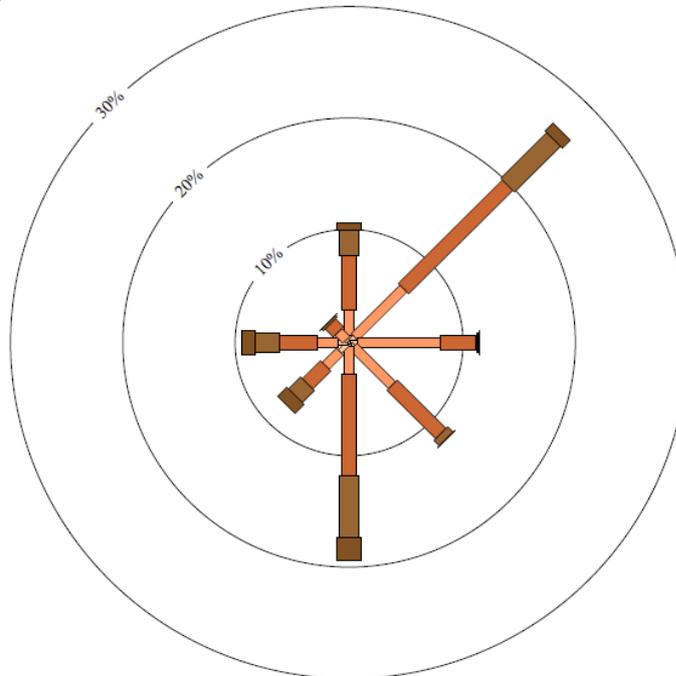
Table 6-1: Wind conditions at Sydney Harbour (Wedding Cake West) weather station (Source: BoM, 2020b)

	N	NE	E	SE	S	SW	W	NW	Calm
9am	12%	9%	4%	5%	12%	25%	25%	5%	3%
3pm	11%	27%	12%	12%	19%	7%	9%	2%	1%

Sydney Harbour (Wedding Cake West) Site No. 066196
 18 September 1997 to 11 August 2019



9am (Calm 3%)



3pm (Calm 1%)

Figure 6-1: Sydney Harbour rose of wind direction versus wind speed (Source: BoM, 2020b)

Geology and sedimentology

Sydney Harbour is a flooded river valley. The Sydney 1:100,000 Geological Series Sheet 9130 (Herbert, 1983) indicates the proposal footprint is underlain by the Hawkesbury Sandstone Formation, comprising medium to coarse grained sandstone with very minor shale and laminate lenses.

Soils

Soils at the proposal footprint are likely to comprise alluvial deposits (comprising sands, sandy clays and clayey sands) of variable depths overlying weathered sandstone.

Most of the estuarine plane layer is likely to be composed of clay and silt, with variable shell content, however the shallow margins close to the shoreline are likely to contain high sand content (Aurecon, 2019b). The high silt and clay content in a marine environment could create concerns with water turbidity associated with construction and low particle settlement rates. The thickness of this layer is variable, with estimates to be made based on available previous investigations (Aurecon, 2019b).

Significant maritime traffic and previous developments and investigations are likely to have disturbed the underlying fluvial sediments in the shallow waters near the wharf (Aurecon, 2019b).

The immediate land-based landscape has been significantly disturbed by human activity, with significant residential development in the area, construction of seawalls along the waterfront and the creation of a park adjacent to the wharf. There is the potential for material to have been imported to site to recontour the landscape and form Kesterton Park area (Cardno, 2020a).

Contamination

Sydney Harbour has extensive areas of polluted sediments mainly associated with the historical industrial character of the catchment. Key potential contamination sources at and near the proposal footprint include contaminated nearshore sediments and stormwater discharge and surface water runoff.

A Stage 2 Contamination assessment was undertaken in 2016 for North Sydney Wharf (Coffey, 2016b). Two sediment samples in the construction footprint were assessed and found:

- The shallow sediments within the top 20 centimetres of the investigation area reported elevated contamination, with copper, lead, mercury, zinc, dichlorodiphenyldichloroethane and endrin detected above trigger levels
- Heavy metals and polycyclic aromatic hydrocarbons (PAH) are known to be present in this part of the Sydney Harbour due to historical industrial activity in the region. Total PAH concentration exceeded the trigger level in one sample and may be attributable to the former gasworks operation to the north of the site.

The study determined that the contamination risk arising from ferry wharf construction are considered medium to high (Coffey, 2016b).

A preliminary site investigation (PSI) was undertaken in 2020 for the North Sydney Wharf (Cardno, 2020a) to identify historical sources of potential contamination or potentially contaminating activities that may have taken place on or adjacent to the proposal footprint. This PSI is provided as Appendix C. A review of the site history identified historical activities with potential to result in contamination, including (Cardno, 2020a, Appendix C):

- Whaling station (coal ash containing PAH and heavy metals, fuels containing total recoverable hydrocarbons (TRH))
- Quarrying (use of steam powered machinery and equipment producing PAH)
- Storage area associated with the defence base and gas works (storage of equipment, fuels and industrial activity)
- HMAS Platypus base and gas works (coal ash containing PAH and heavy metals, fuels containing TRH from boats, and chemical and fuel storage).

A risk assessment conducted as part of the preliminary site investigation (Cardno, 2020a) identified that the proposal area represents a medium residual risk for potential contaminants in sub-surface materials, groundwater and sediment.

A search of the NSW EPA online contaminated land register in April 2020 identified the former gasworks site on High Street at the Sub Base Platypus, Neutral Bay and the associated seabed sediments directly adjacent to the gasworks within close proximity to the proposal footprint. Due to the proximity of the proposal to the formerly regulated areas, the likelihood of soils interacting with contaminated groundwater is considered high (Cardno, 2020a, Appendix C).

There is one premise, the Royal Sydney Yacht Squadron, located near the wharf which is operating under a licence issued under the *Protection of the Environment Operations Act 1997*. The licence is for activities relating to boat construction and maintenance. The premises is located on the Kirribilli Peninsula and is unlikely to impact the proposal.

Acid sulfate soils

The North Sydney LEP does not include Acid Sulfate Soils (ASS) risk maps. As there are no ASS risk maps available for the landside area it is considered unlikely that ASS are present on the land.

A review of the Australian Atlas of Acid Sulfate Soils (ASRIS) on the 5 April 2020 indicated that there is a high probability of occurrence for ASS in the subtidal marine environments.

A study was conducted by Coffey (2016b) to test for the presence of acid sulfate soils within the marine excavation zone. These results showed reducible sulphur concentrations lower than the minimum action criteria stipulated by the *Acid Sulfate Soils Manual* (1998), published by the Office of Environment and Heritage (OEH).

6.1.3 Potential impacts

Construction

Water based

Hydrodynamic effects

The proposal involves activities that would cause physical disturbance to the aquatic environment. This includes piling and the installation of the prefabricated superstructure elements using a barge mounted crane. The scale of the disturbance would be minimal and insufficient to cause any dynamic changes in current speed, wave characteristics, saline/freshwater mixing or flushing.

Localised sediment disturbance and smothering

Potential impacts would be limited by the requirement to undertake the piling work during calm conditions, when there would be the least water movement in the harbour (refer section 0). Potential disturbance of seabed sediments during removal of tidal steps and associated piles would be localised and temporary in nature.

Locally, the distributed coarser sediments would settle out of suspension almost immediately while the finer sediments could mobilise over a greater area as they would remain buoyant in the water column. Disturbance of sediments would be minimised through the work methodology, including progressing the work in sections which would allow sediments to settle between works.

A silt boom and curtain would be deployed around the waterside works of the construction footprint, with further additional safeguards to be detailed in the Construction Environmental Management Plan (CEMP) and supporting environmental work method statement (EWMS), discussed further in section 6.1.4.

Erosion and scour

Any work taking place in the aquatic environment has the potential to cause erosion and scour. This is caused from introducing new structures typically on, or close to, the seabed, as this may alter sediment transport patterns.

Under construction of the proposal, the temporary use of jack-ups/anchors during lifting and piling work would be the only equipment that would impact on the seabed. However, the associated equipment would typically only be in place for a few weeks. Some localised impacts are expected within a few metres of where jack and/or anchor point would be temporarily installed, however this would be an insufficient amount of time to cause any material scour or erosional impacts. The number of jackups/ anchors would be reduced to the minimum required, with the placement of these locations selected to avoid any areas of sensitive habitat. With the introduction of this safeguard and the other standard safeguards described in section 6.1.4, it is concluded that any impacts and be avoided and/or minimised.

Contamination and localised pollutant disturbance

Sediments containing elevated concentrations of selected heavy metals and pesticides have been identified within the proposal footprint (Coffey, 2016b). Other pollutants which may be encountered include:

- Surfactants, oils, fuels, diesels and metals due to stormwater runoff
- Pesticides and heavy metals from stormwater runoff from the surrounding areas.

Notwithstanding the presence of contaminated sediments at the proposal footprint, potential impacts would be minimal due to the limited disturbance of the sediments, and the limited sediment depth on the seabed across the proposal footprint.

As such, despite there being known elevated concentrations of contaminants locally, the scale of disturbance would mean that any additional impacts would be negligible with the implementation of safeguards in section 6.1.4.

Land based

Erosion and sedimentation

Minor earthworks are proposed in Kesterton Park for the construction of the accessible ramp and footpath, and the installation of new parking spaces at the end of High Street. The construction footprint may result in the disturbance of up to 0.06 hectares of the green space in Kesterton Park. Construction works would include the

disturbance of topsoil, bulk earthworks, build up works and regrading for the construction of the new accessible ramp. This includes the construction of a new retaining wall about 40 metres in length. The grassed area of Kesterton Park on the western side of the retaining wall and accessible ramp would be regraded to suit the new ramp and sub-soil drainage. Temporary stockpiling of earthworks materials would occur during construction. Minor cut and fill would be required for the construction of the parking spaces.

Contamination

Potential for contaminated sub-surface soils and sediment was identified. An intrusive soil investigation to the depth of excavation to provide waste classification of the materials to be removed is recommended. An unexpected finds procedure would be implemented if required.

Excavated soil and rock for the road and footpath upgrade works would be temporarily stockpiled on site and backfilled upon completion provided it is not contaminated or weed infested.

Accidental material spill within the compound area may occur from storing, handing and/or transferring the required small volumes of welding materials, lubricants, solvents, fuels, oils and diesels. Potential impacts would be mitigated through the appropriate management of the storage of such materials, and inclusion of spill kits as noted in section 6.1.4.

Operation

Water based

Erosion and scour

Under the proposal, piles for the jetty and ponton (including protection and pivot piles) would be installed. As water flows around these structures there is the potential to create local scour and erosion. In this location, the only expected impacts would be limited to within a few metres of each pile given that:

- The low dynamic character close to the bed around the piles located within the sub-benthic sediments
- The limited amount of sediment substrate locally.

Local sediment conditions would adjust over time.

Sedimentation

Ferry services would resume during operation, with minimal change in ferry movements required to service the new wharf location. As such, no significant impacts from sedimentation are anticipated.

Land based

As described in section 2.5, there are various landside site modifications proposed including:

- Construction at the cul-de-sac to establish the new accessible carpark to be DDA compliant
- Construction of a new footpath / ramp to be DDA compliant from the parking area to the wharf.

No significant impacts to the terrestrial land surface are anticipated during operation as no significant change to existing operations are proposed.

6.1.4 Safeguards and management measures

Table 6-2 lists the safeguards and management measures that would be implemented to protect the land surface and hydrology to account for the impacts identified in section 6.1.3.

Table 6-2: Land surface and hydrology safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Soil and water	LS1	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion, contamination and water pollution and describe how these risks will be addressed during construction.	Contractor	Pre-construction
	LS2	Any excavated sediments or soil that require disposal will be sampled, tested and classified in accordance with the EPA's <i>Waste Classification Guidelines: Part 1 Classifying Waste</i> (EPA 2014) prior to being disposed of at a waste facility licensed to accept the relevant class of waste. Any materials classified as Hazardous Waste may require treatment or an immobilisation approach in accordance with Part 10 of the <i>Protection of the Environment Operations (Waste) Regulation 2014</i> prior to off-site disposal.	Contractor	Construction
	LS3	Clean and suitable topsoil will be stockpiled and reused on site where appropriate.	Contractor	Construction
Contaminated land	LS4	An intrusive soil investigation to the depth of excavation will be undertaken to ensure the safety of construction workers and provide waste classification of the materials to be removed.	Contractor	Construction
	LS5	If unexpected contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager and/or EPA.	Contractor	Construction

Impact	ID	Environmental safeguards	Responsibility	Timing
	LS6	The piling methodology shall seek to mitigate the risk of sediment dispersal.	Contractor	Construction
Erosion and sedimentation	LS7	<p>Site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the SWMP. Control measures are to be implemented and maintained (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book) to:</p> <ul style="list-style-type: none"> • Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site. 	Contractor	Pre-construction
	LS8	<p>Prior to commencement of construction activities, sediment control device (such as sediment boom and curtain) will be installed around the construction footprint to contain disturbed sediment from the water surface by allowing suspended sediments to settle back on the bottom of the seabed overtime. The silt boom and curtain would extend from a minimum of 100 millimetres above the water line to a minimum of 2.5 metres below the water line before starting work.</p> <p>Installation should be undertaken during high tide periods from a boat. The device should be designed to rise and fall with the tide to prevent disturbance. Inspection of the device should be undertaken on a daily basis after ebbing tides, with additional inspection be carried following storm events. Monitoring of turbidity inside and outside of the device should also be performed, using a portable turbidity meter/logger. Prior to removing the sediment control device, conditions within the curtain would be assessed visually and with a field instrument to verify that sediment has settled resulting in similar water turbidity to that outside the curtain.</p>	Contractor	Construction

Impact	ID	Environmental safeguards	Responsibility	Timing
	LS9	<p>Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any potential spills or deficient silt curtains or erosion and sediment controls.</p> <p>Results of the observations of the integrity of the silt curtain are required to be recorded and maintained specifically for the purpose. Records are required to be kept on the site and to be made available for inspection by persons authorised by Transport for NSW.</p>	Contractor	Construction
Erosion and scour	LS10	The number of jack-ups/anchor points will be minimised where possible. The locations will be selected to avoid areas of sensitive habitat.	Contractor	Construction
	LS11	Work associated with positioning barges, drilling and pile driving should occur during calm conditions to prevent excessive scouring and other impacts.	Contractor	Construction

6.2 Water quality

This section describes the existing water quality at the wharf and potential impacts associated with the proposal.

6.2.1 Methodology

Published mapping and data were used to define the hydrodynamic and physical characteristics of the aquatic environment. This included:

- Sydney Harbour Water Quality Improvement Plan (LLS, 2015)
- State of the Beaches Annual Reports 2009-2019 (DECCW, 2009, 2010; OEH, 2011a, 2012, 2013, 2014a, 2015, 2016a, 2017, 2018; DPIE, 2019a)
- Beachwatch Enterococci data download (DPIE, 2020a).

6.2.2 Existing environment

North Sydney is in the Port Jackson catchment of Sydney Harbour (LLS, 2015). The majority of this catchment is residential land use (40 per cent), with roads (20 per cent), commercial (17 per cent) and parklands (11 per cent) making up the majority of the catchment (LLS, 2015). Sewer overflows are also a substantial issue in the catchment. These overflows generally operate during high flow events and discharge a mix of stormwater and untreated sewage (LLS, 2015).

The hydrodynamics of Sydney Harbour play an important role in the state of its water quality. Stormwater is mainly generated under high rainfall events. Sydney Harbour is well flushed near the entrance but poorly flushed in the upper reaches. During high rainfall and consequential stormwater events, pollutants that are discharged near to the outlet can be flushed to the ocean, but otherwise they will linger within the estuaries (LLS, 2015).

In Port Jackson, industrialisation in the Sydney area has caused marine pollution and anthropogenic sediment to be deposited into the harbour. There are several sewer overflow points and stormwater drain discharges throughout the region, thus water quality compliance is varied across the Port Jackson region (LLS, 2015). Pollutants commonly associated with stormwater discharge include:

- Sediment from erosion and stormwater inflows, impacting turbidity
- Pathogens such as faecal coliforms
- Litter and other wastes
- Pesticides from agricultural land uses
- Nutrients and pathogens from fertilizers and sewage overflows
- Heavy metals (in river sediments)
- Other contaminants such as hydrocarbons from oil and fuel leaks.

A review of beach water quality data for the last 10 years for Hayes Street Beach in North Sydney LGA (DECCW, 2009, 2010; OEH, 2011a, 2012, 2013, 2014, 2015, 2016a, 2017, 2018; DPIE, 2019a) indicates that water quality is generally safe for swimming most of the time but can be susceptible to pollution from several potential sources of contamination. Enterococci levels generally increase with increasing rainfall,

regularly exceeding the safe swimming limit in response to 5-10 millimetres of rainfall or more.

6.2.3 Potential impacts

Construction

Pollutants

The main impact to water quality would be from the disturbance to sediments during piling as discussed in section 6.1.3. In addition, removal of the tidal steps and associated piles may result in the disturbance of sediments.

Sediments would generally settle out of suspension within the work area, however finer sediments could mobilise over a greater area as they would remain buoyant in the water column. A silt boom and curtain would be installed around the construction footprint for the duration of the waterside works to contain any sediments.

The removal of the tidal steps and associated piles may result in some debris entering the water. The piles would be either fully removed or cut and capped. Debris would be contained within the sediment curtains and would be removed from the site and disposed of appropriately.

Further mitigation would be implemented through the safeguards detailed in section 6.1.4 and section 6.2.4. Notwithstanding, the construction of the proposal has the potential to result in minor impacts to water quality from encountering contaminants.

Accidental spills

The materials required to upgrade the wharf would be generally inert and harmless except for the small quantities of welding materials, lubricants, solvents, fuels and oils. As such, there would be some potential for accidental spills, including:

- Accidents during loading, unloading and installation work
- Leaks and drips from poorly maintained machinery and equipment
- The mismanaged storage of waste materials, including potential for debris to enter the water.

These risks would be greater when undertaking work over, or in, the waterway namely:

- Drilling / hammering the piles
- Transferring equipment and machinery
- Installing the substructures and superstructures.

The primary impact from spills would be a decline in water quality which would have an impact upon the aquatic environment. The impact would depend on the quantity and type of material spilt. However, providing relevant standard controls, such as those identified in section 6.1.4 and section 6.2.4 are implemented the impacts are expected to be minimised.

Accidental material spill within the compound area may occur from storing, handing and/or transferring the required small volumes of welding materials, lubricants, solvents, fuels, oils and diesels. Potential impacts would be mitigated through the appropriate management of the storage of such materials, and inclusion of spill kits as noted in section 6.2.4.

Operation

No significant impacts to water quality are anticipated for operation of the proposal, as ferries would operate similarly to the current movements, and no additional sediment disturbance is anticipated.

Any impacted stormwater drainage would be reinstalled within the construction footprint to maintain the existing drainage regime, no impact to stormwater quality is anticipated.

There is the potential for an accidental spill or discharge during operation. This would be most likely during berthing at the wharf. While this is the case, the same potential exists from the current operational wharf and would be managed under the standard controls already in place across the ferry network. As such, the impacts are expected to be safeguarded against and therefore minimised.

6.2.4 Safeguards and management measures

Table 6-3 lists the safeguards and management measures that would be implemented to protect the water quality to account for the impacts identified in section 6.2.3.

Table 6-3: Water quality safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Accidental spill	WQ1	<ul style="list-style-type: none"> A spill management plan will be developed and communicated to all staff working on site. Appropriate land and aquatic spill kits are to be maintained on site and on barges. Aquatic spill kits must be specific for working within the marine environment. The spill kit must be appropriately sized for the volume of substances at the work site. All workers will be advised of the location of the spill kit and trained in its use. 	Contractor	Pre-construction / Construction
	WQ2	If an incident (e.g. spill) occurs, the Transport for NSW <i>Environmental Incident Classification and Reporting Procedure</i> is to be followed and the Transport for NSW Contract Manager notified as soon as practicable.	Contractor	Construction
	WQ3	In the event of a maritime spill, the incident emergency plan will be implemented in accordance with Port Authority of NSW's response to shipping incidents and emergencies outlined in the <i>NSW State Waters Marine Oil and Chemical Spill Contingency Plan</i> (Maritime, 2012).	Contractor	Construction
	WQ4	Emergency contacts will be kept in an easily accessible location on vehicles, vessels, plant and site office. All workers will be advised of these contact details and procedures.	Contractor	Pre-construction / Construction
	WQ5	Vehicles, vessels and plant must be properly maintained and regularly inspected for fluid leaks.	Contractor	Construction

Impact	ID	Environmental safeguards	Responsibility	Timing
	WQ6	No vehicle or vessel wash-down or re-fuelling will occur on-site.	Contractor	Construction
	WQ7	Any chemicals or fuels stored at the site or equipment barges will be stored in a bunded area.	Contractor	Construction
Pollution-	WQ8	An environmental work method statement (EWMS) will be developed for the removal of the existing tidal steps and piles to minimise the risk of pollutants and debris entering the waterway. The EWMS must be approved by Transport for NSW prior to the demolition of part of the existing wharf structure.	Contractor	Pre-construction

6.3 Biodiversity

This section summarises the proposal's aquatic and terrestrial biodiversity. Appendix D contains a supporting paper prepared by Cardno (Cardno, 2020b).

6.3.1 Methodology

The assessment included a desktop review of published State and Commonwealth records, data and literature to confirm the likely presence of threatened flora, fauna and endangered communities in the local environment. This was followed by a site walkover and aquatic survey of the marine environment covering an area extending to about 50 metres from the proposal footprint. The biodiversity study area is shown on Figure 6-2. The study locality refers to an area within five kilometres of the proposal footprint (for the purpose of the background search).

The following published records were reviewed:

- Soil Landscapes of the Sydney 1:100, 000 Sheet (Chapman and Murphy, 1989)
- Native Vegetation of the Sydney Metropolitan Area – Version 3.1 VIS_ID 4489 (OEH, 2016b)
- NSW Department of Planning, Industry and Environment – Environment, Energy and Science (DPIE-EES) vegetation information system (VIS) Classification.
- NSW BioNet: containing information on threatened and protected species
- NSW DPIE-EES Threatened Biodiversity Data Collection
- NSW Department of Primary Industries (DPI) Fish Communities and Threatened Species Distribution of NSW (NSW DPI, 2016a)
- NSW DPI Threatened species lists and Listed Protected Fish Species
- NSW DPI Mapping the Habitats of NSW Estuaries (Creese, et al., 2009)
- Commonwealth DAWE (formerly DoE) Protected Matters Search Tool (PMST) containing information on Commonwealth protected species
- National System for the Prevention and Management of Marine Pest Incursions: for information on marine pests.

The impact assessment was prepared in accordance with *Environmental Impact Assessment Practice Note: Biodiversity Assessment* (EIA-N06, Roads and Maritime Services, 2016c) with consideration of the:

- *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RTA, 2011)
- *Guidelines for Biodiversity Offsets* (Roads and Maritime, 2016a).

Further detail on the methodology for the assessment of aquatic biodiversity is provided in Appendix D.

6.3.2 Existing environment

Water based

Protected areas

There are no Coastal Wetland or Littoral Rainforests, as defined in the Coastal Management SEPP, in the study area. The closest Coastal Wetland is over three kilometres north-west of the study area at Gore Cove Reserve. The closest Littoral Rainforest is about two kilometres east of the study area at Great Sirius Cove.

There are no nationally important wetlands or Ramsar Wetlands in the study area or the wider study locality. The Parramatta Estuary is considered an estuarine wetland (Kingsford, *et al.*, 2004).

No Aquatic Reserves or Marine Parks occur within the study area or the study locality.

Fish habitat

The marine portion of the study area comprised of the artificial seawall and the subtidal areas surrounding Kesterton Park. The harbour is mapped as Key Fish Habitat (KFH) and is estuarine thus, considered a Class 1 waterway – Major KFH (NSW DPI, 2013; NSW DPI, 2020a).

No seagrass, mangroves or saltmarsh were recorded within the study area.

DPI Fisheries identify three types of key fish habitat (KFH) in their *Policy and Guidelines for Fish Habitat Conservation and Management* comprising:

- Type 1 (highly sensitive KFH)
- Type 2 (moderately sensitive KFH)
- Type 3 (minimally sensitive KFH).

Two distinct fish habitat zones were mapped during the field survey:

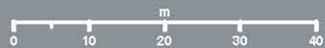
- Subtidal rocky reefs (Type 2 KFH) – Subtidal rocky reefs abutted the sandstone seawall and extended further into Neutral Bay at the southern end of the study area than along the foreshores of the existing wharf. The piles of the existing wharf also formed a platform for colonisation for intertidal and subtidal habitat-forming species. Subtidal rocky reef communities also colonised the vertical areas on existing piles and the bottom one and a half tidal steps
- Soft sediments (Type 3 KFH) – Soft sediment habitats were sparsely littered with rock rubble, shell grit and solid waste materials.

Aquatic habitat within the study area is shown in Figure 6-2.



FIGURE 6-2

1:1,000 Scale at A4



Aquatic habitat and terrestrial vegetation within study area

NORTH SYDNEY



Map Produced by Cardno NSW/ACT Pty Ltd (00 01)
 Date: 2020-09-28 | Project: AWE200198
 Coordinate System: GDA 1984 MGA Zone 56
 Map: AWE200198_GS018_NSydney_AquaticHabitat_REF.mxd 02
 Aerial imagery supplied by Nearmap (April, 2020)

Threatened and protected flora

No threatened species were observed during the field survey.

All marine vegetation, including seagrass, saltmarsh, mangroves and macroalgae, are protected under the FM Act. The study area does not encompass seagrass, saltmarsh or mangroves however, macroalgae was observed colonising intertidal and subtidal rocky reefs. Macroalgae are considered as marine vegetation and Division 4 of the FM Act protects marine vegetation from 'harm' in the form of gathering, cutting, pulling up, destroying, poisoning, digging up, removing, injuring or preventing light from reaching or otherwise harm marine vegetation or any part of it.

The closest estuarine mangroves and saltmarsh is located around 400 metres north-east of the study area in Neutral Bay; and a meadow of the threatened seagrass population, *Posidonia australis*, is located around 300 metres north of the study area.

Threatened and protected fauna

A review of the DPIE-EES BioNet database, NSW DPI Threatened species list and the DAWE PMST revealed 40 aquatic-related threatened species with potential to occur in the study locality. A full list is provided in Appendix D.

No threatened species were observed during the field survey, however, potential habitat for some threatened species were recorded in the study area. An assessment of the likelihood of occurrence of all threatened species based on the study area habitat were carried out to determine the potential for these species to occur within the study area.

Due to the presence of suitable habitat in the study area and/or known populations in the harbour, two species were considered to have a high likelihood of occurrence.

These are:

- White's Seahorse (*Hippocampus whitei*) listed as endangered under the FM Act
- Black Rockcod (*Epinephelus daemeli*) listed as endangered under the FM Act and vulnerable under the EPBC Act.

Some species of fish have been formally protected because they are naturally scarce or their numbers have been substantially reduced over recent decades. These species are protected to help prevent them becoming threatened in the future. The FM Act and the EPBC Act provide for the protection of species. Twenty-three fish and syngnathids were identified as having a moderate to high likelihood of occurrence in the study area. These are listed in Section 3.12 of Appendix D.

The marine vegetation and subtidal areas of the study area form potential habitat however, marine vegetation and subtidal habitat features are not unique to the study area and are widespread throughout the harbour, similar to the distribution of these species.

Pests

Like a great number of other estuaries and waterways, Sydney Harbour is at risk of infestation from the marine pest *Caulerpa taxifolia* (DPI, 2013). *Caulerpa taxifolia* is a fast-growing marine alga native to tropical Australia and the South Pacific (NSW DPI, 2016b). This species is known to alter physical and chemical habitat affecting biodiversity. Populations have been recorded in Port Jackson at Neutral Bay, Mosman, Clifton Gardens, Rushcutters Bay, Double Bay, Rose Bay and many locations in North Harbour and Middle Harbour. Although this species has been mapped to occur in Neutral Bay, it was not detected in the study area. *Caulerpa taxifolia* is known to spread via fishing and boating activities as well as natural hydrology and has potential to occur in the study area.

Underwater noise sensitivity

Large megafauna and fish are sensitive to the impacts of underwater noise. While they can perceive piling generated noise up to 400 metres from its source, they typically avoid coming within 30 metres (Engell-Sorensen, 2000). If they do come within 30 metres of any piling work, then they could be injured or harmed through hearing loss or in extreme instances they can be killed (a term known as acoustic shock).

Land based

Protected areas

The study area does not fall in or is next to any National Parks, Conservation Reserves, Nature Reserves or Regional Parks. The closest National Parks estate is the Fort Denison, which forms part of Sydney Harbour National Park, about 1.5 kilometres south of the study area.

Terrestrial vegetation and habitat

The study area is located on reclaimed land thus, the vegetation within the study area is not remnant or classified as Plant Community Types (PCTs). The foreshores of Neutral Bay are highly urbanised with little to no remnant vegetation. Landscaped gardens, plantings and open park areas characterised the vegetated areas within the study area. These gardens and open park areas occupy about 0.18 hectares of the study area. The remaining areas above Highest Astronomical Tide (HAT) were hardstands (e.g. roads, footpaths etc.).

Mature trees in the study area included Smooth-barked Apple (*Angophora costata*), Spotted Gum (*Corymbia maculata*), Bangalay (*Eucalyptus botryoides*) and Swamp Oak (*Casuarina glauca*) and were planted at the northern and southern ends of Kesterton Park. A row of three young Wildfire (*Corymbia ficifolia*) and one Smooth-barked Apple (*Angophora costata*) fringe the footpath along the water's edge. Another Wildfire, of around the same age, was recorded with the cluster of Swamp Oaks at the southern end of Kesterton Park. Wildfire is a re-flowering Eucalypt native to the south coast of Western Australia and frequently planted in other states. Terrestrial vegetation within the study area is shown in Figure 6-2.

A full list of flora species recorded in the study area is provided in Appendix D.

Although there was no remnant vegetation within the study area, the landscaped gardens and open park areas form potential habitat for a number of species. Trees and vegetation may provide foraging, roosting and breeding resources for birds and arboreal mammals. Microbats may also roost in the crevices of existing wharf and terminal structures during the day.

Threatened species and populations

A review of the DPIE-EES BioNet database, NSW DPI Threatened species list and the DAWE PMST identified 104 threatened and protected species with potential to occur in the study locality. A full list is provided in Appendix D.

Due to the presence of suitable habitat in the study area and/or known populations in the harbour, six species were considered to have a moderate to high likelihood of occurrence. These are:

- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) listed as vulnerable under the BC Act
- Little Bent-winged Bat (*Miniopterus australis*) listed as vulnerable under the BC Act

- Large Bent-winged Bat (*Miniopterus orianae oceanensis*) listed as vulnerable under the BC Act
- Southern Myotis (*Myotis macropus*) listed as vulnerable under the BC Act
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) listed as vulnerable under the BC Act
- Grey-headed Flying Fox (*Pteropus poliocephalus*) listed as vulnerable under the BC Act and the EPBC Act.

Weeds

No priority weeds listed under the *Biosecurity Act 2015* were recorded in the study area.

6.3.3 Potential impacts

Construction

Aquatic

Direct loss of aquatic vegetation and habitat

Direct impact from construction of the proposal would result from the installation of eleven new piles. Three of these piles (508 millimetres in diameter) would be drilled into low-medium relief rocky reef, close to the existing seawall to support the jetty structure while the remaining eight piles (four 914 millimetres in diameter and four 457 millimetres in diameter) would be driven into subtidal soft sediment habitat in deeper water.

The area of low-medium relief rocky reef (Type 2 KFH) (<0.01 hectare) and soft sediment habitat (Type 3 KFH) (0.05 hectare) under the footprint of the piles would be permanently lost while the anchor areas for the barge during construction would be temporarily impacted. This would include the direct removal of macroalgae and sessile marine fauna from subtidal rocky reefs and epifauna and infauna from soft sediment habitats. However, the rocky reef and soft sediment habitats in the study area are characteristic of the majority of subtidal habitat in the harbour and community assemblages are generally ubiquitous and quick to recolonise following disturbance. Thus, the loss of these small areas would not be a substantial loss and anchor areas in soft sediment would quickly recolonise following the removal of the anchors.

The removal of the tidal steps and associated piles of the existing structure would also result in the removal of marine vegetation, habitat and sessile/less mobile fauna on the piles and concrete steps. This constitutes a total vertical marine vegetation/habitat area of about 0.01 hectares. These existing structures are currently densely colonised and the majority of these species are common in other intertidal areas and subtidal rocky reefs and would quickly colonise the piles and pontoon of the new wharf. The total vertical submerged area of the new wharf available for colonisation is about double the vertical area to be removed (about 0.02 hectares). There is potential that the materials proposed for the new piles may not be suitable for colonisation in which case, the marine assemblage on the removed structures could be permanently lost.

Considerations during detailed design to promote colonisation of habitat-forming species could include the installation of structures which provide habitat complexity (e.g. designs available as part of the Living Seawalls Project).

A summary of the area of aquatic habitat directly or indirectly impacted by the proposal is provided in Table 6-4.

Table 6-4: Area of marine vegetation and habitat impacted by the proposal

Vegetation and habitat	Area directly or indirectly impacted (hectares)
Intertidal rocky reef	<0.01 (vertical area only)
Vertical submerged marine vegetation/habitat (intertidal and subtidal)	0.01 (vertical area on existing structures)
Low and medium relief subtidal rocky reef (Type 2 – Moderately sensitive KFH)	<0.01
Soft sediment (Type 3 – Minimally sensitive KFH)	0.05

Indirect impacts to aquatic vegetation and habitat

There is potential for coarse and fine debris to be mobilised during piling, removal of existing structures and vessel movement. This can crush, damage and/or smother marine vegetation and habitat depending on the size of debris. Larger debris would be disposed offsite and should not cause any impacts to marine biodiversity. Mobilisation of finer debris (i.e. sediments) can also result in the mobilisation of contamination known to persist in study area sediments. Depending on the volume and the size of fine debris, wave, tide and current actions, finer particles may not reside in the area for long and this may only be a temporary nuisance to marine assemblages. Furthermore, Neutral Bay and the wider harbour periodically experiences impacts from elevated turbidity, usually as a result of rainfall, tides and swell. Thus, marine assemblages in the study area are likely to be frequently exposed to these conditions and the proposal is unlikely to introduce vastly different conditions.

Water-based construction activities would result in vessel and barge movements in and around the study area. This has potential to increase the frequency of vessel wash impact on intertidal and subtidal rocky reefs and the scour of soft sediment areas. Marine vegetation and sessile fauna can be scoured from the rocky reefs and epifauna, including scattered colonies of macroalgae on hard substratum, and infauna in soft sediment habitats can be removed/relocated. As large and small vessels currently frequent the study area, the community assemblages are likely to be well adapted to vessel wash and scour. Thus, impacts as a result of vessel and barge movements are unlikely to substantially impact marine biodiversity in the study area.

Water-based activities have potential to impact habitat for the Southern Myotis, Black Rockcod and White's Seahorse. The foraging resource that the study area represents would be made available for these species following the completion of construction thus, proposal impacts to potential foraging habitat for these species are only temporary. The loss of potential habitat from the installation of two piles on subtidal rocky reef (506 millimetres in diameter each) and the removal impact of part of the existing structure is considered minimal for Black Rockcod and White's Seahorse. This is a very small proportion of available habitat in their distribution and the installation of new piles would provide similar, if not the same habitat for these species during operation. Additional controls would be implemented to survey for Black Rockcod and White's Seahorse at the start of construction so that individuals in the area at the start of construction are not harmed.

Injury and mortality

Proposal construction activities are unlikely to substantially impact on mobile marine fauna occurring within the study area. Fish are highly mobile and temporary disturbance from the movement of vessels, piling and removal of structures would be

minor, as similar and higher condition habitat are abundant and wide-ranging in the harbour.

An increase in vessel and barge activity during construction is associated with an increased risk of vessel strikes with marine turtles and mammals. The proposal footprint is considered suboptimal habitat for most marine mammals and very few individuals, if any, would occur during construction. The increased risk, however, is proportional to the increase in vessel traffic for the proposal relative to overall vessel traffic. This proportional increase is considered to be very small.

Underwater noise and vibration

Tolerance to changes in noise, vibration and water quality may vary among species, but the response is generally similar to these types of activities in a busy harbour (i.e. movement away from unfavourable conditions). Marine fauna in the harbour are likely to be exposed to an ambient level of noise from existing marine activities. These species are also likely to recolonise the study area once conditions return to pre-construction levels.

Terrestrial

Loss of vegetation and habitat

The proposal would remove 0.06 hectares of landscaped gardens and parks. This includes mostly mown Buffalo grass in the open areas of Kesterton Park and *Carex* sp. and Guinea Flower in the garden bed along the water's edge. In this 0.06 hectares of landscaped gardens and parks, three juvenile Wildfire trees and one Smooth-barked Apple would also be removed.

Vegetation to be removed does not form any remnant PCTs but does form potential habitat for some highly mobile, disturbance tolerant native fauna. The removal of vegetation as a result of the proposal would remove potential habitat for native fauna. However, the overstorey and groundcover species to be removed forms only a small portion of similar habitat along the fragmented and highly urbanised foreshores of Neutral Bay. The removal of habitat resources is unlikely to have a substantial impact on native fauna as there is an abundance of similar habitat across the study locality. The majority of vegetation to be cleared is associated with the establishment of the construction compound. Thus, following the decommissioning of the construction compound (i.e. completion of construction), up to 0.05 hectares of the compound site would be restored and landscaped as part of Kesterton Park.

Weed invasion

Disturbance of vegetation can result in the introduction or spread of exotic flora (i.e. weeds). This can occur by the spread of opportunistic exotic vegetation from adjacent private properties or new species can be introduced via equipment, plant and footwear. Any foreign equipment or materials brought onto the construction site also has potential to introduce diseases such as Phytophthora (*Phytophthora cinnamomi*) and Myrtle Rust (*Puccinia psidii*). The vegetation and habitat in the study area and the surrounding areas are susceptible to weeds and diseases if not managed during construction.

Erosion and sedimentation

Vegetation clearing and grubbing would expose soils and components of landfill which can then be easily mobilised. Contaminants in the soil and landfill can also be subsequently released into the surrounding environment albeit material leaching is currently potentially occurring (Cardno, 2020a). Erosion and sedimentation is most likely to impact harbour waters, particular during inclement weather (e.g. rainfall, high winds) if controls are not implemented. This could result in unfavourable, turbid

conditions, the smothering of sessile marine vegetation, habitat and fauna and water, sediment and biota contamination in Neutral Bay and even the wider harbour.

Operation

Aquatic

The jetty, gangway and pontoon components of the proposal would sit permanently on or above the water's surface and avoid impacts to the seabed. However, these structures would shade a portion of intertidal rocky reef, subtidal rocky reef and subtidal soft sediment habitat. As a result, less than 0.01 hectares of subtidal rocky reef habitat assemblage may change and result in a reduction of macroalgae. This impact area is a very small proportion of subtidal rocky reef habitat in the study area and the wider harbour and is not considered ecologically significant.

Shading of intertidal and soft sediment habitat (about 0.05 hectares) is not expected to substantially change community assemblages as these areas generally lack marine vegetation. The removal of part of the existing wharf structure would leave a small portion of soft sediment habitat (<0.01 hectares) exposed to sunlight. This is not expected to have any substantial impacts to soft sediment communities.

The relocation of the ferry terminal also translates to the relocation of localised ferry wash and underwater turbulence. Neutral Bay currently experiences substantial vessel traffic and ferry routes are likely to vary from time to time. Impacts from the small changes to the docking and departing ferry route at the new terminal are unlikely to be detectable in the highly variable boating environment of Neutral Bay. There is potential for soft sediment habitat to be scoured where the ferry jets would be located while docking and departing the new terminal, however, these habitats are quick to recover. Sediment mobilisation from ferry jets may affect nearby rocky reef habitat, however, communities in the study area are likely to be well-adapted to turbidity and sedimentation from stormwater runoff and from existing vessel traffic.

The structures of the new terminal are not expected to substantially alter coastal processes or hydrology of the study area or the wider harbour. The proposal would install eight piles and a floating pontoon while removing a set of concrete intertidal steps and associated piles. The size of these structures are small in comparison to the extent of the estuary thus would not interfere with fish passage. Due to the size of these structures in proportion to the estuary, alterations to hydrodynamics are likely to be localised and unlikely to produce substantial impacts to marine biodiversity.

Terrestrial

As there is not expected to be any change to passenger numbers or operational activities around the wharf there is limited potential for any operational terrestrial ecology impacts.

Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the EPBC Act. A referral to the Australian Government Department of Agriculture, Water and Environment (DAWE) is not required for biodiversity matters.

6.3.4 Safeguards and management measures

Table 6-5 lists the biodiversity safeguards and management measures that would be implemented to account for the impacts identified in section 6.3.3.

Table 6-5: Biodiversity safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Biodiversity	B1	Integrate the management of flora and fauna into the construction environmental management plan (either as a standalone flora and fauna management plan or a subplan). This is to include all terrestrial and marine flora and fauna.	Contractor	Pre-construction
	B2	Retained vegetation in close proximity to construction activities (e.g. south-western corner) will not be damaged or removed and mitigation measures identified in the <i>Arboricultural Assessment Report: North Sydney Wharf High Street, North Sydney</i> (Earthscape Horticultural Services, 2020) will be implemented.	Contractor	During construction
Removal of native vegetation, threatened species habitat and habitat features	B3	Native vegetation and habitat removal will be minimised through detailed design.	Transport for NSW	Detailed design
	B4	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Pre-construction
	B5	Vegetation and habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction
	B6	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Detailed design / Post construction

Impact	ID	Environmental safeguards	Responsibility	Timing
		Replacement planting (species and number) will be determined in consultation with North Sydney Council to reinstate habitat and minimise impacts to the visual characteristics of Kesterton Park.		
	B7	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the project site.	Contractor	Construction
Removal of marine vegetation and habitat	B8	Considerations during detailed design to promote colonisation of habitat-forming species could include the installation of structures which provide habitat complexity (e.g. designs available as part of the Living Seawalls Project).	Transport for NSW	Detailed design
	B9	Direct removal of marine vegetation and habitat limited to the footprint of the eleven piles and some minor anchoring during water-based construction activities.	Contractor	Construction
	B10	Minimise anchoring where possible and avoid anchoring on subtidal rocky reef habitat.	Contractor	Construction
	B11	Complete a targeted survey for Black Rockcod and White's Seahorse within 24 hours prior to the commencement of water-based construction activities. Black Rockcod individuals should be encouraged to move away from the study area and White's Seahorse should be captured and relocated to nearby similar habitat. A White's Seahorse relocation plan (including other Synghathids as per DPI Fisheries advice on 9 September 2020) should be developed in consultation with DPI Fisheries to dictate this activity.	Transport for NSW	Pre-construction
	B12	A Section 37 permit under the FM Act to relocate Syngnathids collected during the targeted pre-clearance survey would be required as part of the White's Seahorse relocation. Alternatively, a provision can be added to a	Transport for NSW	Pre-construction

Impact	ID	Environmental safeguards	Responsibility	Timing
		Part 7 Permit under Section 205 of the FM Act to include approval for Syngnathid relocation.		
Aquatic impacts	B13	Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (NSW DPI, 2013).	Contractor	Construction
	LS8	<p>Prior to commencement of construction activities, sediment control device (such as sediment boom and curtain) will be installed around the construction footprint to contain disturbed sediment from water surface by allowing suspended sediments to settle back on the bottom of the seabed overtime. The silt boom and curtain would extend from a minimum of 100 millimetres above the water line to a minimum of 2.5 metres below the water line before starting work.</p> <p>Installation should be undertaken during high tide periods from a boat. The device should be designed to rise and fall with the tide to prevent disturbance. Inspection of the device should be undertaken on a daily basis after ebbing tides, with additional inspection be carried following storm events. Monitoring of turbidity inside and outside of the device should also be performed, using a portable turbidity meter/logger. As with installation, decommissioning should be carried out by boat during high tide periods.</p>	Contractor	Construction
	LS11	Work associated with positioning barges, drilling and pile driving should occur during calm conditions to prevent excessive scouring and other impacts.	Contractor	Construction
	WQ1	<ul style="list-style-type: none"> A spill management plan will be developed and communicated to all staff working on site. 	Contractor	Pre-construction / Construction

Impact	ID	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> Appropriate land and aquatic spill kits are to be maintained on site and on barges. Aquatic spill kits must be specific for working within the marine environment. The spill kit must be appropriately sized for the volume of substances at the work site. All workers will be advised of the location of the spill kit and trained in its use. 		
	B14	Piling to stop if marine mammals are observed within 100 metres of the project area and only to recommence once they have moved beyond 100 metres of the proposal footprint or are not seen for at least 20 minutes.	Contractor	Construction
Changes to coastal processes	B15	The detailed design should aim to avoid/minimise any impact to coastal processes and hydrology.	Transport for NSW	Detailed design
Injury and mortality of fauna	B16	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction
Invasion and spread of weeds, pests and diseases	B17	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction
	B18	Pest species will be managed within the project site.	Contractor	Construction
	B19	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction
	B20	Water-based equipment and vessels to be sourced from local suppliers. Equipment and vessels must be cleaned and inspected prior to entering the project site.	Contractor	Construction

Impact	ID	Environmental safeguards	Responsibility	Timing
	B21	Occurrence of any marine pests must be reported to DPI Fisheries.	Contractor	Construction
Noise, light and vibration	B22	Shading and artificial light impacts will be minimised through detailed design.	Transport for NSW	Detailed design

6.3.5 Biodiversity offsets

The proposal is not expected to clear any remnant native vegetation (or PCTs) and would only clear up to 0.06 hectares of landscaped native/exotic vegetation. Offsets are not required for the clearing of this vegetation.

The proposal is expected to impact less than 0.01 hectares of marine vegetation on subtidal rocky reefs as well as about 0.01 hectares of vertically colonised marine vegetation on the existing wharf structures to be removed. About 0.02 hectares of submerged surface area would be available for recolonisation of marine vegetation and other habitat-forming species as part of the new wharf to replace the areas removed during construction. A permit under Section 205 of the FM Act would be required to 'harm' marine vegetation as per the definition in section 3.12. Any additional offset requirements for this would be determined in consultation with DPI Fisheries during the permit application.

6.4 Noise and vibration

This section summarises the proposals noise and vibration impacts. Appendix E contains a supporting technical paper prepared by Cardno (Cardno 2020c).

6.4.1 Methodology

Construction assessment

The construction assessment reviewed how the proposed activities, methods and scheduling described in Chapter 3 would affect noise and vibration sensitive receivers in the local area. The assessment was completed in accordance with the *Construction Noise and Vibration Guideline* (CNVG, Roads and Maritime, 2016b). Noise levels from construction works were predicted using 3D noise modelling software (SoundPLAN).

Operational assessment

The operational assessment included qualitative consideration of any amenity noise change from using the upgraded wharf in its new location.

6.4.2 Existing environment

Noise monitoring and ambient noise levels

Existing noise levels surrounding the proposal were determined through unattended noise monitoring between 20 April 2020 and 7 May 2020. Details of noise monitoring locations and results are identified in Table 6-6. Monitoring for unattended survey was performed across three time spans: day, evening and night. Figure 6-3 displays the logger locations.

The existing acoustic environment is generally dominated by road traffic noise on local roads, noise from boats on the harbour and distant traffic due to the wharf's proximity to the Sydney Harbour Bridge.

Table 6-6: Unattended noise monitoring locations and noise levels

ID	Location	Noise Level (dBA RBL ¹)		
		Day ²	Evening ²	Night ²
Logger 1	Kurraba Reserve, Kurraba Point	45	42	38
Logger 2	Kesterton Park, North Sydney	45	40	34

1. RBL – rating background level. The overall single-figure background level representing each assessment period (daytime/evening/night-time) as defined in the NSW Noise Policy for Industry (EPA 2017)
2. Time periods defined as – Day: 7am to 6pm Monday to Saturday, 8am to 6pm Sunday; Evening: 6pm to 10pm; Night: 10pm to 7am Monday to Saturday, 10pm to 8am Sunday.

It should be noted that the background noise monitoring was conducted during COVID-19 and may represent non-typical background noise levels on this basis. Therefore, background noise levels would need to be re-determined (with short term monitoring) prior to construction to ensure that they are similar to those measured, and used as a basis for the noise management levels in this REF.



Figure 6-3: Noise logger locations

Sensitive receivers

The existing wharf is surrounded by a range of noise sensitive receivers, mostly residential. Non-residential receivers include recreational areas such as Kesterton Park, Milsons Park and Sub Base Platypus and educational facilities such as Loreto Kirribilli School.

Sensitive receivers around the proposal are listed in Table 6-7 and shown in Figure 6-4.

Sensitive receivers were assessed through the consideration of noise catchment areas (NCAs) and are shown in Figure 6-5.

Table 6-7: Sensitive receivers and land uses around the proposal

Label	Description	Land use
1	Kurraba Reserve	Passive Recreation
2	Residential North/East	Residential
3	Residential West	Residential
4	Sub Base Platypus	Defence Facility
5	Kesterton Park including the locally listed heritage shelter and seawall (within the curtilage of Kesterton Park)	Passive Recreation
6	Milson Park	Passive Recreation

Label	Description	Land use
7	Residential South/West	Residential
8	Our Lady of The Sea Catholic Church	Place of Worship
9	Residential SSW	Residential
10	Loreto Kirribilli School	School
11	Residential South	Residential
12	Theatre	Theatre
13	Wrixton Park	Passive Recreation
14	Yacht Squadron	Community Facility
1	Kurraba Reserve	Passive Recreation
2	Residential North/East	Residential



Figure 6-4: Sensitive receivers and surrounding land uses



Figure 6-5: Noise catchment areas

6.4.3 Criteria

The Roads and Maritime *Construction Noise and Vibration Guideline* (Roads and Maritime 2016) (CNVG) provides a framework for the assessment of noise during the construction phase of the proposal. The CNVG references the following documents to provide the criteria for the assessment of construction noise and vibration impacts:

- EPA *Interim Construction Noise Guideline* (ICNG)
- EPA *Assessing Vibration – Technical Guideline*
- EPA *Road Noise Policy* (RNP).

The CNVG provides recommended minimum separation distances between vibration intensive plant and sensitive receivers for minimising the risk of cosmetic damage. The CNVG further states that the minimum working distance for cosmetic damage must be complied with at all times, unless otherwise approved by Transport for NSW or under the environmental licence as relevant.

Construction noise assessment criteria

Works may be carried out, outside of standard hours due to the nature of the proposal. For this reason, noise management levels (NMLs) have been calculated for both standard and non-standard hours. The NMLs are detailed in Table 6-8 and are based on the measures RBLs and the noise criteria detailed in the INCG.

Table 6-8: Noise management levels for each noise catchment area

NCA	Noise Management Level, dB(A)			*Sleep Disturbance L _{A1} , 1 min
	Standard Hours (RBL + 10 dB(A))	Outside Standard Hours (RBL + 5 dB(A))		
	Day	Evening	Night	
1	55	47	43	60
2	55	45	39	60

*Sleep disturbance criteria has been calculated based on an assumed typical internal LAeq noise level of 35 dB(A) referenced from Australian Standard AS:2107 and corrected with a typical inside to outside noise reduction of 10 dB(A).

Construction vibration assessment criteria

The minimum working distance for vibration intensive plant from sensitive receivers is listed in Table 2 of the CNVG. Table 6-9 presents these recommended minimum working distances for specific construction activities.

Table 6-9: Recommended minimum working distances for vibration intensive plant from sensitive receivers

Plant item	Rating / Description	Minimum working distance		
		Cosmetic Damage (BS 7385)	Cosmetic damage (DIN 4150) Heritage and other sensitive structures	Human Response (OH&E Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	14 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	16 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	33 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	41 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	54 m	100 m
	> 300 kN (> 18 tonnes)	25 m	68 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	19 m	23 m

Plant item	Rating / Description	Minimum working distance		
		Cosmetic Damage (BS 7385)	Cosmetic damage (DIN 4150) Heritage and other sensitive structures	Human Response (OH&E Vibration Guideline)
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	60 m	73 m
Vibratory Pile Driver	Sheet Piles	2 m to 20 m	50 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	40 m	4 m
Jackhammer	Hand Held	1 m (nominal)	2 m	2 m

6.4.4 Potential impacts

Construction

Construction stages

For assessment of construction and vibration impacts, six scenarios were determined to identify various construction stages. Table 6-10 identifies the construction stages.

Table 6-10: Modelled construction stages

Stage No.	Description
1a	Site establishment
1b	Demolition
2	Construction of Land Side Works
3a	Installation of Steel Piles Within Waterway – Drilling (outside of standard hours)
3b	Installation of Steel Piles Within Waterway – Hammering (outside of standard hours)
3c	Installation of Steel Piles Within Waterway – Piling (outside of standard hours)
3d	Installation of Steel Piles Within Waterway – Day Works
4	Installation of Pontoon and Gangway
5	Installation of New and Improved Facilities
6	Site Clean Up

Activity based noise

Each level of construction staging would include various types of equipment and be used during various times of the day. Table 6-11 lists the types of equipment and relevant sound power levels that would occur during construction and identify what scenario equipment would be used. The table also identifies the scenario total sound power level (SWP).

Table 6-11: Plant and associated sound power levels

Plant	SPL*	1a	1b	2	3a	3b	3c	3d	4	5	6
Barge Crane	110								1		
Bobcat	105									1	1
Chainsaw	114			1							
Concrete Pump	109							1			
Concrete Truck	109							1			
Day-maker	98				2	2	2	2			
EWP	98	1									
Excavator	108		1	1	1	1				1	
Floating Boom (Crane)	105	1	1								
Franna Crane	98	1								1	1
Generator	98			1	1	1	1	1	1		
Hand Tools	94								1	1	
Jack Hammer	115			1							
Oxy Acetylene Cutting	96				1	1	1	1			
Pavement Profiler	117			1							
Piling Rig (Screw)	112						1				
Pneumatic Drill	115		1								

Plant	SPL*	1a	1b	2	3a	3b	3c	3d	4	5	6
Pneumatic Hammer	115					1					
Road Truck	108	1									1
Rock Breaker (mounted)	118		1								
Rock Drill	118				1						
Truck	110				1	1	1	1			
Truck (medium rigid)	103	1		1					1	1	1
Tug Boat	108										1
Vibratory Roller	109			1							
Work Boat	108		1		1	1	1	1	1	1	
Total L _{Aeq}		111	121	121	119	118	116	116	113	113	113

* SPL – Sound Power Level, L_{Aeq}, dB(A)

Predicted construction noise levels

The predicted noise impact from construction activities in the form of noise contour maps and predicted levels at discrete receivers is presented in Appendix E. Predicted construction noise levels at each modelled NCA for each scenario are shown in Table 6-12. The levels represent the worst case predicted noise impact at the most affected receivers in each NCA. Noise levels as a result of construction activities are predicted to be lower than these levels for the remaining receivers within each associated NCA.

Table 6-12: Noise impact summary

Criteria / Scenario	NCA1	NCA2
NML standard hours (dBA)	55	55
NML out of hours (evening) (dBA)	47	45
NML out of hours (night) (dBA)	43	39
Highly noise affected (dBA)	75	75
Scenario 1a	57	80
Scenario 1b	65	88
Scenario 2	65	93
Scenario 3a	64	85

Criteria / Scenario	NCA1	NCA2
Scenario 3b	62	84
Scenario 3c	61	83
Scenario 3d	61	84
Scenario 4	58	83
Scenario 5	57	80
Scenario 6	58	85
Noticeable (> 55dB(A))		
Clearly audible (>65 dB(A))		
Moderately intrusive (> 75 dB(A))		
Highly intrusive / Highly noise affected (>75 dB(A))		

Some receivers are expected to be highly noise affected for all construction scenarios associated with the wharf proposal.

Construction noise levels are predicted to exceed management levels for “standard” and “non-standard” hours of operation for all construction stages at the nearby residential receivers, particularly for construction Stages 3A, 3B and 3C (piling works outside of standard hours).

It should be noted that this assessment has endeavoured to carry out “worst case” noise modelling, and noise levels are predicted based on all sources operating simultaneously within the worksite. This is therefore likely to represent the worst case scenario and construction noise levels would generally be less than those predicted.

Sleep disturbance

The most likely source of potential sleep disturbance from outside of construction hours works would be from hammering, pile screwing, and drilling.

Maximum noise levels have been predicted to the nearest affected residential receivers to allow a review of the potential for sleep disturbance from construction activities at night. The predicted L_{Amax} results are detailed in Table 6-15 of Appendix E and indicate that maximum construction noise levels at NCA 1 and NCA 2 are likely to exceed the sleep disturbance criteria for all “outside of standard hours” construction scenarios, when construction works are located nearby. For this reason, it is recommended that activities with potentially high maximum levels such as the use of pneumatic tools and drilling are minimised at these locations during the quietest periods of the overall night-time period, although it is noted that piling is likely to occur in the early morning when waters are calm.

Vibration impacts

For the purposes of this assessment, the following proposed plant with the potential to generate significant vibration has been considered:

- Bored Piling Rig
- Vibratory Roller
- Rock hammers

- Rock Drill
- Truck movements.

Construction vibration levels vary depending on the distance from the equipment in use, the energy level imparted to the ground by the construction process, and the bedrock type. The most significant vibration sources associated with the construction work would be vibratory rollers and piling rigs. It is anticipated that no blasting would be required as part of this proposal.

The seawall (located within the curtilage of the locally heritage listed Kesterton Park) is in close proximity to the proposed piling works. The existing heritage structure located to the south of the works is located potentially approximately 25-30 metres to the south of the proposed piling works. Both of these items are likely to be inside the safe working limits recommended by DIN 4150.3, and predicted vibration levels of > 5mm/s could be experienced at the structure.

Where works are proposed within the safe working limits, specialist advice should be sought from an appropriately qualified structural engineer who is familiar with heritage structures to support any proposed relaxation of the initial cosmetic damage screening criterion. Any such relaxation shall be approved by Transport for NSW or under the environmental license as relevant.

In addition, and in conjunction with the above specialist advice from a structural engineer, test vibration measurements of piling and other vibration intensive plant at the work location closest to the structure should be carried out prior to works commencing to determine the level of vibration at the sensitive structure. If vibration levels exceed the Heritage Building limits detailed in Table 5-3 of Appendix E, alternative work methods should be sought.

Operation

The upgraded wharf would service a similar patronage as to the existing environment. As such, there is not expected to be any change in amenity noise under the proposal. No change in operational traffic is anticipated.

6.4.5 Safeguards and management measures

Table 6-13 lists the noise and vibration safeguards and management measures that would be implemented to account for the impacts identified in section 6.4.4.

Table 6-13: Noise and vibration safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Noise and vibration	NV1	<p>Preparation of a noise and vibration management plan based on recommendations provided within the NSW ICNG and Australian Standard AS 2436-1981: Guide to Noise Control on Construction, Maintenance and Demolition Sites. This is to include, but not be limited to:</p> <ul style="list-style-type: none"> • Plant controls: <ul style="list-style-type: none"> – Use of noise attenuating controls at the source, such as mufflers, acoustic screens, etc. – Plant and equipment would be in good working order to prevent excess noise generation. – Locating static sources of noise such as the generators as remotely as possible from noise sensitive receivers – Use of broadband reversing alarms, or “quackers”, on mobile equipment in accordance with the relevant health and safety regulations – Use of temporary noise barriers where practical. The height and location of these barriers would be determined during preparation of the construction noise and vibration management plan when more information regarding the proposed plant to be used for each construction stage is available – Investigate whether “at plant” mitigation or muffled plant is available for plant with high source noise levels such as rock hammers and piling rigs, and plant emitting continuous noise such as generators – Acoustic curtains (generally loaded vinyl based products), attached to wire construction fencing or laid over steel scaffold can also provide practical temporary 	Contractor	Pre-construction

Impact	ID	Environmental safeguards	Responsibility	Timing
		<p>noise barriers. We recommend that this is investigated for stationery plant within the worksites once a detailed schedule of works and plant is available</p> <ul style="list-style-type: none"> - Provision of a solid 2 metre high anti-gawk barrier along the site work area boundaries may provide some reduction to nearby receivers, however this is only expected to benefit the lower levels of the nearby receivers. Local barriers will have minimal effects on noise reduction for receivers with multiple levels as there will still be a clear line of sight from the works to the receivers. Inclusion of an angled return at the top of the barrier (if this is practical to construct) may provide increased benefit to multiple storey receivers when the plant is located close to the barrier and is generally stationery. We recommend that this is further investigated once a detailed schedule of works and plant is available. • Management and behavioural controls: <ul style="list-style-type: none"> - Ensure that managers effectively communicate acceptable and unacceptable work practices for the site, through staff site inductions, notice boards, and prestart meetings - Avoid the need for reversing in the construction area by creating a loop road or similar - Avoid dropping materials from height - Workers should avoid shouting, minimise talking loudly, and avoid slamming vehicle doors. • Allowing construction to occur only during approved construction hours, unless otherwise required as a condition of Transport for NSW safety requirements • Conducting noise monitoring during all construction phases/scenarios considering the potential exceedances for the purposes of assisting in noise mitigation and to verify the findings of this noise assessment. • Implementing a procedure for dealing with complaints to ensure that all complaints are registered and dealt with appropriately. • Conducting additional monitoring if complaints are received or proposed activities and number of plants exceed those assumed in this assessment 		

Impact	ID	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> Modification of work activities where noise or vibration is found to cause unacceptable impact. Application of respite periods for noise activities. 		
Noise and vibration	NV2	<ul style="list-style-type: none"> Carrying out works within standard daytime hours as follows: <ul style="list-style-type: none"> 7:00 am to 6:00 pm Monday to Friday 8:00 am to 1:00 pm Saturdays, no work on Sundays or public holidays. Do not carry out operations during evening or night-time hours, unless required for safety reasons when the water is calmer during the night period (including early morning). Should operations be required outside standard hours, an Out of Hours Procedure detailing works schedule, approval process, communications requirements and management measures will be prepared. All reasonable and feasible efforts should be undertaken to ensure noise levels would not exceed the ICNG noise management levels stated in Section 6.4.3 of this assessment by carrying out night-works with reduced numbers of plant for example. 	Contractor	Construction
	NV3	<ul style="list-style-type: none"> Notification of potentially affected receivers detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the work (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of work. A contact telephone number and email address will be available for community feedback. 	Transport for NSW / Contractor	Pre-construction
	NV4	Conduct short term background noise monitoring prior to construction to confirm the ambient noise levels presented in this report, which were carried out during COVID 19 and may not be representative of typical levels.	Transport for NSW / Contractor	Pre-construction
Vibration impact to	NV5	Where works are proposed within the safe working limits for the heritage structures (seawall in Kesterton Park (LEP no. 10858), North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) and Rockcliff	Contractor	Pre-construction

Impact	ID	Environmental safeguards	Responsibility	Timing
heritage structures		Mansions (LEP no. I0853)), specialist advice should be sought from an appropriately qualified structural engineer who is familiar with heritage structures to assess if vibrations associated with the proposed works will potentially result in impacts to heritage structures. Vibration monitoring should be carried out to confirm vibration levels prior to construction commencement.		
	NV6	Regular inspections of the construction activities and work areas should be undertaken by structural engineers and any other required specialist to monitor and review the construction methodology and confirm the integrity of the seawall in Kesterton Park (LEP no. I0858), structures within Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853). Assessment and monitoring of vibration impacts should adhere to: <ul style="list-style-type: none"> British Standard BS 7385: Part 2: Evaluation and Measurement for Vibrations in Buildings –Part 2 Guide to Damage Levels from Ground-Borne Vibration German Standard DIN 4150, Part 3: Structural Vibration in Buildings: Effects on Structures 	Contractor	Construction
Vibration	NV7	Where buildings are located within the safe working distance zone, dilapidation surveys should be carried out prior to construction.	Contractor	Pre-construction / Construction
	NV8	Where receivers are located within the safe work distance zones, vibration monitoring should be carried out to ensure compliance with the required criteria. If exceedances are recorded, works should be modified accordingly to reduce vibration levels.	Contractor	Pre-construction / Construction

6.5 Landscape character and visual impact

This section summarises the proposal’s landscape character and visual impacts. Appendix F contains a supporting paper (landscape and visual impact assessment, LCVIA) prepared by Cardno (Cardno, 2020d).

6.5.1 Methodology

The LCVIA was prepared based on the Roads and Maritime’s *Environmental Impact Assessment Practice Note EIA-N04 - Guideline for landscape character and visual impact assessment* (EIA- N04 Guidelines) December 2018.

The assessment identifies the overall impact of the proposed works on each of the Landscape Character Zones (LCZ) through predicting the sensitivity of the LCZ to changes as a result of the proposed works followed by identifying the anticipated magnitude change that would result from implementation of the proposed works within each LCZ.

The assessment also provides a visual impact assessment to identify the visual changes and impacts on the site and its surroundings when viewed from key vantage points. The assessment would combine the viewers' sensitivity to the proposal with the magnitude of the proposed works/structure within the existing views.

Table 6-14 details the landscape character and visual impact grading matrix.

Table 6-14: Landscape character and visual impact rating matrix (Source: Roads and Maritime, 2018)

	Magnitude				
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.5.2 Existing environment

The wharf is positioned in Neutral Bay and at the tip of the peninsula. It is located adjacent to Kesterton Park, to the east of Warringah Freeway and High Street. The bay itself is enclosed by the Kirribilli Peninsula to the south and Kurraba Point to the east. North Sydney Wharf is one of three wharves within Neutral Bay, the others being Neutral Bay and Kurraba Point wharves.

Landscape and urban context

The existing North Sydney Wharf is a concrete wharf incorporating a jetty with single berthing and no canopy cover. The wharf is situated at the eastern edge of Kesterton Park and is accessed through High Street via Kesterton Park. Kesterton Park is an open space public foreshore area which consists of mainly native vegetation, a large

grassed area, children's playground, public toilets and seats and picnic tables. The park offers panoramic views of the Sydney Harbour, Kurraba Point and Neutral Bay.

A sandstone seawall is constructed along the edge of the peninsula around two metres above the mean high-water mark. A cul-de-sac is located at the end of High Street and is separated from the water by a turf mound and a series of sandstone retaining walls.

The surrounding area predominantly comprises residential development, including three to six storey residential flat buildings and single to two storey detached dwellings.

Sub Base Platypus site (formerly HMAS Platypus) is located approximately 160 metres north of North Sydney Wharf. This site is being redeveloped by the Sydney Harbour Federation Trust and comprises public open space/domain and commercial premises. A new access path has been constructed connecting Kesterton Park and the Sub Base Platypus.

Heritage context

According to the North Sydney LEP, the following local heritage items are located within the vicinity of the proposal:

- Kesterton Park, High Street (Item No: I0858)
- North Sydney Bus Shelter - West of the wharf (Item No: I0407)
- Rockcliff Mansions, 144 High Street (Item No: I0853).

The western side of High Street is also identified as Careening Cove Heritage Conservation Area.

An Aboriginal Heritage Information System (AHIMS) search was conducted on 19 June 2020 and no known Aboriginal heritage sites are recorded or declared in or near the wharf.

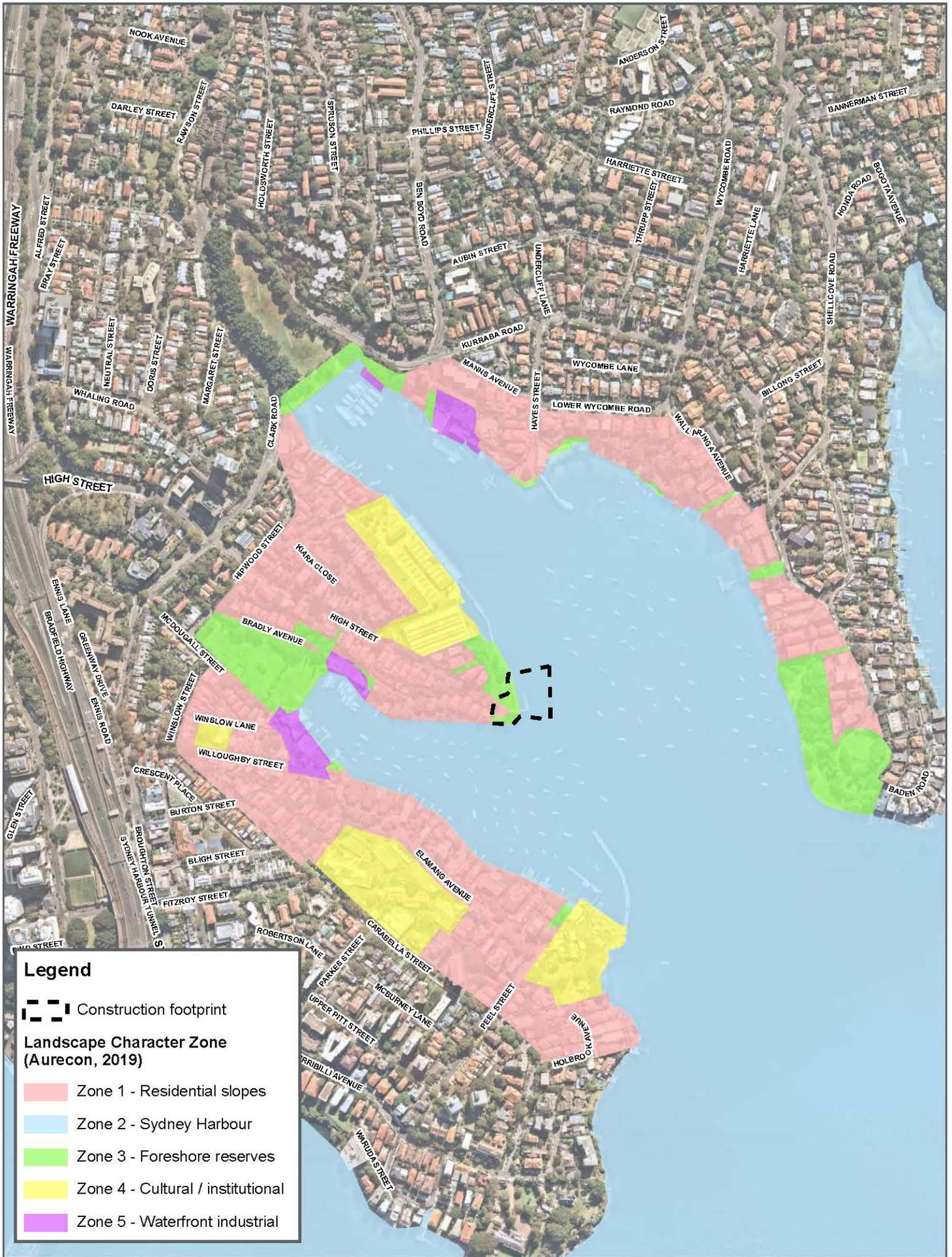
The heritage environment and heritage impacts are described in Section 6.6 and Section 6.7.

Landscape character zones

In assessing the landscape character of North Sydney and how the proposed wharf would fit within the surrounding landscape, the study area has been divided into five LCZ as shown in Figure 6-6.

These landscape character zones were identified based on the following:

- LCZ1 – Residential slopes including residential areas in the suburbs of North Sydney, Kurraba Point, Neutral Bay and Kirribilli
- LCZ2 – Sydney Harbour
- LCZ3 – Foreshore reserves including Kesterton Park, Milson Park, and Kurraba Reserve
- LCZ4 – Cultural or institutional areas including Sub Base Platypus, Loreto Kirribilli school and the Royal Sydney Yacht Squadron
- LCZ5 – Waterfront industrial areas in Neutral Bay and Kirribilli.



Legend

Construction footprint

Landscape Character Zone (Aurecon, 2019)

- Zone 1 - Residential slopes
- Zone 2 - Sydney Harbour
- Zone 3 - Foreshore reserves
- Zone 4 - Cultural / institutional
- Zone 5 - Waterfront industrial

FIGURE 6-6
1:7,000 Scale at A4
m
0 50 100 150

Landscape character zones
NORTH SYDNEY



Map Produced by Cardno NSM/ACT Pty Ltd (WOL)
Date: 20.10.08-03 | Project: AWE200198
Coordinate System: GDA 1984 MGA Zone 56
Map: AWE200198_GS021_NSydney_LandscapeCharacter_REF.mxd (1)
Aerial Imagery supplied by Neamap (April, 2010)

Viewpoints

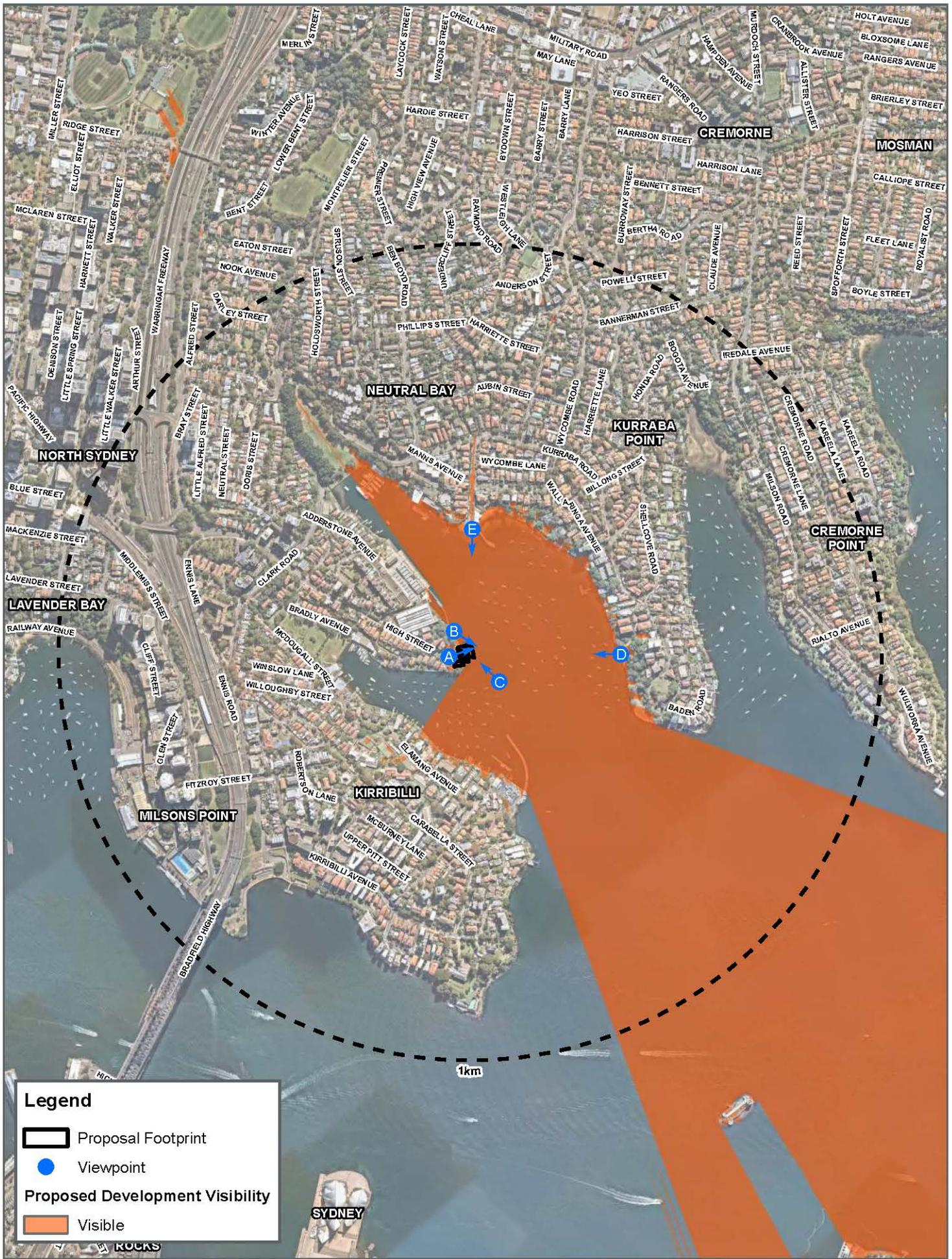
The following distance zones have been established to assist in the assessment on key views within the vicinity of the proposal. The zones are categorised as follow:

- Foreground zone (FZ): 0 – 250m from the viewer
- Middle ground zone (MZ): 250 – 500m from the viewer
- Background zone (BZ): 500m or greater from the viewer.

Five viewpoints were selected in consultation with Transport for NSW to assess the visual impact which are detailed in Table 6-15 and shown on Figure 6-7.

Table 6-15: Viewpoint locations and descriptions

Viewpoint	Description	Distance zone
Viewpoint A – Kesterton Park, adjacent to the existing cul-de-sac at High Street, looking north-east (Figure 6-8)	Viewpoint A is located at the western edge of Kesterton Park, adjacent to the cul-de-sac at High Street, looking east. It is located approximately 30 metres from the existing and proposed North Sydney Wharf. Viewpoint A is orientated toward Kurraba Point. Residential development at Kurraba Point is visible from this viewpoint.	FZ
Viewpoint B – Kesterton Park (near the existing playground) looking south-east (Figure 6-9)	Viewpoint B is located at the eastern edge of Kesterton Park, adjacent to the existing footpath between Kesterton Park and the Neutral Bay foreshore. The viewpoint is approximately 30 metres from the existing North Sydney Wharf and is orientated toward Sydney Harbour.	FZ
Viewpoint C – Sydney Harbour looking north-west (Figure 6-10)	Viewpoint C is from Sydney Harbour, looking north at a distance of approximately 60 metres from the existing North Sydney Wharf. Viewpoint C is captured from the Harbour City Ferry route from Kirribilli Wharf to North Sydney Wharf.	FZ
Viewpoint D – Kurraba Reserve looking west (Figure 6-11)	Viewpoint D is located within Kurraba Reserve looking west at a distance of approximately 400 metres from the existing North Sydney Wharf. Viewpoint D is dominated by buildings situated along Kirribilli's foreshore, Sub Base Platypus to the north-east and tall commercial/residential buildings located at North Sydney and Milsons Point. The existing North Sydney Wharf is visible from this location as a small component of a broad view that incorporates the foreshore, the North Sydney skyline and moored yachts in Neutral Bay.	MZ
Viewpoint E – Neutral Bay Wharf looking south (Figure 6-12)	Viewpoint E is located at Neutral Bay Wharf, looking southwest. It is located approximately 350 metres from the existing North Sydney Wharf. Viewpoint E is dominated by the industrial buildings at Sub Base Platypus; Iora Apartment located at 1 Kiara Close, North Sydney and yachts anchored within Neutral Bay. The existing North Sydney Wharf is a small element within Viewpoint E.	MZ



Legend

- Proposal Footprint
- Viewpoint

Proposed Development Visibility

- Visible

FIGURE 6-7
 1:12,000 Scale at A4

Visibility analysis and key viewpoints

NORTH SYDNEY

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)

Date: 20.01.08-07 | Project: A/ME200198

Coordinate System: GDA 1994 MGA Zone 56

Map: A/ME200198_GS022_NS/whsy_VA_1km84mod 01

Aerial imagery supplied by Neamsp (April, 2002)



Figure 6-8: Viewpoint A (Source: Transport for NSW)



Figure 6-9: Viewpoint B (Source: Transport for NSW)

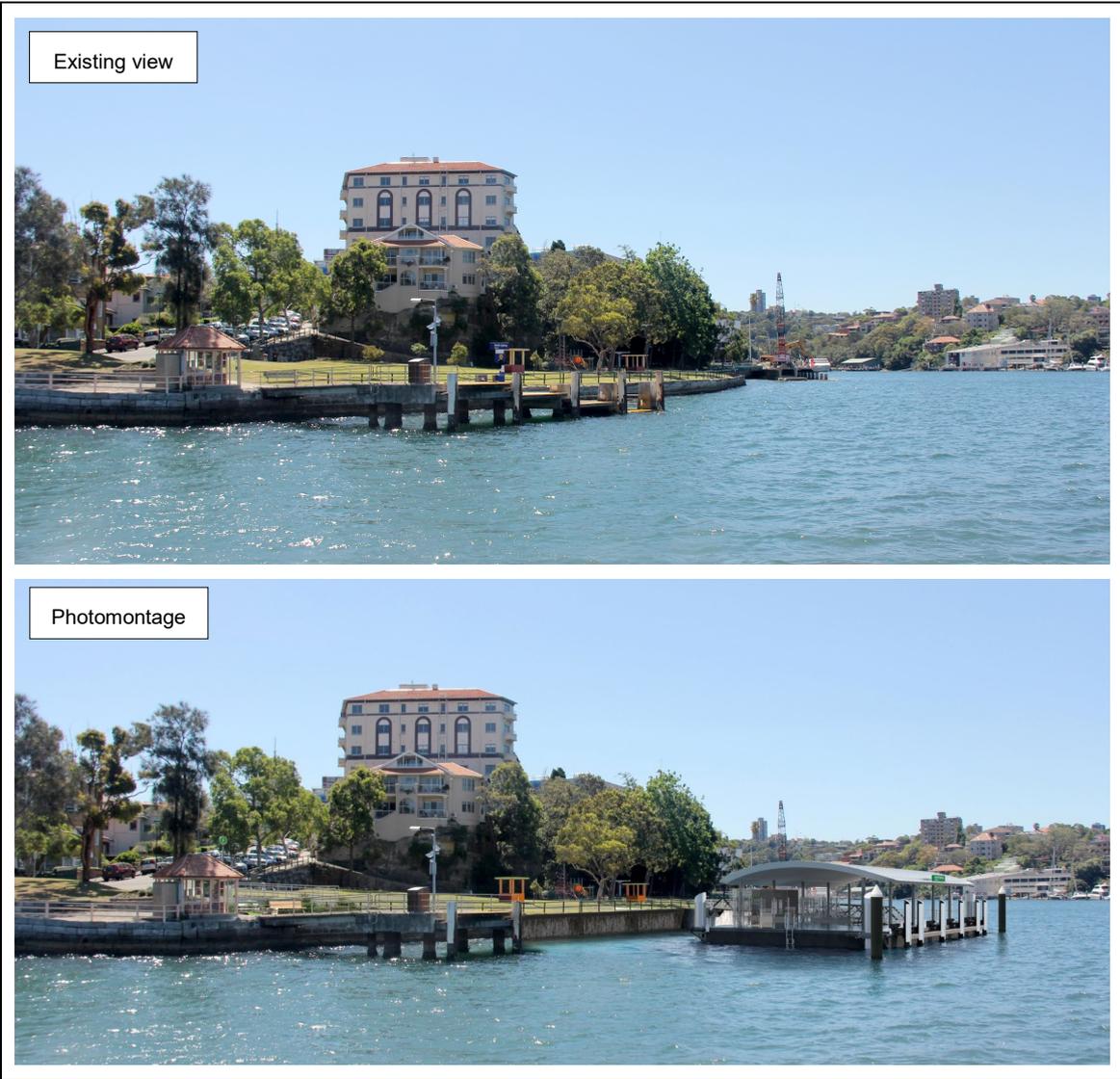


Figure 6-10: Viewpoint C (Source: Transport for NSW)



Figure 6-11: Viewpoint D (Source: Transport for NSW)



Figure 6-12: Viewpoint E (Source: Transport for NSW)

6.5.3 Potential impacts

Construction

Landscape character and visual impacts during construction are expected due to the following construction components:

- Presence of equipment, barges and piling equipment around the wharf
- Removal of part of the existing wharf structure and construction of a new wharf
- Established temporary compound site to include site sheds, amenities shed and storage containers for tools and materials
- Minor excavation during construction of footpaths, new kiss and ride space and accessible parking space.

Work would have the greatest impact to values associated with the residential, Sydney Harbour and foreshore reserve landscape zones where the effects would be:

- Change in the composition and setting of the wharf by its partial removal
- Temporary introduction of construction equipment into the landscape, affecting overall amenity and setting.

This impact would be limited to the construction duration.

Operation

Landscape character

Table 6-16 summarises the landscape impact assessment on the landscape character zones identified in section 6.5.2. Appendix F provides additional detail on the landscape character zones.

Table 6-16: Landscape character assessment summary

Zone	Sensitivity	Magnitude	Impact	Description of impact
LCZ1 – Residential	High-Moderate	Moderate-Low	Moderate	<p>The proposed wharf would have visual connections with the surrounding private dwellings located to the north and east of the subject site.</p> <p>This residential zone is capable of absorbing moderate change without altering its character.</p>
LCZ2 – Sydney Harbour	High-Moderate	Low	Moderate	<p>The scale of the wharf is in keeping with other wharfs located within the vicinity, such as Neutral Bay and Kirribilli Marina and Australian Border Force College.</p> <p>The proposed wharf would result in a positive landscape character change within the vicinity of the site as the existing wharf is in a poor state of repair and would ensure a consistent design with other existing wharves in the board locality such as Neutral Bay Wharf, Mosman Bay, McMahons Point, Milsons Point and Cremorne Point Wharf.</p> <p>Considering the scale and location of the wharf, it is unlikely that the wharf would be highly visible and that it would adversely impact on views from Sydney Harbour.</p>
LCZ3 – Foreshore reserves	High-Moderate	Moderate	High-Moderate	<p>The new wharf would impact on some open water views toward Kurraba Point as it is situated along the eastern boundary of Kesterton Park. However, ample water views are available in the north east and south east section of the park. No significant aspect would be impacted by the proposal.</p> <p>The wharf would be well integrated with the surrounding environment as lightweight materials, simple lines and colours which will blend with the</p>

Zone	Sensitivity	Magnitude	Impact	Description of impact
				surrounding maritime uses and minimise any potential visual impact.
LCZ4 – Cultural / institutional	Medium-Low	Low	Medium-Low	<p>Cultural and institutional are unlikely to be impacted by the proposed wharf. These institutions are mostly dispersed within Neutral Bay and consist of large building footprint and form, which would partially dominate views and vistas.</p> <p>The closest cultural/institutional is the Sub Base Platypus, which is located approximately 160 metres north of the North Sydney Wharf. The Sub Base Platypus mainly consists of bulky repurposed navy buildings with a boardwalk (i.e. former wharf of the Sub Base) along the water edge. The backdrop of Sub Base Platypus comprises a 10-15 metres sandstone cliff. A 5-7 storey residential complex is located on top of the sandstone cliff. Considering the scale and context of Sub Base Platypus, it is unlikely the wharf upgrade would have an adverse impact on this substantial site.</p> <p>The wharf would be partially visible from the RSYS. Due to the distance and the existing wharf structure at RSYS, any visual impact generated by the wharf is considered insignificant.</p> <p>The wharf will not be visible from the Ensemble Theatre.</p>
LCZ5 – Waterfront industrial	Low	Negligible	Negligible	<p>The industrial uses/zones are located at Careening Cove. Considering the topography of the area, it is unlikely the proposed wharf will be visible from Careening Cove.</p> <p>Furthermore, the waterfront industrial zone generally consists of larger buildings and structures, which would have a more detrimental visual impact than the proposed ferry wharf.</p> <p>Considering the above factors, any change to the landscape character</p>

Zone	Sensitivity	Magnitude	Impact	Description of impact
				of the zone generated by the proposed wharf is considered negligible.

It is considered that the proposed North Sydney Wharf would have a moderate impact on the surrounding character zones. The landscape character within the proximity of North Sydney Wharf generally consists of recreation/foreshore area adjoining residential uses and Sydney Harbour.

The proposal would introduce a larger structure with curvilinear roofing to the Neutral Bay foreshore. The proposed structure would be located approximately 40 metres north of the existing wharf and extend approximately 30 metres from the foreshore.

Viewpoints

Visual impact from each key viewpoint is established through an assessment of the sensitivity of the view combined with the magnitude of the proposal within that view point. Table 6-17 summarises the visual impact assessment.

Table 6-17: Visual impact assessment summary

View-point	Visible element	Sensitivity	Magnitude	Description of impact
A (Figure 6-8)	Platform roof, gangway roof, landside works	High - Moderate	High	<p>High-Moderate</p> <p>Part of the proposed wharf would be located below the sandstone retaining wall along the Neutral Bay foreshore. The visibility of the proposed wharf would also vary subject to tidal fluctuation.</p> <p>Due to the size and height of the proposed wharf, the visual impact from this viewpoint would be greater when compared to the existing wharf. However, the impact is limited to the water view towards Kurraba Point.</p> <p>Views to Sydney Harbour, from Kesterton Park, are still available from the foreshore footpath and Wurrabirri Point. Therefore, the reduction of water view to Kurraba Point is not considered to be as significant.</p>
B (Figure 6-9)	Platform roof, gangway roof, landside works	High-Moderate	High-Moderate	<p>High-Moderate</p> <p>Pedestrians' view, utilising the footpath along the foreshore, would be impacted. However, the visual impact is likely to be temporary and other vantage points of the Sydney Harbour are</p>

View-point	Visible element	Sensitivity	Magnitude	Description of impact
				available near the existing North Sydney Wharf.
C (Figure 6-10)	Platform and roof	Moderate	High-Moderate	<p>Moderate</p> <p>The proposed wharf would introduce a new element into the harbour and would be highly visible from this viewpoint.</p> <p>Most people would be travelling to and from this viewpoint. Therefore, the duration of view of the proposed wharf is likely to be short and temporary.</p> <p>The design of the North Sydney Wharf reflects the practical use of the foreshore area and harbour as a ferry wharf. The proposed design is considered an improvement to the existing wharf and generally consistent with other wharf upgrades located within the Sydney Harbour.</p>
D (Figure 6-11)	Platform and roof	Moderate-Low	Moderate-Low	<p>Moderate-Low</p> <p>Due to the minor scale of the proposed North Sydney Wharf, it would not be the dominant element within Viewpoint D.</p> <p>The existing landscaping at Kesterton Park and along High Street would soften the proposed structures and reduce potential visual impacts.</p>
E (Figure 6-12)	Platform and roof and gangway	Moderate-Low	Moderate-Low	<p>Moderate-Low</p> <p>The key attractor of this viewpoint is the existing industrial buildings located at the Sub Base Platypus and three residential buildings located above the sandstone wall at Sub Base Platypus.</p> <p>The new wharf is a larger structure when compared to the existing wharf. However, the proposed structure is sitting low in the middle ground and partially blends into taller buildings located within the background. Therefore,</p>

View-point	Visible element	Sensitivity	Magnitude	Description of impact
				<p>the magnitude of the new wharf is considered moderate-low.</p> <p>Views to Sydney Harbour and Garden Island would not be impacted by Viewpoint E.</p>

The new North Sydney Wharf would be visible from a number of viewpoints within the vicinity of the site. The visual impact generated by the proposed wharf varies from viewpoint to viewpoint.

The North Sydney Wharf is directly overlooked from the Kesterton Park and the existing footpath along the foreshore. This is a highly sensitive area as Kesterton Park is identified as a local heritage item and moderately utilised by the public.

Visual impact from Kesterton Park is considered high-moderate as the impact is limited to the water view towards Kurraba Point. Furthermore, views to Sydney Harbour are still available from the foreshore footpath and Wurrabirri Point.

Views from the footpath at the foreshore (i.e. Viewpoint B) would include the new wharf as a new built element. However, views of the Sydney Harbour are available from all other points along the footpath and Kesterton Park. Therefore, the visual impact in this area would be high-moderate.

Visual impacts from Sydney Harbour (i.e. captured from the Harbour City Ferry route) are considered moderate. Most people will be travelling to and from this Viewpoint. Therefore, the duration of view of the proposed wharf is likely to be short and temporary. No significant aspect would be impacted.

Kurraba Point and Neutral Bay Wharf are considered moderate-low sensitivity viewpoints. Due to the distance from North Sydney Wharf, the new structure would be minor in scale when compared to nearby industrial and residential buildings. It is not identified as the dominant element within these viewpoints. Additionally, the proposed structure would not result in any view loss.

Overall the impact is considered moderate with the proposal forming part of a broader harbour context with minimal impact on existing views.

6.5.4 Safeguards and management measures

Table 6-18 lists the landscape character and visual amenity safeguards and management measures that would be implemented to account for the impacts identified in section 6.5.3.

Table 6-18: Landscape character and visual amenity safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Landscape and visual	LV1	<p>Urban design principles will be integrated throughout the detailed design and construction of the proposal and include:</p> <ul style="list-style-type: none"> • Similar visual structures (such as jetties, pontoons and wharfs) as those located within Neutral Bay, Neutral Harbour and Careening Cove • The design of the wharf consistent with the Neutral Bay Wharf situated to the north-east and other wharfs within Sydney Harbour • A coordinated palette of materials and colours to respond to the existing maritime and foreshore character • Low-scale landside and waterside works to improve accessibility, wayfinding and services • The approaches to and surrounds of the wharf designed to maximise amenity and keeping with the existing urban and landscape environment. • Landscape treatment of the approaches to the wharf to be appropriate and complimentary to the existing landscape of Kesterton Park. Sandstone blocks will be used in the design with respect to the earlier use of the area as a quarry. 	Transport for NSW	Detailed design
	LV2	Hoarding will be erected around the construction compound where possible, to reduce visibility.	Contractor	Construction
	LV3	Where out of hours work is required, lighting will be directionally controlled to limit potential impacts of light spill on surrounding receivers, including residential properties.	Contractor	Construction

Impact	ID	Environmental safeguards	Responsibility	Timing
	LV4	All impacted areas and ground surfaces must be reinstated as near as possible to their original state following the completion of works within Kesterton Park (LEP no. I0858)	Contractor	Post-construction
	B6	Native vegetation will be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011). Replacement planting (species and number) will be determined in consultation with North Sydney Council to reinstate habitat and minimise impacts to the visual characteristics of Kesterton Park.	Contractor	Detailed design / Post construction

6.6 Non-Aboriginal heritage

This section summarises the proposal's non-Aboriginal heritage impacts. Appendix G contains a supporting technical paper (statement of heritage impact, SOHI) prepared by Artefact (Artefact, 2020).

6.6.1 Methodology

This SOHI has been prepared in accordance with the guidelines outlined by the Heritage Office, now Heritage NSW, Department of Premier and Cabinet (Heritage NSW, DPC), and Department of Urban Affairs & Planning in the document *Statements of Heritage Impact as part of the NSW Heritage Manual*. This SOHI has been prepared in accordance with the principles contained in the most recent edition of *The Burra Charter: The Australian ICOMOS Charter for Places of Cultural Significance*.

Heritage listed items within and in the vicinity of the construction footprint were identified through a search of the relevant state and federal statutory and non-statutory heritage registers, including:

- World Heritage List (WHL)
- Commonwealth Heritage List (CHL)
- National Heritage List (NHL)
- State Heritage Register (SHR)
- Section 170 Heritage and Conservation Registers
- North Sydney LEP
- NSW State Heritage Inventory (SHI) Database
- Register of the National Estate (RNE)
- Register of the National Trust of Australia (NSW) (RNTA).

A site inspection was conducted on 12 March 2020. The aim of the site inspection was to inspect the area of proposed impacts to inform a preliminary assessment of archaeological potential and to identify heritage items in the vicinity of the construction footprint that may be affected by the proposal. The inspection was undertaken on foot and a photographic record was made.

6.6.2 Existing environment

North Sydney Wharf historical background

In 1880 the primary wharf for Neutral Bay appeared to be to the north-east of the construction footprint, located on the western shore of Neutral Bay. By 1888 however a small wharf had been established at the end of High Street located about 10 metres to the south-west of the present-day wharf. The ferry route travelled between Circular Quay, High Street, Neutral Bay wharf at Hayes Street and two additional wharves at Kurraba Point.

Sydney Water Board plans from 1891 depict the wharf at the end of High Street as a long jetty which extended out from south-west end of the peninsula that had yet to be formalised, with a rectangular waiting room located about half way along the jetty. The Water Board plans also show that a second wharf had been constructed along the formalised edge of the peninsula in the location of the present-day wharf. In contrast to

the long wharf to the south, the second wharf was depicted as being shorter and slightly wider, and not extending a great distance out from the peninsula.

By 1943, when extensive aerial photographs were taken of much of the greater Sydney region, the earlier long wharf had had been demolished and the south-west side of the peninsula had been formalised with the construction of the seawall. It is likely that the former wharf was demolished at the same time that the seawall was constructed.

By 1986 the former wharf had been demolished and replaced with the extant L-shaped structure, featuring a gangplank out from the seawall and a right-angled turn to the north. The wharf is a timber and precast concrete construction, situated on piling and with the northern alignment comprised of three small flights of steps.

Listed heritage items

Table 6-19 lists the heritage items located within or next to the construction footprint of the proposal. These heritage items are shown on Figure 6-13. The heritage items within a one kilometre visual buffer zone are also included in Table 6-19. The extent of the one kilometre visual buffer zone is based on the visibility analysis shown on Figure 6-7

Table 6-19: List of heritage items in the vicinity of the proposal

Item	Address	Significance	Listing	Distance from construction footprint
Kesterton Park	High Street	Local	North Sydney LEP no. I0858	Within
North Sydney Bus Shelters	High Street	Local	North Sydney LEP no. I0407	Within
Careening Cove Conservation Area	N/A	Local	North Sydney LEP no. CA10	Adjacent
Rockcliff Mansions	144 High Street	Local	North Sydney LEP no. I0853	Adjacent
Sydney Opera House (buffer zone)	2 Circular Quay east, Sydney (buffer zone extends to Argyle Street and Fitzroy Street)	World	WHL 166rev NHL ID 105738 SHR no. 01685 City of Sydney LEP 2012 no. I1712 RNE ID 2353 RNT	Visual buffer zone (350m south-east)
Customs Marine Centre	Ben Boyd Centre	Local	CHL ID 105249 North Sydney LEP no. I0576 RNE ID 101166	Visual buffer zone (320m north)

Item	Address	Significance	Listing	Distance from construction footprint
Hastings	2 Hayes Street	State	SHR no. 00567 North Sydney LEP no. I0628 RNE ID 14699	Visual buffer zone (280m north)
Nutcote	5 Wallaringa Avenue	State	SHR no. 00505 North Sydney LEP no. I0730 RNE ID 16484	Visual buffer zone (290m north-east)
Gasworks Remains, HMAS Platypus	1 Kiara Close and 118-138 High Street	Local	North Sydney LEP no. I0859	Visual buffer zone (100m north)
'House'	17 Elamang Avenue	Local	North Sydney LEP no. I0215	Visual buffer zone (200m south)
'House'	5 Elamang Avenue	Local	North Sydney LEP no. I0212	Visual buffer zone (240m south)
Site and remains of Port Jackson and Manly Steamship Company depot	Kurraba Road	Local	North Sydney LEP no. I0669	Visual buffer zone (360m east)
Once Upon A Time'	115A Kurraba Point	Local	North Sydney LEP no. I0660	Visual buffer zone (315m north-east)
Site of former Spains Wharf	Spains Wharf Road	Local	North Sydney LEP no. I0705	Visual buffer zone (305m north-east)
'House'	7 Wallaringa Avenue	Local	North Sydney LEP no. I0731	Visual buffer zone (300m north-east)
'House'	9 Wallaringa Avenue	Local	North Sydney LEP no. I0732	Visual buffer zone (300m north-east)
Wallaringa Mansions	1 Wallaringa Avenue	Local	North Sydney LEP no. I0736	Visual buffer zone (300m north-east)
Neutral Bay Wharf	1-7 Hayes Street	Local	North Sydney LEP no. I0627	Visual buffer zone (280m north)
Anderson Park	N/A	Local	North Sydney LEP no. I0767	Visual buffer zone (500m north-west)

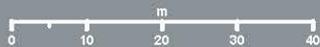


Legend

-  Construction footprint
- Heritage - North Sydney LEP 2013 (DPE, 2019)**
-  Conservation Area - General
-  Item - General

FIGURE 6-13

1:1,000 Scale at A4



Heritage listings

NORTH SYDNEY



Map Produced by Cardno NSW/ACT Pty Ltd (MOL)
 Date: 2020-06-07 | Project: AWE200198
 Coordinate System: GDA 1994 MGA Zone 56
 Map: AWE200198_GS025_NS_sdney_HeritageREF.mxd: 01
 Aerial imagery supplied by Nearmap (April, 2020)

Archaeology

A preliminary archaeological assessment identified that the construction footprint has potential to contain archaeological remains of local significance, including evidence of former road surfaces, quarrying activities, earlier sea/retaining walls and the former wharf infrastructure. Areas of archaeological potential are shown on Figure 6-14. A summary of the findings of archaeological potential and significance is provided in Table 6-20. These archaeological remains are generally unlikely to be found in association with in situ artefact bearing deposits, such as intact occupation deposits.

Artefactual material would primarily be associated with reclamation fills, which would not be considered in situ deposits. As a result, the potential archaeological remains within the construction footprint would likely be classified as 'works'. The preliminary archaeological assessment has found that there is generally nil to low potential for 'relics' as defined by the *Heritage Act 1977*.

Table 6-20: Summary of archaeological potential and significance

Phase	Land use	Potential remains	Potential	Significance
Phase 1 (1788-1870)	Informal use and whaling allotments	Evidence of informal use and undocumented structures of whaling allotments	Nil to low	Local
Phase 2 (1870-1941)	Industrial use	Quarrying; land reclamation; earlier sea/retaining walls; earlier wharves (both terrestrial and maritime remains); former road surfaces	Low to moderate for structural remains Moderate to high for reclamation fill	Local for structural remains / former seawalls etc. Reclamation fill would not reach the threshold of local significance.
Phase 3 (1941-c.1950)	RAN Torpedo Facility	Evidence of temporary structures	Nil to low	Unlikely to reach the threshold of local significance
Phase 4 (c.1950-present)	Kesterton Park and recreational use	Not considered archaeological	Nil	N/A



FIGURE 6-14

1:1,000 Scale at A4



Areas of archaeological potential

NORTH SYDNEY



Map Produced by Cairno NSW/ACT Pty Ltd (WOL)
 Date: 2020-09-28 | Project: AWE200198
 Coordinate System: GDA 1994 MGA Zone 56
 Map: AWE200198_GS001_NSydney_ArchaeologicalPotential.mxd 01
 Aerial imagery supplied by Nearmap (April 2020)

6.6.3 Potential impacts

Construction

Direct and potential direct (physical) impacts

The proposal would directly impact two of the identified local heritage items: Kesterton Park (LEP no. I0858) and North Sydney Bus Shelter (LEP no. I0407).

Potential vibration impacts to heritage structures is provided in Section 6.4.

Kesterton Park (LEP no. I0858)

The proposal would result in impacts Kesterton Park (LEP no. I0858) through the introduction of new structures, such as the proposed wharf, parking spaces and retaining wall, and the loss of about 5 per cent of the public green space of the park. However, the new wharf is consistent with the historical use of the area, the wharf and associated elements have been designed with appropriate materials and colours to reduce the visual impact, and most of the park landscape would be unchanged. The proposal would also allow greater accessibility and appreciation of Kesterton Park (LEP no. I0858) by providing DDA compliant access.

The proposed wharf has been designed to be relatively unobtrusive and would not have a strong impact on the context and setting of Kesterton Park (LEP no. I0858), or on views to and from heritage items in the area.

The proposed works would directly modify a small portion of the seawall for installation of the new gangway abutment. However, the affected area is expected to be limited to a localised portion of the seawall and the remainder would be unaffected. The proposed works in proximity to the seawall would be located within the safe working distance for cosmetic damage identified in the CNVG (Roads and Maritime, 2016b) which may cause structural impacts to the fabric of the seawall. However, only a small number of piles are required and the potential impacts could be largely mitigated through control measures (refer in section 6.6.4). As a result, it is expected that any potential direct impacts resulting from vibrations would be minimal.

Overall, the proposed works would result in a minor to moderate direct impact to Kesterton Park (LEP no. I0858) and a negligible potential direct impact, but these impacts would not affect the overall significance of the heritage item.

North Sydney Bus Shelter (LEP no. I0407)

The existing bus shelter would be retained as part of the proposal. The proposed works associated with the bus shelter include the removal of the existing aerial on top of the bus shelter, and the removal of other elements such as the CCTV camera, emergency help point and ticket machine. These are not considered to be contributing elements to the significance of the bus shelter however, and therefore the removal of them would not result in impacts to significant fabric.

Based on the proposed works, the bus shelter would be located within the safe working distance for cosmetic damage identified in the CNVG (Roads and Maritime, 2016b) which could result in potential direct impacts. However, the bus shelter at Kesterton Park is only one shelter of the larger North Sydney Bus Shelter (LEP no. I0407) group, which is made up of 51 bus shelters. As a result, any potential direct vibration impacts to the bus shelter at Kesterton Park would cause minimal impacts to North Sydney Bus Shelter (LEP no. I0407) overall.

Overall, the proposed works would result in a neutral direct and negligible potential direct impact to North Sydney Bus Shelter (LEP no. I0407), but this impact would not affect the overall significance of the heritage item.

Careening Cove Conservation Area (LEP no. CA10)

As the proposed works are located outside of the curtilage of Careening Cove Conservation Area (LEP no. CA10) there would be no direct impacts.

Based on the proposed works the built fabric of Careening Cove Conservation Area (LEP no. CA10) would be located within the minimum safe working distance for cosmetic damage identified in the CNVG (Roads and Maritime, 2016b) and the vibrations associated with the proposed works could result in potential direct impacts. However, only three buildings within the much larger conservation area would be located within the minimum safe working distance, with all other buildings in the conservation area located at a safe distance. As a result, it is expected that any potential direct impacts resulting from vibrations would be minimal compared to the overall conservation area.

Overall, the proposed works would result in neutral direct and negligible potential direct impacts to Careening Cove Conservation Area (LEP no. CA10), but this impact would not affect the overall significance of the heritage item.

Rockcliff Mansions (LEP no. I0853)

As the proposed works are located outside of the curtilage of Rockcliff Mansions (LEP no. I0853) there would be no direct impacts.

Based on the location of the proposed works the Rockcliff Mansions (LEP no. I0853) would be located within the minimum safe working distance for cosmetic damage identified in the CNVG (Roads and Maritime, 2016b) and the vibrations associated with the proposed works could result in potential direct impacts. However, as the structure is located towards the edge of the minimum safe working distance it is expected that any potential direct impacts resulting from vibrations would be minimal.

Overall, the proposed works would result in neutral direct and negligible potential direct impact to Rockcliff Mansions (LEP no. I0853), but this impact would not affect the overall significance of the heritage item.

Impacts to archaeological resources

It is not expected that the proposed works would impact potential terrestrial or maritime archaeological remains of the former wharves, since the excavations and piling are located further to the north of documented location of the former wharves.

Furthermore, the removal of the existing tidal step piles, which are located in proximity to the former northern wharf, is not planned to involve excavations of the surrounding sediment. The proposal has also been designed to avoid excavations within the footprint of the two structures associated with the former northern wharf, including the possible weigh bridge, which were both located within the construction footprint and may still survive. Excavation within the footprint of these structures would generally be limited to a proposed shallow swale along the west side of the existing footpath, however, this would be shallower than the footpath and therefore is unlikely to impact any potential remains. The remaining excavations would primarily be located to the west of the former weigh bridge and would be at a higher elevation than the existing footpath (due the current slope of the ground surface). As a result, the proposal has largely mitigated the risk of potential impacts to significant remains of the weigh bridge.

Overall, the proposed works would potentially result in negligible impacts to archaeological remains of local significance. As a result, it is unlikely that detailed archaeological management and investigation would be required. Furthermore, the

preliminary archaeological assessment has found that the potential archaeological remains would likely be limited to 'works'. As a result, an exception under section 139 (4) of the *Heritage Act 1977* would not be required for the proposed works and they would be managed under the Roads and Maritime *Unexpected Heritage Item Procedure 2015*.

Operation

Indirect (visual) impacts

The visual impact of the proposal was assessed for all heritage items identified within the visual buffer of the proposal as shown in Table 6-21 (refer Appendix G for details).

It was determined that the proposal would result in a minor to moderate visual impact to Kesterton Park (LEP no. I0858), but this impact would not affect the overall significance of the heritage item. The proposal would have a neutral or negligible visual impact to all other heritage items. As the proposed works would not impact upon the Commonwealth heritage values of Customs Marine Centre (CHL ID 105249), or the World heritage values of the Sydney Opera House (WHL 166rev), a referral to the Commonwealth in accordance with the EPBC Act would not be required.

Table 6-21: Summary of heritage impacts

Item	Direct	Indirect	Potential direct	Archaeological
Kesterton Park	Minor to moderate	Minor to moderate	Negligible	Negligible
North Sydney Bus Shelters	Neutral	Negligible	Negligible	Neutral
Careening Cove Conservation Area	Neutral	Negligible	Negligible	Neutral
Rockcliff Mansions	Neutral	Negligible	Negligible	Neutral
Sydney Opera House (buffer zone)	Neutral	Neutral	Neutral	Neutral
Customs Marine Centre	Neutral	Negligible	Neutral	Neutral
Hastings	Neutral	Negligible	Neutral	Neutral
Nutcote	Neutral	Negligible	Neutral	Neutral
Gasworks Remains, HMAS Platypus	Neutral	Negligible	Neutral	Neutral
'House'	Neutral	Negligible	Neutral	Neutral
'House'	Neutral	Negligible	Neutral	Neutral
Site and remains of Port Jackson and Manly Steamship Company depot	Neutral	Negligible	Neutral	Neutral
Once Upon A Time'	Neutral	Negligible	Neutral	Neutral

Item	Direct	Indirect	Potential direct	Archaeological
Site of former Spains Wharf	Neutral	Negligible	Neutral	Neutral
'House'	Neutral	Negligible	Neutral	Neutral
'House'	Neutral	Negligible	Neutral	Neutral
Wallaringa Mansions	Neutral	Negligible	Neutral	Neutral
Neutral Bay Wharf	Neutral	Negligible	Neutral	Neutral
Anderson Park	Neutral	Negligible	Neutral	Neutral

6.6.4 Safeguards and management measures

Table 6-22 lists the non-Aboriginal safeguards and management measures that would be implemented to account for the impacts identified in section 6.6.3.

Table 6-22: Non-Aboriginal safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Archaeological significance	H1	If any design changes result in additional excavations and impacts to potential archaeological remains of the former weigh bridge, further archaeological assessment and management will be required. This may include a program of archaeological test excavation.	Transport for NSW	Detailed design / pre-construction
	H2	If unexpected 'relics' are encountered during excavation, a section 146 relics notification will be forwarded to Heritage NSW, DPC. 'Relics' cannot be impacted without appropriate approvals under the <i>Heritage Act 1977</i> .	Contractor	Construction
	H3	If significant archaeological remains are encountered during excavation, design options for avoiding impacts to the significant archaeological remains should be considered where practicable and opportunities should be investigated for the implementation of heritage interpretation.	Contractor	Construction
Non-Aboriginal heritage	H4	A heritage induction will be provided to workers prior to construction, informing them of the location and significance of known heritage items and the implementation of the Roads and Maritime <i>Unexpected Heritage Item Procedure 2015</i> if unanticipated heritage items or depositions are located during construction. The heritage induction will include management of expected non-significant archaeological remains, such as minor artefactual material associated with Phase 2 reclamation fills.	Contractor	Pre-construction
	H5	The Roads and Maritime <i>Unexpected Heritage Item Procedure 2015</i> will be implemented if unanticipated heritage items or depositions are located during construction.	Contractor	Construction

Impact	ID	Environmental safeguards	Responsibility	Timing
Vibration impact to heritage structures	NV5	Where works are proposed within the safe working limits for the heritage structures (seawall in Kesterton Park (LEP no. 10858), North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853)), specialist advice should be sought from an appropriately qualified structural engineer who is familiar with heritage structures to assess if vibrations associated with the proposed works will potentially result in impacts to heritage structures. Vibration monitoring should be carried out to confirm vibration levels prior to construction commencement.	Contractor	Pre-construction
	NV6	Regular inspections of the construction activities and work areas should be undertaken by structural engineers and any other required specialist to monitor and review the construction methodology and confirm the integrity of the seawall in Kesterton Park (LEP no. I0858), North Sydney Bus Shelter (LEP no. I0407), and structures within Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853). Assessment and monitoring of vibration impacts should adhere to: <ul style="list-style-type: none"> British Standard BS 7385: Part 2: Evaluation and Measurement for Vibrations in Buildings –Part 2 Guide to Damage Levels from Ground-Borne Vibration German Standard DIN 4150, Part 3: Structural Vibration in Buildings: Effects on Structures. 	Contractor	Construction
	H6	If vibration monitors are attached to the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) or Rockcliff Mansions (LEP no. I0853), they must not be attached with permanent fixings. They should be removable without causing damage. Bees wax may be a suitable attachment method.	Contractor	Construction
	H7	If it is identified that levels of vibration are causing damage to heritage fabric, works must cease, and the construction methodology reviewed by the project	Contractor	Construction

Impact	ID	Environmental safeguards	Responsibility	Timing
		engineers in consultation with a Heritage Consultant in order to mitigate further impacts. A temporary protection plan to outline protection measures required for significant fabric during activities causing potential vibration impacts would be prepared prior to commencement of works.		
Impact to heritage item (LEP no I0407)	H8	Care must be taken during the removal of the non-significant elements from the North Sydney Bus Shelter (LEP no. I0407) to ensure that significant fabric is not damaged in the process. An environmental work method statement (EWMS) should be prepared to guide the removal of elements from the bus shelter to minimise the risk of inadvertent impacts.	Contractor	Pre-construction
Impact to heritage item (LEP no I0858)	H9	Works within Kesterton Park (LEP no. I0858) must be kept to a minimum where possible and be undertaken with care to minimise impacts to the local heritage item and minimise the loss of public green space and vegetation.	Contractor	Construction
	H10	An environmental work method statement (EWMS) should be prepared to guide the modification of the seawall within Kesterton Park (LEP no. I0858) for the new gangway abutment and pavement finish.	Contractor	Pre-construction
	B6	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011). Replacement planting (species and number) will be determined in consultation with North Sydney Council to reinstate habitat and minimise impacts to the visual characteristics of Kesterton Park.	Contractor	Detailed design / Post construction
	LV4	All impacted areas and ground surfaces must be reinstated as near as possible to their original state following the completion of works within Kesterton Park (LEP no. I0858).	Contractor	Post-construction
	H11	A Photographic Archival Recording should be undertaken of Kesterton Park (LEP no. I0858) to document its current visual setting prior to any impacts and modifications.	Contractor	Pre-construction

Impact	ID	Environmental safeguards	Responsibility	Timing
Design	H12	If any design changes result in additional underwater ground disturbing works in the location of the current wharf, then a maritime archaeological assessment should be undertaken to assess the potential for impacts to maritime archaeological remains of the former wharves.	Transport of NSW	Detailed design / Pre-construction
	H13	Any project redesign resulting in new ground disturbance, vegetation removal, or new features must be assessed in an addendum to the North Sydney Wharf SOHI.	Transport for NSW	Detailed design / Pre-construction

6.7 Aboriginal cultural heritage

This section summarises the proposal's Aboriginal heritage impacts. The Transport for NSW Aboriginal Cultural Heritage Officer has issued a Stage 1 clearance letter for the proposal in accordance with *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) on 4 June 2020, included as Appendix H.

6.7.1 Methodology

The assessment included a desktop review of published records, data and literature, including a records search of the Aboriginal Heritage Information Management System (AHIMS) to confirm the presence of values in the local area.

The PACHCI assessment was completed for Aboriginal heritage assessment in reference to the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011b), the *Code of Practice for the Protection of Aboriginal Objects* (DECCW, 2010), and the *Code of Practice of Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010).

6.7.2 Existing environment

The Stage 1 PACHCI Assessment assessed the proposed works as being unlikely to have an impact on Aboriginal cultural heritage.

The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places
- The AHIMS search did not indicate any known Aboriginal objects or places in the immediate study area
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the *Due Diligence Code of Practice for the Protection of Aboriginal objects in NSW* (DECCW, 2010) and the Roads and Maritime's procedure
- The Aboriginal cultural heritage potential of the study area appears to be severely reduced due to past disturbance.

6.7.3 Potential impacts

Construction

The proposed works are unlikely to result in harm to Aboriginal objects and sites, as the works are limited to the existing wharf structure, sea wall and minor public domain works; all of which are within heavily disturbed land. Stage 1 of the Roads and Maritime PACHCI was completed for the proposal, which concluded the proposal was unlikely to have an impact on Aboriginal cultural heritage and did not require further investigations or assessment.

The Standard Management Procedure *Unexpected Heritage Items* (Roads and Maritime, 2015) would be followed in the event that unrecorded Aboriginal object(s) are identified during construction.

Operation

The North Sydney Wharf would continue to operate as a wharf, serviced by the same vessels, so it is not expected that there would be any change in the nature or severity of impact to unknown Aboriginal objects or sites.

An Aboriginal Heritage Impact Permit (AHIP) under the *National Parks and Wildlife Act 1974* is not required for the proposal.

No impacts to Aboriginal heritage items are anticipated during operation of the proposal as no significant change to the existing operation is proposed.

6.7.4 Safeguards and management measures

Table 6-23 lists the Aboriginal heritage safeguards and management measures that would be implemented to account for the impacts identified in section 6.7.3.

Table 6-23: Aboriginal heritage safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Aboriginal heritage	AH1	Should the scope of the proposed work change, further consultation with Transport for NSW's Aboriginal Cultural Heritage Officer and regional environmental staff must be undertaken to reassess any potential impacts on Aboriginal cultural heritage.	Transport for NSW	Pre-construction / Construction
Unexpected heritage finds	AH2	The Standard Management Procedure – <i>Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that (an) unknown or potential Aboriginal object(s), including skeletal remains, is/are found during construction. This applies where Transport for NSW does not have approval to disturb the object(s) or where a specific safeguard for managing the disturbance (apart from the procedure) is not in place. Work would only restart once the requirements of that procedure have been satisfied.	Contractor	Construction

6.8 Transport, traffic and access

This section describes the land and maritime based traffic, transport and access impacts associated with the proposal.

6.8.1 Methodology

A qualitative assessment of transport, traffic and access was performed and considers the following:

- Desktop assessment of existing transport options near the proposal
- Evaluation of construction and operation impacts to maritime and landside transport.

6.8.2 Existing environment

Land transport

Road network

North Sydney Wharf is located in Neutral Bay, at the tip of a small peninsula to the east of the Warringah Freeway on Sydney's Lower North Shore. The wharf sits at the water's edge of Kesterton Park and is accessed through the park from High Street, which runs along the ridge of the peninsula terminating at the wharf.

The road network within the vicinity of the wharf is characterised by residential streets with on-street and off-street parking. Speed limits in the area are generally 50 kilometres per hour in the vicinity of the proposal.

Bus network

The wharf interchange offers no direct connectivity to bus services. This is due to insufficient road width and turning space for buses along High Street. There are three bus stops within a 500 metres radius of the wharf (around five minutes walking time); two are located on Clark Road and one on High Street on the northern side of the intersection of High Street and Clark Road.

There are two bus routes that travel along Clark Road: routes 263 and 269. The timetables of these two bus routes are not aligned to ferry timetables.

Route 263 travels between Crows Nest and the CBD. The service frequency ranges between 15 minutes and 45 minutes from Monday to Friday, and 45 minutes and 70 minutes on weekends.

Route 269 follows a circular route between McMahon's Point through North Sydney, Kirribilli, Milsons Point and back through North Sydney to terminate at McMahon's Point. It is designed as a local route connecting passengers between four ferry wharves and two train stations along Sydney's Lower North Shore. This route runs hourly Monday to Friday (between 8.30am to 5:15pm) and does not operate on the weekend or public holidays.

Train network

Milsons Point station and North Sydney station are located 1.1 kilometre and 1.2 kilometre (walking distance) away from the wharf, respectively. Both stations are part of the T1 North Shore, Northern and Western Line, providing connectivity to Hornsby,

Epping, Penrith and Richmond. Frequency along this line ranges from three minutes between trains during peak period and 10 minutes during off-peak.

Bicycle network

Unmarked bicycle routes determined by North Sydney Council are signposted along Clark Road, Alfred Street, Broughton Street and the Pacific Highway. These bicycle routes provide connectivity to Milsons Point and North Sydney stations and towards Military Road in the north. Access for cyclists travelling to and from the wharf requires connectivity to the local bicycle network via High Street. No bicycle parking hoops or secure lockers are currently provided at the wharf.

Pedestrian access

Pedestrian access to the wharf is along High Street with local streets branching off into the low-density residential areas. A concrete footpath is available along both sides of High Street from Kesterton Park to Clark Road. High Street has an average slope of 2.5 per cent between the wharf and Clark Road, making it wheelchair accessible.

Parking

On-street parking is available along High Street with angled spaces along the north-east side of High Street, and parallel kerbside parking along the south-west side. Parking is restricted to two hours between 8:30am and 6:00pm Monday to Friday, with exceptions to permit holders. There is a 'no parking' restriction at the High Street cul-de-sac.

Water transport

Ferry services

North Sydney Wharf is part of the F5 Ferry Service that operates between Circular Quay and Neutral Bay. The service travels in a circular direction from Circular Quay to Kirribilli, North Sydney, Neutral Bay, Kurraba and back to Circular Quay. It takes about 15 minutes for the ferry to travel from North Sydney Wharf to Circular Quay.

The ferry service operates at North Sydney at the following times:

- Weekdays: between 6:07am and 11:35pm, every 30 minutes
- Saturdays: between 6:35am and 11:35pm, every hour
- Sundays and public holidays: between 8:35am and 8:35pm, every hour.

A review of 2017 opal card data completed during the concept design stage indicated that the highest average patronage in a one-hour period was 11 patrons (10 boarding, one alighting).

Ferry patronage in the case of a special event was also recorded, with the maximum number of boarding and alighting passengers in an hour as 38 patrons.

Transdev (formerly Harbour City Ferries) is the primary public transport network operator using the wharves within the Inner Harbour, Outer Harbour and Parramatta River areas. Transdev operates the services under an agreement with Transport for NSW.

Commercial and recreational activity

Charter boats are able to use the existing wharf in accordance with the Transport for NSW *Wharf Access Policy*. Public transport ferry services have priority to access the wharf based on their timetabling.

There are mooring on either side of the navigational channel, the closest mooring to the proposal is about 55 metres to the south-east.

6.8.3 Potential impacts

Construction

Land transport

Construction vehicles would access the proposal via High Street. There would be a large number of heavy vehicles accessing the site via High Street during earthworks, retaining wall and ramp construction. It is anticipated that most materials and equipment required for land based elements of the proposal would be delivered by road.

Up to five heavy vehicles would be used for construction and a maximum of ten light and heavy vehicles would be used for deliveries to site. Temporary traffic lights or stop-go provisions on High Street may be required if major deliveries take place by road.

The additional construction traffic expected within the area is considered minor and would be unlikely to affect the capacity of the road network. Any potential impacts associated with construction vehicles at the site would be mitigated through the preparation and implementation of a Traffic Management Plan (TMP).

Closure of North Sydney Wharf would require commuters to use alternative transport. As bus services are not able to access High Street due to the insufficient road width, it is anticipated that ferry commuters would use existing bus services along Clark Road, or existing train services.

Some commuters may also use private vehicles during the construction which may result in additional commuter traffic. Based on patronage data for the wharf, this could include up to 100 vehicles over an average weekday. This traffic would be spaced over the day, and from different locations within the wharf catchment, and is not likely to result in congestion related impacts to the existing road network.

Pedestrian and cyclist access around Kesterton Park would be restricted. However, this would be maintained by providing an alternate route around the construction footprint as shown on Figure 3-2. Pedestrian and cyclist access to the foreshore would be limited during construction.

The ancillary facilities identified in section 3.4 do not include provision for light vehicle parking. It is anticipated that any parking requirements during construction would utilise the existing parking arrangements available locally. There may be loss of some parking spaces on High Street during construction.

Alternatively, the construction contractor may seek Council approval to implement a work zone to provide parking. Typically, this process would also involve consultation with adjacent properties and commercial premises. Final access and parking arrangements would be confirmed by the construction contractor.

Some workers may travel to and from the site by boat from the off-site facility minimising impacts to parking in the vicinity of the proposal. Where feasible, plant, equipment and materials would also be transported to the construction work site by barge or boat. Where parking is required for construction vehicles this would be managed through the TMP.

Water transport

North Sydney Wharf would be closed for up to six months during construction. Based on the patronage data for the North Sydney Wharf, there would be disruption of up to 200 passengers per day due to closure of the wharf. It is anticipated that no alternate transport would operate during construction (due to the inability for buses to turn around at the end of High Street) and existing bus and train services or private vehicles would be used by ferry commuters.

A maritime exclusion zone may be required around the construction footprint during construction to prevent commercial and recreational traffic entering the area. This would also include changes to the F5 Neutral Bay ferry route to avoid the construction site.

Where feasible, materials and equipment for water based elements of the proposal would be shipped (barged) into and out of the area to limit any impact on High Street and surrounds. This would provide the best method to build the marine components and may also be used to deliver materials for the land-based components of the proposal. The amount of materials shipped to site, over being delivered by road, would be confirmed during detailed design.

Construction of the proposal would result in up to four vessels travelling between an off-site facility and the wharf each day. The minor increase in vessel movements is not considered to be significant in the context of the harbour.

Operation

Land transport

Ferry services would recommence once the new wharf is operational. The proposal would result in the improvement of efficiency and user experience of ferry services from the wharf. This may result in an increase to patronage of the wharf and ferry service and additional commuter traffic travelling to and from the wharf. However, this is not considered to be significant based on the existing patronage of the wharf.

The footpaths around the wharf would also be widened to meet DDA and BCA standards, improving accessibility to the wharf from High Street.

The proposal would result in the construction of a dedicated accessible parking space and a kiss-and-ride space in the cul-de-sac of High Street.

Three bicycle hoops would also be installed at the interchange.

Water transport

Ferry operations to North Sydney Wharf interchange would commence once the new wharf is operational. The proposal would result in the improvement of efficiency and user experience of ferry services from the wharf. This may result in an increase to patronage of the wharf and ferry service. However, this is not considered to be significant based on the existing patronage of the wharf.

The new Sub Base Platypus development to the north of the wharf is anticipated to attract visitors to the area and is expected to increase future patronage.

The proposal would enable the continuation of a ferry service for the period of its 50-year operational life and would also improve the efficiency and user experience of the wharf.

Part of the existing wharf would be retained as part of the proposal. Recreational fishing would be allowed at the existing structure.

6.8.4 Safeguards and management measures

Table 6-24 lists the transport, access and parking safeguards and management measures that would be implemented to account for the impacts identified in section 6.8.3.

Table 6-24: Land transport and parking safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Land transport, parking and access	T1	<p>A Traffic Management Plan (TMP) will be prepared and will include the following.</p> <ul style="list-style-type: none"> • Final access and parking arrangements • Alternate pedestrian and cyclist access around the construction area • Measures to ensure light vehicle parking is strictly in accordance with North Sydney Council requirements and prevents parking on footpaths and grassed areas adjacent the site. 	Contractor	Pre-construction
	T2	Where possible, the preferred means of transporting equipment and materials to the site will be via boat and barge over land transport so as to limit impacts to the local road network.	Contractor	Construction
	T3	Public transport passengers will be notified of any impacts to transport services and the alternative transport arrangements prior to the commencement of construction. This will include updates to the timetable (online and Opal app) indicating the temporary closure of the North Sydney Wharf.	Transport for NSW	Pre-construction / construction
Water transport	T4	<ul style="list-style-type: none"> • A maritime navigation exclusion zone will be established during construction to prevent unauthorised vessels entering the area. • This zone will be clearly defined to communicate access for other water users. 	Contractor	Pre-construction / construction
	T5	A Maritime TMP will be prepared and implemented during the water based construction work. The Maritime TMP will be prepared consultation with	Contractor	Pre-construction / construction

Impact	ID	Environmental safeguards	Responsibility	Timing
		<p>Transport for NSW and approved by the Harbourmaster. In addition, the project will:</p> <ul style="list-style-type: none"> • Fit all buoys with lights • Prepare Response Plans for emergencies and spills for all construction vessels • Fit at least one vessel with an Automatic Identification System (AIS) • Retrieve any material associated with the construction of the development that enters the water to prevent the obstruction of vessel movements • Prepare a Communications Plan for implementation during the work which must include 24/7 contact details, protocols for enquiries, complaints and emergencies. <p>Any variation to the above will be agreed in advance with the Harbourmaster.</p>		
	T6	Commercial, recreational operators and private services that use the existing wharf will be advised of the wharf closure at least two weeks prior to closure.	Transport for NSW	Pre-construction / construction

6.9 Socio-economic

This section summarises the proposal's socio-economic impacts. Appendix I contains a Socio-Economic Impact Assessment (SEIA) prepared by Cardno (Cardno, 2020e).

6.9.1 Methodology

The SEIA assesses the socio-economic impact of the proposal in accordance with Roads and Maritime's *Environmental Impact Assessment Practice Note – Socio-economic assessment* (EIA-N05) (Practice Note) (Roads and Maritime, 2013).

For the purpose of defining a boundary for assessing social and economic characteristics, ABS geographic boundaries referred to as Statistical Areas Level 2 (SA2s) have been used, and the North Sydney LGA was used as a comparison.

The following data sources were used to define the socio-economic baseline:

- Data on population and demography, income and employment, and business and industry were sourced from the ABS Census 2016, and Commonwealth, State and local government agencies
- Existing socio-economic policies and strategies in the North Sydney area, including local government policies and strategies:
 - North Sydney Council Annual Report 2018/2019 (North Sydney Council, 2019a)
 - North Sydney Community Strategic Plan 2018-2028 (North Sydney Council, 2018a)
 - North Sydney Council Delivery Program 2018/19-2020/21 (North Sydney Council, 2018b)
 - North Sydney Council Operational Plan 2019/20 (North Sydney Council, 2019b)
 - Greater Sydney Harbour Estuary Coastal Management Program Scoping Study (BMT, 2018)
- North Sydney Wharf Upgrade Concept Design Community Consultation Report – March 2020 (NSW Government, 2020). Outcomes of community consultation on the concept design of the proposal
- Analysis of social infrastructure, based on a review of publicly available information, including Council's webpage
- NSW Department of Planning, Industry and Environment (DPIE) population projections (DPIE, 2019b)
- Available mapping and imagery from Google maps and Cardno's spatial data store.

This assessment is informed by the following studies undertaken as part of the concept design and REF:

- North Sydney Wharf Upgrade: Landscape character and visual impacts (Cardno, 2020d)
- North Sydney Wharf Upgrade: Noise and vibration assessment (Cardno, 2020c)

- North Sydney Wharf – Ferry Wharf Upgrade Program TAP 3 – Communications and Stakeholder Engagement Plan 2020 (Cardno, 2020f)
- Preliminary Landscape Character and Visual Impact Assessment: Ferry Wharf Upgrade Program Package 3 North Sydney Wharf Interchange (Aurecon, 2019d).

The SEIA was also informed by stakeholder and community consultation undertaken during the concept design.

6.9.2 Existing environment

The proposal is situated in the Neutral Bay – Kirribilli Statistical Area (refer Figure 6-15). It is an area of 220 hectares within the North Sydney LGA. The Neutral Bay – Kirribilli Statistical Area (the study area) includes the suburbs of Kirribilli, Neutral Bay, Kurraba Point and North Sydney (eastern section only). The proposal is located in the suburb of North Sydney.

Population and demography

At the time of the 2016 Census, the study area had an estimated residential population of about 17,852 people, of these 47 per cent were male and 53 per cent were female. Aboriginal and/or Torres Strait Islander people made up 0.3 per cent of the population.

About 795 people live in the neighbourhoods closest to the North Sydney Wharf. In 2016, about 495 were recorded to live in the area (SA1–1141619) north of the High Street and 300 people live south of the High Street (SA1–1141608).

The study area experienced a seven per cent population growth between 2011 and 2016. This is lower than the rate of population growth in the North Sydney LGA (9 per cent) and Greater Sydney (10 per cent) for the same period.

In 2018 North Sydney LGA estimated population was 74,172. By 2036, the population of North Sydney LGA is forecast to grow by 11 per cent, which is 84,422 people (North Sydney Council, 2019).

Transport and access

The majority of the employed residents (40 per cent) of the study area used public transport (train, bus, ferry, tram/light rail) as at least one of their methods of travel to work and 34 per cent travelled by car (either as driver or as passenger). The majority of residents travel to work via bus (16 per cent) and 2 per cent of residents travel to work via ferry. When compared to Greater Sydney (20 per cent), a high proportion of residents rely on public transport to reach work in the study area (40 per cent). This reflects the study area's high level of access to bus, rail and ferry services.

The transport network is described in further detail in Section 6.9.

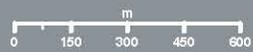


Legend

- Construction footprint
- Study Area - (Statistical Area Level 2: Neutral Bay - Kirribilli)
- North Sydney Council (LGA)
- Suburbs within the Study Area

FIGURE 6-15

1:20,000 Scale at A4



Administrative boundaries in the study area

NORTH SYDNEY



Map Produced by Cardno NSW /ACT Pty Ltd (WOL)
 Date: 2020-06-03 | Project: AWE200198
 Coordinate System: GDA 1994 MGA Zone 56
 Map: AWE200198_GS026_NSsydney_AdminBound.mxd 01
 Aerial imagery supplied by Nearmap (April, 2020)

Economic profile

In 2016 the median weekly household income in the study area was \$2,265. This was slightly lower than that of the North Sydney LGA (\$2,360).

About 71 per cent of the study area's labour force was employed full time and about 21 per cent were employed part time. This correlates with the relatively high proportion (25 per cent) of young workforce in the study area. The most common occupations in the study area include professionals (43 per cent), managers (21 per cent) and clerical and administrative workers (13 per cent). People in the study area mainly worked for the professional, scientific and technical services and financial and insurance industry sectors.

Local business

The study area is comprised of a large number (2,969, ABS 2016 data) of local businesses due to the close proximity to the Sydney CBD. The largest employing industries are: Professional, Scientific and Technical Services.

The only local business within close proximity to the wharf is Sub Base Platypus centre.

Main types of local businesses and service providers within 500 metres include:

- Loreto Kirribilli School
- Ensemble Theatre – performing arts theatre
- Lansdowne Gardens – Aged care services.
- Carnarvon Lodge Kirribilli – guest house
- Glenferrie Lodge – guest house
- Various cafés and restaurants
- Various marinas and other boating clubs:
 - Kirribilli Marina
 - Sydney Flying Squadron Ltd
 - Royal Sydney Yacht Squadron.

Social infrastructure

Social infrastructure refers to community facilities, services and networks which help individuals, families, groups and communities meet their social needs, maximise their potential for development and enhance community well-being.

Social infrastructure located within the study area, close to the proposal includes:

- Local Parks including:
 - Kesterton Park
 - Submariners' Memorial inside the HMAS Platypus site
 - Milson Park
 - Wrixton Park
 - Miss Gladys Carey Reserve
 - Colindia Reserve
- Public transport facilities such as bus stops operating in the Clark Street and Carabella Street
- Our Lady Star of the Sea Catholic Church

- Loreto Kirribilli, an independent Roman Catholic single-sex primary and secondary day school for girls
- North Sydney Wharf waiting shelter - It was noted during consultation for the proposal that the waiting shelter is considered by the community an important heritage site.

Community values

Community values are those socio-economic aspects considered to be important to quality of life and well-being. They include social factors such as a sense of safety, well-being, belonging and community diversity, as well as physical assets, such as parks and recreational areas.

A survey conducted in 2020 by the North Sydney Council (Jetty Research, 2020) reveals that the residents generally appreciate:

- Maintaining parks, ovals and bushland areas
- Access to/provision of recreation facilities
- Feeling safe in the neighbourhood (crime, road safety, pedestrians, cyclists, street lighting etc.)
- Maintaining waste management and recycling services
- Maintaining the visual amenity and character of the area
- Cleanliness of the neighbourhood.

6.9.3 Potential impacts

Construction

The proposal would be constructed over a duration of up to six months starting in early 2021. North Sydney Wharf would be closed throughout the construction period. Ferry passengers would be notified ahead of construction and updated whilst the proposal is built. Local bus services, North Sydney train station and Neutral Bay Wharf are possible alternatives for some customers in the catchment area of North Sydney Wharf.

Existing bus services would be used to support access to Sydney CBD as bus transport would remain operational. Ferry users travelling to or from the city could catch the existing 263 bus service along the Clark Street to travel to Sydney CBD or can catch the 269 bus service along Carabella Street to reach Milsons Point train station.

A maritime exclusion zone may be required around the proposal footprint during construction to prevent commercial and recreational traffic entering the area. This would also include changes to the F5 Neutral Bay ferry route to avoid the construction site. The closure of the wharf would cause disruption to approximately 38 passengers daily due to the requirement to switch transport modes. Disruptions could potentially involve increased travel times by using bus or combination of bus and train compared to travelling by ferry. Some commuters may also use private vehicles during the construction which may result in additional commuter traffic and increased travel times during peak hours. Any disruption would be minimised through notification ahead of construction, and consequent updates. In addition, the short-term impacts during construction described above would be offset by the benefits of the upgraded Wharf and interchange during operation.

The NSW Government leased private vessel moorings as well as water-based activities and fishing conducted from the wharf would be impacted by restricting access and marine exclusion zone.

There would be a number of heavy vehicles accessing the proposal site via High Street during the earthworks, retaining wall and ramp construction. It is anticipated that most materials and equipment required for land-based elements of the proposal would be delivered by road. Temporary traffic lights or stop-go provisions on High Street may be required if major deliveries take place by road. The additional construction traffic expected within the area is considered minor and would be unlikely to affect the capacity of the road network. Any potential impact associated with construction vehicles at the site would be mitigated through the preparation and implementation of a traffic management plan.

The southern area of Kesterton Park would be closed to the public during construction of the land side works of the wharf. A site compound is likely to be required within the park. A land exclusion area may also need to be established for the safety of people using the park and other recreational activities during construction. As a result, local clubs and recreational users may potentially be impacted during the construction period. At the end of construction, the exclusion zones would be removed and the area would be landscaped and made accessible again.

The existing heritage listed waiting shelter on the foreshore would not be removed as part of the North Sydney Wharf Upgrade, however access would be restricted for a period of time. This area is utilised as a resting area for recreational users, and closure during construction may cause disruption to these users. However, Kesterton Park is well serviced by other seating and sheltered areas, and the temporary loss of use of the existing waiting shelter is not considered to be significant, as alternative locations in close vicinity would be able to be utilised.

Noise, air quality and visual impacts from construction activities would disrupt the amenity of the area. This would directly impact residents surrounding the wharf, and any residents accessing the Kesterton Park and playground area. There would be temporary loss of amenity in the area surrounding the wharf due to the construction works and presence and use of barge mounted cranes and other plant and equipment. Landside construction would result in a temporary loss of amenity near the Kesterton Park. The temporary loss of amenity, along with restrictions on pedestrian access, may discourage the use of these areas in the vicinity of the wharf during construction.

Some construction activities may require work to be carried out during early mornings when the water is calm and the harbour is least busy, a time of day where residents may be more likely to be at home and therefore disrupted by the activities. Construction activities conducted at night time or the general high voltage lighting used during construction may also disrupt nearby residents.

Indirect impact to local businesses in the broader area may occur due to noise, air quality and visual impacts, as well as the decline in patronage of the wharf and general decline in local amenity. Further consultation with the community would be undertaken to determine sensitive periods for surrounding businesses and other receivers. This may include consultations with the surrounding businesses to understand their peak hours. Management measures described in section 6.9.4 would aim to minimise these impacts.

The proposal would also generate some opportunities for employment of local people and to buy resources, potentially from businesses in the region.

Operation

The proposal would provide a range of long term socio-economic benefits for the study area community, as well as communities and businesses in the wider region.

Currently, customers with mobility needs are unable to access High Street from North Sydney Wharf. The proposed Wharf design includes a new floating pontoon which would improve the efficiency and safety of wharves for customers getting on and off ferries that stop at the wharf. An accessible ramp would be installed along the foreshore to access High Street. The footpaths around the wharf would also be widened to meet DDA and BCA standards, improving accessibility to the Wharf from High Street. This also would improve access to customers with prams.

The existing wharf at North Sydney includes an uncovered jetty and tidal steps for ferries to pickup and drop-off customers. The new pontoon would have a waiting area with a curved roof, seating and glass weather protection panels to provide passengers with a comfortable place to wait for their ferry.

The proposal includes improved access to the wharf via High Street through providing a kiss and ride zone at the wharf, as well as with the installation of new bike hoops and additional car spaces. Accessible parking at the primary wharf entry would also be provided.

Ferry services would recommence once the new wharf is operational. The proposal would result in the improvement of efficiency in patron movement on and off the ferry, and an improved customer experience of ferry services from the wharf. This may result in an increase to patronage of the ferry service and additional commuter traffic travelling to and from the wharf. However, this is not considered to be significant based on the existing patronage of the wharf.

The new Sub Base Platypus development to the north of the wharf is anticipated to attract visitors to the area and is expected to increase future patronage.

The proposal would potentially increase access to goods, services, and economic opportunities for locals by upgrading and improving accessibility to the wharf.

Part of the existing Wharf would be retained as part of the proposal. Recreational berthing and fishing would be allowed at the existing structure.

The overall visual impact of the proposal once operational is moderate. The design would incorporate surrounding elements to tie in to the area, for example, the landside upgrade has been designed to fit in with the urban landscape of Kesterton Park. The wharf design aims to unify and identify the harbour wharves and the ferry commuter transport system. This impact would be minimised through the use of glass walls for wind protection and curved roof is designed to be low profile and minimise the impact on the views to and from the water. More detailed assessment of the visual impact during operation are described in section 6.5.

During operation, the extra lighting and security cameras at the wharf would deter antisocial behaviour from occurring and provide a safer night-time environment for ferry users. Generally, the design of the ferry wharf creates a clear hierarchy of space, enable safe access/egress, and enables formal and passive surveillance. There would be an emergency button on the pontoon for the security of waiting passengers.

6.9.4 Safeguards and management measures

Table 6-25 lists the socio-economic safeguards and management measures that would be implemented to account for the impacts identified in section 6.9.3.

Table 6-25: Socio-economic safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Socio-economic	SE1	<p>A Communications and Stakeholder Engagement Plan will be developed prior to the commencement of construction and will be implemented during construction to provide timely and accurate information to stakeholders during construction. It will include (as a minimum):</p> <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents and local businesses, including changes to traffic, public transport services and access • A contact name and telephone number for complaints <p>The Plan will be prepared in accordance with the Community Involvement and Communications Resource Manual (RTA, 2008).</p>	Transport for NSW	Pre-construction / construction
	SE2	<ul style="list-style-type: none"> • A webpage and free-call number will be established for enquiries regarding the proposal, and will remain active for the duration of construction. • Contact details will be clearly displayed at the entrance to the site. • All enquiries and complaints will be tracked through a tracking system, and acknowledged within 24 hours of being received. 	Contractor	Pre-construction / construction
Sustainability	SE3	Investigate opportunities to encourage the Contractor to purchase goods and services locally.	Contractor	Pre-construction / construction
	SE4	Investigate opportunities to incorporate community health and wellbeing initiatives in the design and construction of the project.	Transport for NSW / Contractor	Detailed design / construction

Impact	ID	Environmental safeguards	Responsibility	Timing
Land transport and parking	T2	Where possible, the preferred means of transporting equipment and materials to the site will be via boat and barge over land transport so as to limit impacts to the local road network.	Contractor	Construction
	T3	Public transport passengers will be notified of any impacts to transport services and alternative transport arrangements prior to the commencement of construction. This will include updates to the timetable (online and Opal app) indicating the temporary closure of the North Sydney Wharf.	Transport for NSW	Pre-construction / construction
Maritime transport	T4	<ul style="list-style-type: none"> • A maritime navigation exclusion zone will be established during construction to prevent unauthorised vessels entering the area. • This zone will be clearly defined to communicate access for other water users. 	Contractor	Construction

Other safeguards and management measures that would address socio-economic impacts are identified in section 6.4.5 (noise) 6.5.4 (visual and 6.10.3 (air quality).

6.10 Air quality

6.10.1 Existing environment

The existing air quality near the location of the proposal is primarily influenced by emissions from motor vehicles and residential activities. Air quality is also influenced by the prevailing weather and climatic conditions, bushfires and other natural factors such as pollen.

The nearest DPIE air quality monitoring stations to the site is the Bradfield Highway roadside monitoring station in North Sydney. This site was commissioned in 2018. The nearest long term air quality monitoring site is located at Rozelle which is part of the Sydney east monitoring network.

A review of air quality data for the year to April 2020 for Bradfield Highway and Rozelle indicates that air quality is generally categorised as 'Good' based on the Air Quality Index (AQI) (DPIE, 2020b).

The closest Bureau of Meteorology (BoM) monitoring station to the location of the proposal with rainfall data is located at Observatory Hill, Sydney (station number 066062). Data from the BoM (BoM, 2020b) reports that the average annual rainfall recorded at Observatory Hill is 1210 millimetres.

Sydney Harbour (Wedding Cake West) weather station (station number 066196) is located about 4 kilometres to the east of the proposal. Afternoon winds are generally stronger than morning winds tending towards 20-40 kilometres per hour with morning winds generally 10-30 kilometres per hour (BoM, 2020b). Wind direction and speed varies throughout the day, usually being calmer in the morning. Wind speed and direction also varies throughout the year.

6.10.2 Potential impacts

Construction

During the construction of the proposal temporary impacts on air quality may arise from:

- Minor generation of particles and dust from general construction work (e.g. excavations, concrete cutting and breaking)
- Minor emissions (primarily diesel exhaust) from plant and machinery
- Minor emissions from construction traffic and water vessels.

These impacts are expected to be short-term, low intensity and be able to be managed through identified safeguard and management measures.

Operation

The level of operation of the ferry services would not increase so no additional impacts to the air quality expected from the operation of the proposal.

6.10.3 Safeguards and management measures

Table 6-26 lists the air quality safeguards and management measures that would be implemented to account for the impacts identified in section 6.10.2

Table 6-26: Air quality safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Air quality	AQ1	<p>Air quality during construction will be considered and addressed within the CEMP and would include methods to manage work during strong winds or other adverse weather conditions as required. As a minimum, the following measures will be included:</p> <ul style="list-style-type: none"> • Covering all loaded trucks and vessels • Machinery to be turned off rather than left to idle when not in use • Maintenance of all vehicles, including trucks and vessels entering and leaving the site in accordance with the manufacturers specifications to comply with all relevant legislation • Maintenance of all plant and equipment to ensure good operating conditions and exhaust emissions comply with the <i>Protection of the Environment Operations Act 1997</i> • Maintaining the work site in a condition that minimises fugitive emissions such as minor dust • Appropriate sediment and erosion controls for any exposed earth or stockpiled waste 	Contractor	Pre-construction / construction
Sustainability	AQ2	<p>During construction, the construction contractor is to monitor performance of their non-road diesel plant and equipment against US EPA, EU or equivalent emissions standards using the Transport for NSW <i>Air Emissions Workbook - DMS-FT-439</i>.</p>	Contractor	Construction

6.11 Waste management and resource use

6.11.1 Methodology

The assessment considered the impacts associated with:

- Resource use and materials management during construction
- Waste generation, management and disposal during construction
- The proposal's ability to respond to waste management and resource conservation plans, policies and guidelines.

The basis of assessment was to consider the hierarchy of avoiding waste generation and primary resource use in favour of reduction, reuse and recycling, consistent with the *NSW Waste Avoidance and Resource Recovery Act 2001*.

6.11.2 Existing environment

Public waste bins are provided at the existing wharf and are managed as part of the existing wharf operations. There is the potential for litter to enter Sydney Harbour from existing wharf activities and from the use of the foreshore and Kesterton Park.

Recreational fishing is undertaken from the existing wharf. Fishing waste was noted as an issue during the community consultation for the concept design development.

In terms of resource use, the wharf has required ongoing maintenance, repair and upgrade over time. This has required the use of small quantities of replacement materials such as timber and metal.

6.11.3 Potential impacts

Construction

Waste management

Construction activities would generate various waste streams that would need to be managed and disposed of. Potential wastes include:

- Waste fuels, oils, liquids and chemicals
- Packaging wastes such as cardboard, timber, paper and plastic
- General garbage and sewage from the temporary compound
- Potential for acid sulfate soils in the marine environment (refer section 6.1.2)
- Potential for contaminated soils and sediment (refer section 6.1.2)
- Various building material wastes (including metals, timbers, plastics and concrete)
- Earthworks spoil
- Asphalt and concrete
- General waste, including food, litter and other wastes generated by the construction workers.

Landside ancillary facilities would be contained within the site compound(s), and include a portable toilet and small shipping container/shed. Minimal storage of materials is anticipated, but may include precast materials and some plant and equipment. Where feasible, materials would be barged, including fuels, oils and other required liquids which would be stored in bunded containers. All waste removed from the proposal footprint would be transferred by a licenced contractor to a licenced receiving facility.

Any excavated material would be reused where suitable or classified before being disposed to an appropriately licenced facility in accordance with *Waste Classification Guidelines: Part 1 Classifying Waste* (EPA 2014). Where necessary, this would include sampling and analysis.

Resource use

Transport for NSW adopts a resource reduction strategy based on using:

- Alternative low-energy, high recycled content materials where they are cost and performance competitive and comparable in environmental performance
- Locally sourced materials, noting that most of the materials needed to build the proposal are widely available and typically in abundant supply in the local market
- Alternative forms of material sourcing to reduce the distances or methods travelled to supply materials.

Operation

One of the objectives of the Ferry Wharf Upgrade Program is to increase patronage of the Sydney Harbour ferry network. The proposal would lead to an increase in patronage as a result of improved access and generally improving the wharf facility. As a result, increased waste may be generated but incidences of littering are not expected to increase given that waste management is likely to improve with the installation of new garbage receptacles and improved facilities.

6.11.4 Safeguards and management measures

Table 6-27 lists the waste management safeguards and management measures that would be implemented to account for the impacts identified in section 6.11.3.

Table 6-27: Waste management safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Waste	WM1	<p>A Waste Management Plan (WMP) will be prepared in accordance with the WARR Act. A WMP is to prepared as part of the CEMP and would include measures to minimise waste, outline methods of disposal, reuse and recycling and monitoring, as appropriate. This is to include the following:</p> <ul style="list-style-type: none"> • Appropriate measures to avoid and minimise waste associated with the proposal should be investigated and implemented where possible. • Waste management, littering and general tidiness will be monitored during routine site inspections. 	Contractor	Pre-construction / Construction
	LS2	<p>Any excavated sediments or soil that require disposal will be sampled, tested and classified in accordance with the EPA's <i>Waste Classification Guidelines: Part 1 Classifying Waste</i> (EPA 2014) prior to being disposed of at a waste facility licensed to accept the relevant class of waste. Any materials classified as Hazardous Waste may require treatment or an immobilisation approach in accordance with Part 10 of the <i>Protection of the Environment Operations (Waste) Regulation 2014</i> prior to off-site disposal.</p>	Contractor	Construction
Resource use	WM2	<p>Recycled, durable, and low embodied energy products will be considered to reduce primary resource demand in instances where the materials are cost and performance competitive and comparable in environmental performance (e.g. where quality control specifications allow).</p>	Contractor	Pre-construction / construction

Impact	ID	Environmental safeguards	Responsibility	Timing
Sustainability	WM3	During construction, Construction Contractor is to monitor waste and recycling quantities using the Transport for NSW <i>Waste Data Collection Workbook – DMS-FT-436</i> .	Contractor	Construction

Other safeguards and management measures that address hazards impacts are identified in sections 6.1.4 and 6.2.4 (with regards to spills and contamination).

6.12 Hazards, risk and utilities

6.12.1 Methodology

The assessment considered the impacts associated with potential hazards and risks, and utilities during construction and operation of the proposal.

6.12.2 Existing environment

The existing wharf may pose a safety risk to ferry users due to the use of tidal steps which are not accessible. The tidal steps make it difficult for prams and wheelchairs to get on and off the ferries, particularly when the lower steps are used. There is the potential for slips and falls from the steps.

There is an alarmed life buoy in a sheltered case at the bottom of the stairs on the existing jetty.

There is one potentially hazardous and/or contaminated site (as identified on the NSW EPA contaminated sites register) located within 1 kilometre of the site (refer section 6.1.2).

No flooding issues, or other hazards and risks are expected at the site.

Utilities within the vicinity of the proposal footprint include:

- Existing low voltage street Light Pillar on High Street (SL Pillar 3.0) in new parking area
- Existing low voltage cable mains in new parking area
- LV cable mains along new access path to wharf.

A water mains connection is located about 40 metres from the proposal area.

There is the potential for unknown utilities to exist within the proposal footprint.

6.12.3 Potential impacts

Construction

The following hazards and risks would be associated with the proposal during construction:

- Construction materials, wastes and/or other objects have the potential to fall from the land based construction area into the harbour causing water pollution and risk to human health
- Construction materials, waste and/or objects have the potential to fall from the construction barge or other construction vessels into the harbour causing water pollution and risk to human health
- Physical injury to construction workers due to various hazards and risks associated with the construction activities (e.g. piling or underwater construction activities, gangway installation, or confined space entry)
- Physical injury to public due to various hazards and risks associated with the construction activities

- Risk to human health or the environment from spillage of materials and/or wastes into the water
- Risk to human health or the environment from the dispersion of potentially contaminated sediments, discussed further in section 6.1.2
- Risk to human health or the environment from air quality related impacts from dust generated during construction activities.

Potential impacts to utilities include:

- Existing low voltage cable mains and light pillars would be relocated and/or protected as required.
- The closest existing water mains connection at the wharf is located about 40 metres away from the wharf entrance. A water main connection is proposed at the start of the jetty which would be tapped in from the existing water main.

Operation

The new wharf has been designed to comply with relevant standards, minimising risk to passenger welfare during operation of the wharf, and improving accessibility.

The installation of two pivot piles, and a debris deflector adjacent to the wharf, would assist ferries berthing and disembarking at the wharf.

Vessel movements to the wharf would continue to be managed through standard maritime procedures.

6.12.4 Safeguards and management measures

Table 6-28 lists the hazards safeguards and management measures that would be implemented to account for the impacts identified in section 6.12.3.

Table 6-28: Hazards safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Hazards and risks	HR1	Appropriate emergency equipment such as flotation devices and first aid kits will be kept within the construction area.	Contractor	Construction
	HR2	Safe work method statements or similar will be implemented to manage health and safety risks for the works.	Contractor	Pre-construction / construction
	HR3	Weather forecasts will be monitored during construction. In the unlikely event of a major flood event or strong marine winds/waves, equipment and materials will be temporarily removed from the site, where possible.	Contractor	Construction
	HR4	An application to Ausgrid for connection of grid power for the new wharf and to Sydney Water for connection to the water mains will be required.	Transport for NSW / Contractor	Pre-construction
	HR5	Dial Before You Dig (DBYD) investigations will be carried out prior to undertaking any excavation or piling works to identify any additional cables not identified during design.	Contractor	Pre-construction
	HR6	All utilities within and adjacent to the proposal footprint will be located prior to the start of the works.	Contractor	Pre-construction

6.13 Climate change and greenhouse gas

6.13.1 Climate change strategic framework

The Intergovernmental Panel on Climate Change has produced climate change projections. In Australia, both the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Bureau of Meteorology (BoM) have produced regional downscaled projections for Australia from these projections.

In 2014 the NSW Government published climate change 'snapshots' for each region in NSW, including the Sydney region. The climate change predictions for Sydney can be summarised as (OEH, 2014b):

- Higher than average temperatures (maximum and minimum temperatures)
- The number of hot days will increase and the number of cold nights will decrease
- Rainfall is projected to decrease in spring and winter, and increase in summer and autumn
- Average fire weather is projected to increase in spring, and severe fire weather days are projected to increase in spring and summer.

The NSW Coastal Planning Guideline: *Adapting to Sea Level Rise* (DoP, 2010) applies to the proposal. This guideline requires that the following eight criteria be considered when designing development proposals:

- Development avoids or minimises exposure to immediate coastal risks (seaward of the immediate hazard line)
- Development provides for the safety of residents, workers or other occupants on-site from risks associated with coastal processes
- Development does not adversely affect the safety of the public off-site from a change in coastal risks as a result of the development
- Development does not increase coastal risks to properties adjoining or within the locality of the site
- Infrastructure, services and utilities on-site maintain their function and achieve their intended design performance
- Development accommodates natural coastal processes
- Coastal ecosystems are protected from development impacts
- Existing public beach, foreshore or waterfront access and amenity is maintained.

In October 2009 the NSW government released its *NSW Sea Level Rise Policy* (DECCW, 2009a). The policy provided sea level rise planning benchmarks as follows:

- 40 centimetres by 2050
- 90 centimetres by 2100.

On 8 September 2012, the State government withdrew these benchmarks in order to provide more flexibility in considering local conditions when determining future

hazards. Responsibility for adopting sea level rise projections for use in planning was transferred back to local government.

Climate change risk assessment

A Climate Change Risk Assessment was completed at Concept Design Phase (Aurecon, 2019c). The assessment identifies climate variables that are a risk to the proposal including:

- Sea level rise – sea level rise would increase the potential for inundation of fixed marine structures such as jetties, saltwater intrusion onto marine structures and coastal erosion. Inundation could result in the failure of floating pontoons and gangways. Increased coastal erosion could affect the foundations of landside structures and compromise their integrity. Sea level rise could also inundate landside stormwater and drainage infrastructure, resulting in increased localised flooding at and near the landside approaches to the wharves
- Increased mean annual temperature – higher temperatures have the potential to compromise the integrity of external facades and road surfaces leading to quicker deterioration and cracking, which would increase maintenance costs
- Increased number of hot days and heatwave events – extreme heat has the potential to cause heat stress in customers, especially at wharves that do not provide shelter from sunlight
- More frequent and intense fire weather – more frequent or intense fire events could result in direct loss of wharf property or assets and lives of passengers and staff
- Mean rainfall – extreme rainfall events could create water flows that exceed the drainage and stormwater systems resulting in localised flooding. It could also result in damage to aboveground structures
- Drought – extended periods of drought conditions can cause decrease in soil moisture resulting in ground shrinkage and soil movements. This has the potential to damage underground infrastructure which could compromise serviceability.

6.13.2 Potential impacts

Construction

Climatic factors would not constrain construction of the proposal except during adverse weather conditions such as prolonged heavy rain or high winds which may occur during the construction period. These may delay the completion of construction.

Construction would contribute to climate change through the generation of greenhouse gases from construction activities. A temporary increase in greenhouse gas emissions, primarily carbon dioxide, would be expected during construction of the proposal due to exhaust emissions from construction machinery and vehicles transporting materials and personnel to and from the site.

The detailed design process would undertake a compliant carbon footprinting exercise in accordance with Transport for NSW's Carbon Estimate and Reporting Tool Manual (Transport for NSW, 2019) or other approval modelling tools. The carbon footprint would be used to inform decision making in design and construction.

Due to the small scale of the proposal and the short-term temporary nature of the individual construction works, it is considered that greenhouse gas emissions resulting from the construction would be kept to a minimum through the implementation of the standard mitigation measures.

Operation

Projections for various climate variables which have the potential to impact the wharf were considered in the Climate Risk Assessment completed during the concept design phase in line with Transport for NSW Climate Risk Assessment Guidelines.

The proposal has minimised its exposure to climate change risks by including a fixed gangway and hydraulic platform which have been designed to provide appropriate clearances of existing tides, storm surge, sea and wave action whilst also considering projected sea level rise over the next 50 years. The design of the pontoon, waiting area and gangway was designed to account for 2070 projections of sea level rise. The proposal includes the construction of a new fixed structure within the water. The hydraulic platform has been designed to consider the changes in sea level rise.

More extreme and more frequent heat events as a result of climate change may lead to more rapid degradation of the wharf structures. This may result in additional maintenance requirements.

Shading is provided on the pontoon to protect passengers during extreme weather events.

There would be some greenhouse gas emissions emitted during maintenance of the wharf.

Any climate change impacts of constructing, operating and maintaining the proposal are considered minor.

There would be some greenhouse gas emissions during maintenance of the wharf, although maintenance requirements have been considered in the materials used for the proposal and are considered minor.

It is anticipated that, once operational, the proposal may result in an increase in use of North Sydney Wharf and a relative decrease in use of private motor vehicles by commuters to travel to and from North Sydney. A modal shift in transport usage may reduce the amount of fuel consumed by private motor vehicles with a corresponding relative reduction in associated greenhouse gas emissions in the local area.

6.13.3 Safeguards and management measures

Table 6-29 lists the climate change and greenhouse gas safeguards and management measures that would be implemented to account for the impacts identified in section 6.13.2.

Table 6-29: Climate change and greenhouse gas safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Climate change	CC1	During detailed design undertake a compliant carbon footprinting exercise in accordance with the Transport for NSW <i>Carbon Estimate and Reporting Tool Manual</i> (Transport for NSW, 2019). The carbon footprint will be used to inform decision making in design and construction.	Contractor	Detailed design / Construction
	CC2	During detailed design undertake a compliant climate risk assessment in accordance with the Transport for NSW <i>Climate Risk Assessment Guidelines – DMS-SD-081</i> .	Contractor	Detailed design
	CC3	The detailed design process will consider adaptation measures for climate change, including the following: <ul style="list-style-type: none"> • Design of pontoons, waiting areas and gangways • Integrate coastal erosion control techniques around landside infrastructure • Drainage and storm water infrastructure • Specifications of materials in design • Weather protection features. 	Contractor	Detailed design

6.14 Sustainability

6.14.1 Sustainability in design

Transport for NSW is committed to minimising the impact on the natural environment using the Transport for NSW *Sustainable Design Guidelines (SDG) v4.0 rating tool* to measure and drive sustainability performance. The SDG rating tool was developed to support Transport for NSW's ongoing commitment to sustainability to deliver environmental and social benefits as outlined in the Transport for NSW *Environment and Sustainability Policy* (Transport for NSW, 2020) and Transport for NSW's *Future Transport Strategy 2056* (Transport for NSW, 2018).

The SDG rating tool sets targets across the following key areas:

- Climate change adaptation and resilience
- Energy management
- Waste and recycling
- Materials
- Water conservation
- Supply chain management
- Community benefit.

Key design elements and strategies developed during concept design will be used to further develop the design and construction.

6.14.2 Potential impacts

The design of the proposal has been based on the principles of sustainability, including aiming for a 'Silver' rating as a program under the Transport for NSW *Sustainability Design Guidelines v4.0* and the Transport for NSW *Environmental Management System (EMS)*. These guidelines require a number of mandatory and discretionary initiatives to be applied.

Further positive impacts in relation to climate change and sustainability associated with the proposal include encouraging a reduction in private vehicle use and increase the accessibility of public transport services.

6.14.3 Safeguards and management measures

Table 6-30 lists the sustainability safeguards and management measures that would be implemented to account for the impacts identified in section 6.14.2.

Table 6-30: Sustainability safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Sustainability	S1	The Contractor shall propose a suitably qualified and experienced sustainability officer at a minimum 14 days prior to site establishment to be endorsed by Transport for NSW. The sustainability officer will be responsible for implementing the sustainability objectives for the Project. Details of the sustainability officer, including defined responsibilities, duration and resource allocation throughout the appointment are to be submitted to Transport for NSW prior to the preparation of the Sustainability Management Plan.	Contractor	Pre-construction
	S2	Prior to commencement of construction, a Sustainability Management Plan shall be endorsed by Transport for NSW. The Plan shall be provided at least 14 days prior to site establishment and include the following minimum components: <ul style="list-style-type: none"> • A completed electronic checklist demonstrating compliance with Transport for NSW's <i>NSW Sustainable Design Guidelines Version 4.0</i> (7TP-ST-114) • The Contractors sustainability goals and targets, internal procedures, and implementation strategy. 	Contractor	Pre-construction
	S3	The Contractor must comply with the Transport for NSW <i>Sustainable Design Guidelines version 4.0</i> .	Contractor	Construction
	CC1	During detailed design undertake a compliant carbon footprinting exercise in accordance with the Transport for NSW <i>Carbon Estimate and Reporting Tool Manual</i> (Transport for NSW, 2019). The carbon footprint will be used to inform decision making in design and construction.	Contractor	Detailed design / Construction

Other safeguards and management measures that address hazards impacts are identified in sections 6.3.4 (biodiversity), 6.6.4 (non-Aboriginal heritage), 6.9.4 (socio-economic), 6.10.3 (air quality), 6.11.4 (waste) and 6.13.3 (climate change).

6.15 Cumulative impacts

6.15.1 Study area

North Sydney Council has divided the LGA into precincts. North Sydney Wharf is within the Milson precinct (refer Figure 6-16). Projects within the Milson precinct and the Sydney Ferries Network (Figure 6-17) have been considered for the purposes of this cumulative impact assessment.

A search of the following databases was completed to identify any projects which might result in cumulative impact with the proposal:

- Department of Planning, Industry and Environment – major project
- Sydney North Planning Panel Development and Planning Register
- North Sydney Council Development Application Register.

Projects identified on the above registers that may impact the proposal have been identified in Table 6-31.

6.15.2 Broader program of work

The proposal is part of a broader program of work to upgrade the commuter ferry wharves in Sydney. The proposal is located at North Sydney, which is part of the F5 Ferry Service that operates between Circular Quay and Neutral Bay.

The Ferry Wharf Upgrade Program includes planned upgrades to multiple wharves in the Sydney Ferries Network including Taronga Zoo (F2) and South Mosman (F6).

North Sydney Wharf Upgrade is expected to start in the first half 2021 and to be closed for a period of up to six months.

Potential impacts from the construction and operation of identified past, present and future projects are summarised in Table 6-31.

In addition, other minor residential alterations and development applications have been identified. No significant construction related traffic would be generated for these projects outside of light vehicles travelling to the site and minor deliveries of equipment and materials.

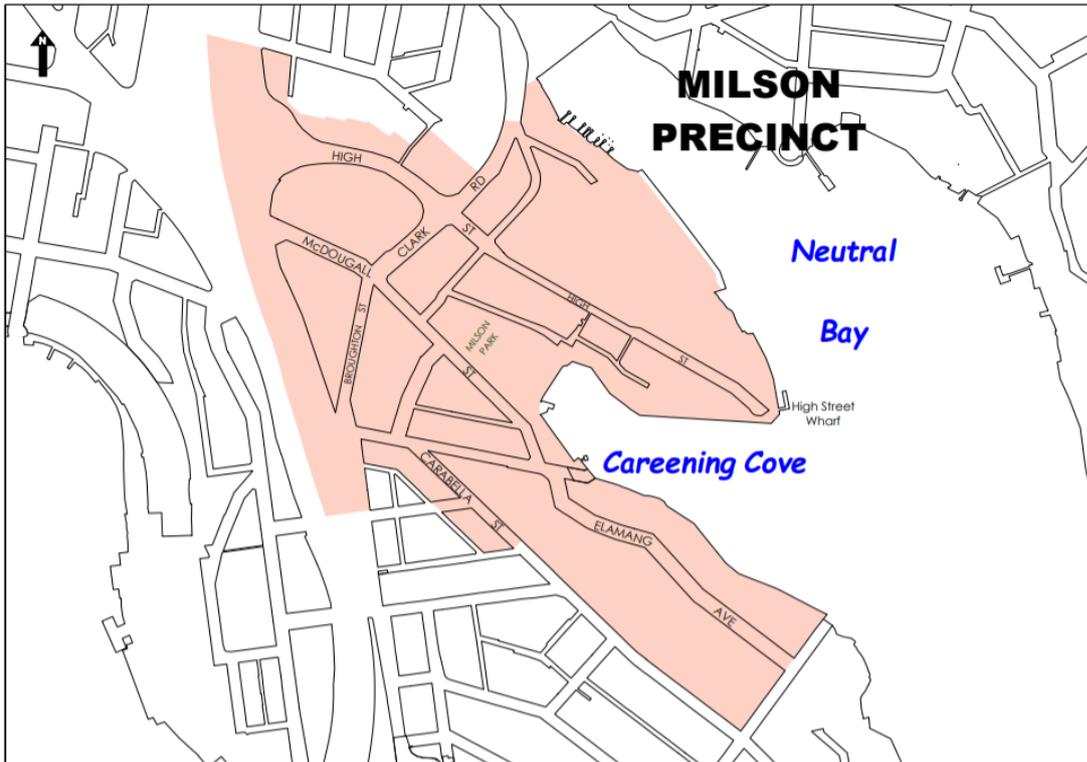


Figure 6-16: Milson precinct

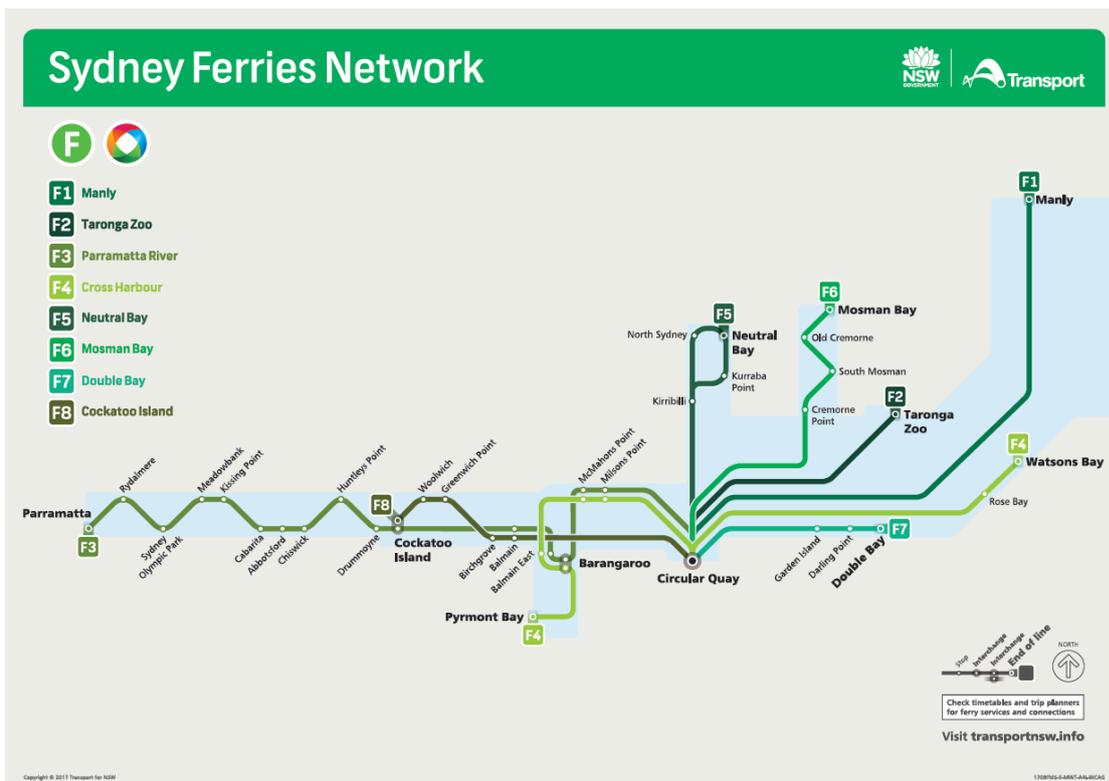


Figure 6-17: Sydney ferries network

6.15.3 Other projects and developments

Table 6-31: Past, present and future projects

Project	Construction impacts	Operational impacts
<p>Ferry Wharf Upgrade Program</p>	<p>Upgrade of North Sydney Wharf would require additional boat movements within Sydney Harbour for the delivery of materials to the proposal area and may conflict with other wharf upgrades.</p> <p>There would be a potential minor short term cumulative increase in exhaust emissions from construction projects within the region. Developments within the region would contribute to climate change through the generation of greenhouses gases from construction activities. Greenhouse gases would be generated through the use of fossil fuels by construction plant and equipment, transportation of personnel and materials and the embodied carbon in the materials used such as concrete and steel. These impacts are considered to be minor.</p>	<p>The Ferry Wharf Upgrade Program would have a beneficial cumulative impact through improved passenger amenity and consistent ferry wharf design across the network. It would result in improvements to:</p> <ul style="list-style-type: none"> a) Safety for commuters b) Recreational facilities c) Improved travel times d) Improved customer experience due to upgraded facilities e) The public domain and quality of customer experience.
<p>Loreto School Redevelopment (State Significant Development)</p> <p>Partial demolition of existing buildings; maximum building envelopes for new buildings; upgrading existing facilities; removal of 11 trees; increasing capacity of students.</p> <p>Located on Elamang Avenue, Kirribilli.</p> <p>Development application approved by Independent Planning Commission.</p>	<p>Potential impacts to traffic, noise and air quality. Reduced visual amenity from the bay during construction.</p>	<p>The proposal would result in additional teachers and students which may result in a minor increase in local traffic. Loss of views to residential properties on the Kirribilli peninsula and a reduction in residential amenity. Alteration of views from the bay.</p>
<p>62 Willoughby Street, Kirribilli</p> <p>To carry out alterations and additions to an existing boat repair facility and marina including the removal of slip rails, timber jetties and mooring piles and construction of a boatshed, installation of a</p>	<p>Potential impacts to traffic, noise and air quality. Reduced visual amenity from the bay during construction.</p>	<p>Some minor increase in maritime traffic may result from the proposal.</p>

Project	Construction impacts	Operational impacts
boat crane with the capacity for 35T vessels, installation of a floating pontoon to accommodate five (5) vessels, concrete hardstand, vehicular crossing and ancillary works. Proposed hours of operation of the boat repair facility are Monday to Friday (7.30am-5pm) and Saturday (8.00am-3:00pm) and offices are Monday to Friday (8.30am – 5.30pm). Sydney North Planning Panel DA Under assessment		

6.15.4 Potential impacts

The potential cumulative impacts are listed in Table 6-32.

Table 6-32: Potential cumulative impacts

Environmental factor	Construction	Operation
Socioeconomic	Cumulative impacts to patrons of the ferry network due to closure of North Sydney Wharf.	No operational impacts are anticipated.
Traffic and transport	Minor increase in marine traffic.	No operational impacts are anticipated.

6.15.5 Safeguards and management measures

Table 6-33 lists the cumulative impacts safeguards and management measures that would be implemented to account for the impacts identified in section 6.15.4.

Table 6-33: Cumulative impacts safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Cumulative construction impacts	C1	<ul style="list-style-type: none"> • Consultation will include notification prior to the start of the works • Updates on any delays or changes to the construction period will also be communicated. 	Transport for NSW	Pre-construction / construction

7 Environmental management

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

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) would be prepared to describe the safeguards and management measures identified. The CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The CEMP would be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer prior to the commencement of any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF would be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures would minimise any potential adverse impacts arising from the proposed work on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Summary of safeguards and management measures

Impact	No.	Environmental safeguards	Responsibility	Timing
General – minimise environmental impacts during construction	GEN1	<p>A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Environment Manager prior to commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> • any requirements associated with statutory approvals • details of how the project will implement the identified safeguards outlined in the REF • issue-specific environmental management plans • roles and responsibilities • communication requirements • induction and training requirements • procedures for monitoring and evaluating environmental performance, and for corrective action • reporting requirements and record-keeping • procedures for emergency and incident management • procedures for audit and review. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Contractor/Transport for NSW project manager	Pre-construction/detailed design
General – notification	GEN2	All businesses, residential properties and other key stakeholders (e.g. schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor/Transport for NSW	Pre-construction

Impact	No.	Environmental safeguards	Responsibility	Timing
General – environmental awareness	GEN3	<p>All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular ‘toolbox’ style briefings.</p> <p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> • Areas of non-Aboriginal heritage sensitivity • Adjoining residential areas requiring particular noise management measures • Waterside impacts. 	Contractor/Transport for NSW	Pre-construction/detailed design
Soil and water	LS1	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion, contamination and water pollution and describe how these risks will be addressed during construction.	Contractor	Pre-construction
	LS2	Any excavated sediments or soil that require disposal will be sampled, tested and classified in accordance with the EPA’s <i>Waste Classification Guidelines: Part 1 Classifying Waste</i> (EPA 2014) prior to being disposed of at a waste facility licensed to accept the relevant class of waste. Any materials classified as Hazardous Waste may require treatment or an immobilisation approach in accordance with Part 10 of the <i>Protection of the Environment Operations (Waste) Regulation 2014</i> prior to off-site disposal.	Contractor	Construction
	LS3	Clean and suitable topsoil will be stockpiled and reused on site where appropriate.	Contractor	Construction
Contaminated land	LS4	An intrusive soil investigation to the depth of excavation will be undertaken to ensure the safety of construction workers and provide waste classification of the materials to be removed.	Contractor	Construction
	LS5	If unexpected contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the	Contractor	Construction

Impact	No.	Environmental safeguards	Responsibility	Timing
		contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager and/or EPA.		
	LS6	The piling methodology shall seek to mitigate the risk of sediment dispersal.	Contractor	Construction
Erosion and sedimentation	LS7	<p>Site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the SWMP. Control measures are to be implemented and maintained (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book) to:</p> <ul style="list-style-type: none"> • Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site. 	Contractor	Pre-construction
	LS8	<p>Prior to commencement of construction activities, sediment control device (such as sediment boom and curtain) will be installed around the construction footprint to contain disturbed sediment from the water surface by allowing suspended sediments to settle back on the bottom of the seabed overtime. The silt boom and curtain would extend from a minimum of 100 millimetres above the water line to a minimum of 2.5 metres below the water line before starting work.</p> <p>Installation should be undertaken during high tide periods from a boat. The device should be designed to rise and fall with the tide to prevent disturbance. Inspection of the device should be undertaken on a daily basis after ebbing tides, with additional inspection be carried following storm events. Monitoring of turbidity inside and outside of the device should also be performed, using a portable turbidity meter/logger. Prior to removing the sediment control device, conditions within the curtain would</p>	Contractor	Construction

Impact	No.	Environmental safeguards	Responsibility	Timing
		be assessed visually and with a field instrument to verify that sediment has settled resulting in similar water turbidity to that outside the curtain.		
	LS9	Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any potential spills or deficient silt curtains or erosion and sediment controls. Results of the observations of the integrity of the silt curtain are required to be recorded and maintained specifically for the purpose. Records are required to be kept on the site and to be made available for inspection by persons authorised by Transport for NSW.	Contractor	Construction
Erosion and scour	LS10	The number of jack-ups/anchor points will be minimised where possible. The locations will be selected to avoid areas of sensitive habitat.	Contractor	Construction
	LS11	Work associated with positioning barges, drilling and pile driving should occur during calm conditions to prevent excessive scouring and other impacts.	Contractor	Construction
Accidental spill	WQ1	<ul style="list-style-type: none"> A spill management plan will be developed and communicated to all staff working on site. Appropriate land and aquatic spill kits are to be maintained on site and on barges. Aquatic spill kits must be specific for working within the marine environment. The spill kit must be appropriately sized for the volume of substances at the work site. All workers will be advised of the location of the spill kit and trained in its use. 	Contractor	Pre-construction / Construction
	WQ2	If an incident (e.g. spill) occurs, the Transport for NSW <i>Environmental Incident Classification and Reporting Procedure</i> is to be followed and the Transport for NSW Contract Manager notified as soon as practicable.	Contractor	Construction
	WQ3	In the event of a maritime spill, the incident emergency plan will be implemented in accordance with Port Authority of NSW's response to shipping incidents and emergencies outlined in the <i>NSW State Waters Marine Oil and Chemical Spill Contingency Plan</i> (Maritime, 2012).	Contractor	Construction

Impact	No.	Environmental safeguards	Responsibility	Timing
	WQ4	Emergency contacts will be kept in an easily accessible location on vehicles, vessels, plant and site office. All workers will be advised of these contact details and procedures.	Contractor	Pre-construction / Construction
	WQ5	Vehicles, vessels and plant must be properly maintained and regularly inspected for fluid leaks.	Contractor	Construction
	WQ6	No vehicle or vessel wash-down or re-fuelling will occur on-site.	Contractor	Construction
	WQ7	Any chemicals or fuels stored at the site or equipment barges will be stored in a bunded area.	Contractor	Construction
Pollution	WQ8	An environmental work method statement (EWMS) is to be will be developed for the removal of the existing tidal steps and piles to minimise the risk of pollutants and debris entering the waterway. The EWMS must be approved by Transport for NSW prior to the demolition of part of the existing wharf structure.	Contractor	Pre-construction
Biodiversity	B1	Integrate the management of flora and fauna into the construction environmental management plan (either as a standalone flora and fauna management plan or a subplan). This is to include all terrestrial and marine flora and fauna.	Contractor	Pre-construction
	B2	Retained vegetation in close proximity to construction activities (e.g. south-western corner) will not be damaged or removed and mitigation measures identified in the <i>Arboricultural Assessment Report: North Sydney Wharf High Street, North Sydney</i> (Earthscape Horticultural Services, 2020) will be implemented.	Contractor	During construction
Removal of native vegetation, threatened species habitat and habitat features	B3	Native vegetation and habitat removal will be minimised through detailed design.	Transport for NSW	Detailed design
	B4	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Pre-construction
	B5	Vegetation and habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction

Impact	No.	Environmental safeguards	Responsibility	Timing
	B6	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011). Replacement planting (species and number) will be determined in consultation with North Sydney Council to reinstate habitat and minimise impacts to the visual characteristics of Kesterton Park.	Contractor	Detailed design / Post construction
	B7	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the project site.	Contractor	Construction
Removal of marine vegetation and habitat	B8	Considerations during detailed design to promote colonisation of habitat-forming species could include the installation of structures which provide habitat complexity (e.g. designs available as part of the Living Seawalls Project).	Transport for NSW	Detailed design
	B9	Direct removal of marine vegetation and habitat limited to the footprint of the eleven piles and some minor anchoring during water-based construction activities.	Contractor	Construction
	B10	Minimise anchoring where possible and avoid anchoring on subtidal rocky reef habitat.	Contractor	Construction
	B11	Complete a targeted survey for Black Rockcod and White's Seahorse within 24 hours prior to the commencement of water-based construction activities. Black Rockcod individuals should be encouraged to move away from the study area and White's Seahorse should be captured and relocated to nearby similar habitat. A White's Seahorse relocation plan (including other Synghathids as per DPI Fisheries advice on 9 September 2020) should be developed in consultation with DPI Fisheries to dictate this activity.	Transport for NSW	Pre-construction
	B12	A Section 37 permit under the FM Act to relocate Syngnathids collected during the targeted pre-clearance survey would be required as part of the White's Seahorse relocation. Alternatively, a provision can be added to a Part 7 Permit under Section 205 of the FM Act to include approval for Syngnathid relocation.	Transport for NSW	Pre-construction

Impact	No.	Environmental safeguards	Responsibility	Timing
Aquatic impacts	B13	Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) and Section 3.3.2 Standard precautions and mitigation measures of the <i>Policy and guidelines for fish habitat conservation and management Update 2013</i> (NSW DPI, 2013).	Contractor	Construction
	B14	Piling to stop if marine mammals are observed within 100 metres of the project area and only to recommence once they have moved beyond 100 metres of the proposal footprint or are not seen for at least 20 minutes.	Contractor	Construction
Changes to coastal processes	B15	The detailed design should aim to avoid/minimise any impact to coastal processes and hydrology.	Transport for NSW	Detailed design
Injury and mortality of fauna	B16	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction
Invasion and spread of weeds, pests and diseases	B17	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction
	B18	Pest species will be managed within the project site.	Contractor	Construction
	B19	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction
	B20	Water-based equipment and vessels to be sourced from local suppliers. Equipment and vessels must be cleaned and inspected prior to entering the project site.	Contractor	Construction
	B21	Occurrence of any marine pests must be reported to DPI Fisheries.	Contractor	Construction
Noise, light and vibration	B22	Shading and artificial light impacts will be minimised through detailed design.	Transport for NSW	Detailed design
Noise and vibration	NV1	Preparation of a noise and vibration management plan based on recommendations provided within the NSW ICNG and Australian Standard	Contractor	Pre-construction

Impact	No.	Environmental safeguards	Responsibility	Timing
		<p>AS 2436-1981: Guide to Noise Control on Construction, Maintenance and Demolition Sites. This is to include, but not be limited to:</p> <ul style="list-style-type: none"> • Plant controls: <ul style="list-style-type: none"> – Use of noise attenuating controls at the source, such as mufflers, acoustic screens, etc. – Plant and equipment would be in good working order to prevent excess noise generation. – Locating static sources of noise such as the generators as remotely as possible from noise sensitive receivers – Use of broadband reversing alarms, or “quackers”, on mobile equipment in accordance with the relevant health and safety regulations – Use of temporary noise barriers where practical. The height and location of these barriers would be determined during preparation of the construction noise and vibration management plan when more information regarding the proposed plant to be used for each construction stage is available – Investigate whether “at plant” mitigation or muffled plant is available for plant with high source noise levels such as rock hammers and piling rigs, and plant emitting continuous noise such as generators – Acoustic curtains (generally loaded vinyl based products), attached to wire construction fencing or laid over steel scaffold can also provide practical temporary noise barriers. We recommend that this is investigated for stationery plant within the worksites once a detailed schedule of works and plant is available – Provision of a solid 2 metre high anti-gawk barrier along the site work area boundaries may provide some reduction to nearby receivers, however this is only expected to benefit the lower levels of the nearby receivers. Local barriers will have minimal effects on noise reduction for receivers with multiple levels as there will still be a clear line of sight from the works to the receivers. Inclusion of an 		

Impact	No.	Environmental safeguards	Responsibility	Timing
		<p>angled return at the top of the barrier (if this is practical to construct) may provide increased benefit to multiple storey receivers when the plant is located close to the barrier and is generally stationary. We recommend that this is further investigated once a detailed schedule of works and plant is available.</p> <ul style="list-style-type: none"> • Management and behavioural controls: <ul style="list-style-type: none"> – Ensure that managers effectively communicate acceptable and unacceptable work practices for the site, through staff site inductions, notice boards, and prestart meetings – Avoid the need for reversing in the construction area by creating a loop road or similar – Avoid dropping materials from height – Workers should avoid shouting, minimise talking loudly, and avoid slamming vehicle doors. • Allowing construction to occur only during approved construction hours, unless otherwise required as a condition of Transport for NSW safety requirements • Conducting noise monitoring during all construction phases/scenarios considering the potential exceedances for the purposes of assisting in noise mitigation and to verify the findings of this noise assessment. • Implementing a procedure for dealing with complaints to ensure that all complaints are registered and dealt with appropriately. • Conducting additional monitoring if complaints are received or proposed activities and number of plants exceed those assumed in this assessment • Modification of work activities where noise or vibration is found to cause unacceptable impact. • Application of respite periods for noise activities. 		
Noise and vibration	NV2	<ul style="list-style-type: none"> • Carrying out works within standard daytime hours as follows: <ul style="list-style-type: none"> – 7:00 am to 6:00 pm Monday to Friday 	Contractor	Construction

Impact	No.	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> - 8:00 am to 1:00 pm Saturdays, no work on Sundays or public holidays. • Do not carry out operations during evening or night-time hours, unless required for safety reasons when the water is calmer during the night period (including early morning). <p>Should operations be required outside standard hours, an Out of Hours Procedure detailing works schedule, approval process, communications requirements and management measures will be prepared. All reasonable and feasible efforts should be undertaken to ensure noise levels would not exceed the ICNG noise management levels stated in Section 6.4.3 of this assessment by carrying out night-works with reduced numbers of plant for example.</p>		
	NV3	<ul style="list-style-type: none"> • Notification of potentially affected receivers detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the work (where applicable) and contact telephone number. • Notification should be a minimum of 7 calendar days prior to the start of work. • A contact telephone number and email address will be available for community feedback. 	Transport for NSW / Contractor	Pre-construction
	NV4	Conduct short term background noise monitoring prior to construction to confirm the ambient noise levels presented in this report, which were carried out during COVID 19 and may not be representative of typical levels.	Transport for NSW / Contractor	Pre-construction
Vibration impact to heritage structures	NV5	Where works are proposed within the safe working limits, for the heritage structures (seawall in Kesterton Park (LEP no. 10858), North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853)), specialist advice should be sought from an appropriately qualified structural engineer who is familiar with heritage structures to assess if vibrations associated with the proposed works will potentially result in impacts to	Contractor	Pre-construction

Impact	No.	Environmental safeguards	Responsibility	Timing
		heritage structures. Vibration monitoring should be carried out to confirm vibration levels prior to construction commencement.		
	NV6	<p>Regular inspections of the construction activities and work areas should be undertaken by structural engineers and any other required specialist to monitor and review the construction methodology and confirm the integrity of the seawall in Kesterton Park (LEP no. I0858), structures within Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853). Assessment and monitoring of vibration impacts should adhere to:</p> <ul style="list-style-type: none"> • British Standard BS 7385: Part 2: Evaluation and Measurement for Vibrations in Buildings –Part 2 Guide to Damage Levels from Ground-Borne Vibration • German Standard DIN 4150, Part 3: Structural Vibration in Buildings: Effects on Structures 	Contractor	Construction
Vibration	NV7	Where buildings are located within the safe working distance zone, dilapidation surveys should be carried out prior to construction.	Contractor	Pre-construction / Construction
	NV8	Where receivers are located within the safe work distance zones, vibration monitoring should be carried out to ensure compliance with the required criteria. If exceedances are recorded, works should be modified accordingly to reduce vibration levels.	Contractor	Pre-construction / Construction
Landscape and visual	LV1	<p>Urban design principles will be integrated throughout the detailed design and construction of the proposal and include:</p> <ul style="list-style-type: none"> • Similar visual structures (such as jetties, pontoons and wharfs) as those located within Neutral Bay, Neutral Harbour and Careening Cove • The design of the wharf consistent with the Neutral Bay Wharf situated to the north-east and other wharfs within Sydney Harbour • A coordinated palette of materials and colours to respond to the existing maritime and foreshore character 	Transport for NSW	Detailed design

Impact	No.	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> • Low-scale landside and waterside works to improve accessibility, wayfinding and services • The approaches to and surrounds of the wharf designed to maximise amenity and keeping with the existing urban and landscape environment. • Landscape treatment of the approaches to the wharf to be appropriate and complimentary to the existing landscape of Kesterton Park. Sandstone blocks will be used in the design with respect to the earlier use of the area as a quarry. 		
	LV2	Hoarding will be erected around the construction compound where possible, to reduce visibility.	Contractor	Construction
	LV3	Where out of hours work is required, lighting will be directionally controlled to limit potential impacts of light spill on surrounding receivers, including residential properties.	Contractor	Construction
	LV4	All impacted areas and ground surfaces must be reinstated as near as possible to their original state following the completion of works within Kesterton Park (LEP no. I0858)	Contractor	Post-construction
Archaeological significance	H1	If any design changes result in additional excavations and impacts to potential archaeological remains of the former weigh bridge, further archaeological assessment and management will be required. This may include a program of archaeological test excavation.	Transport for NSW	Detailed design / pre-construction
	H2	If unexpected 'relics' are encountered during excavation, a section 146 relics notification will be forwarded to Heritage NSW, DPC. 'Relics' cannot be impacted without appropriate approvals under the <i>Heritage Act 1977</i> .	Contractor	Construction
	H3	If significant archaeological remains are encountered during excavation, design options for avoiding impacts to the significant archaeological remains should be considered where practicable and opportunities should be investigated for the implementation of heritage interpretation.	Contractor	Construction
Non-Aboriginal heritage	H4	A heritage induction will be provided to workers prior to construction, informing them of the location and significance of known heritage items and the implementation of the Roads and Maritime <i>Unexpected Heritage</i>	Contractor	Pre-construction

Impact	No.	Environmental safeguards	Responsibility	Timing
		<i>Item Procedure 2015</i> if unanticipated heritage items or depositions are located during construction. The heritage induction will include management of expected non-significant archaeological remains, such as minor artefactual material associated with Phase 2 reclamation fills.		
	H5	The Roads and Maritime <i>Unexpected Heritage Item Procedure 2015</i> will be implemented if unanticipated heritage items or depositions are located during construction.	Contractor	Construction
Vibration impact to heritage structures	H6	If vibration monitors are attached to the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) or Rockcliff Mansions (LEP no. I0853), they must not be attached with permanent fixings. They should be removable without causing damage. Bees wax may be a suitable attachment method.	Contractor	Construction
	H7	If it is identified that levels of vibration are causing damage to heritage fabric, works must cease, and the construction methodology reviewed by the project engineers in consultation with a Heritage Consultant in order to mitigate further impacts. A temporary protection plan to outline protection measures required for significant fabric during activities causing potential vibration impacts would be prepared prior to commencement of works.	Contractor	Construction
Impact to heritage item (LEP no I0407)	H8	Care must be taken during the removal of the non-significant elements from the North Sydney Bus Shelter (LEP no. I0407) to ensure that significant fabric is not damaged in the process. An environmental work method statement (EWMS) should be prepared to guide the removal of elements from the bus shelter to minimise the risk of inadvertent impacts.	Contractor	Pre-construction
Impact to heritage item (LEP no I0858)	H9	Works within Kesterton Park (LEP no. I0858) must be kept to a minimum where possible and be undertaken with care to minimise impacts to the local heritage item and minimise the loss of public green space and vegetation.	Contractor	Construction
	H10	An environmental work method statement (EWMS) should be prepared to guide the modification of the seawall within Kesterton Park (LEP no. I0858) for the new gangway abutment and pavement finish.	Contractor	Pre-construction

Impact	No.	Environmental safeguards	Responsibility	Timing
	H11	A Photographic Archival Recording should be undertaken of Kesterton Park (LEP no. I0858) to document its current visual setting prior to any impacts and modifications.	Contractor	Pre-construction
Design	H12	If any design changes result in additional underwater ground disturbing works in the location of the current wharf, then a maritime archaeological assessment should be undertaken to assess the potential for impacts to maritime archaeological remains of the former wharves.	Transport of NSW	Detailed design / Pre-construction
	H13	Any project redesign resulting in new ground disturbance, vegetation removal, or new features must be assessed in an addendum to the North Sydney Wharf SOHI.	Transport for NSW	Detailed design / Pre-construction
Aboriginal heritage	AH1	Should the scope of the proposed work change, further consultation with Transport for NSW's Aboriginal Cultural Heritage Officer and regional environmental staff must be undertaken to reassess any potential impacts on Aboriginal cultural heritage.	Transport for NSW	Pre-construction / Construction
Unexpected heritage finds	AH2	The Standard Management Procedure – <i>Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that (an) unknown or potential Aboriginal object(s), including skeletal remains, is/are found during construction. This applies where Transport for NSW does not have approval to disturb the object(s) or where a specific safeguard for managing the disturbance (apart from the procedure) is not in place. Work would only restart once the requirements of that procedure have been satisfied.	Contractor	Construction
Land transport, parking and access	T1	A Traffic Management Plan (TMP) will be prepared and will include the following. <ul style="list-style-type: none"> • Final access and parking arrangements • Alternate pedestrian and cyclist access around the construction area • Measures to ensure light vehicle parking is strictly in accordance with North Sydney Council requirements and prevents parking on footpaths and grassed areas adjacent the site. 	Contractor	Pre-construction

Impact	No.	Environmental safeguards	Responsibility	Timing
	T2	Where possible, the preferred means of transporting equipment and materials to the site will be via boat and barge over land transport so as to limit impacts to the local road network.	Contractor	Construction
	T3	Public transport passengers will be notified of any impacts to transport services and the alternative transport arrangements prior to the commencement of construction. This will include updates to the timetable (online and Opal app) indicating the temporary closure of the North Sydney Wharf.	Transport for NSW	Pre-construction / construction
Water transport	T4	<ul style="list-style-type: none"> A maritime navigation exclusion zone will be established during construction to prevent unauthorised vessels entering the area. This zone will be clearly defined to communicate access for other water users. 	Contractor	Pre-construction / construction
	T5	<p>A Maritime TMP will be prepared and implemented during the water based construction work. The Maritime TMP will be prepared consultation with Transport for NSW and approved by the Harbourmaster. In addition, the project will:</p> <ul style="list-style-type: none"> Fit all buoys with lights Prepare Response Plans for emergencies and spills for all construction vessels Fit at least one vessel with an Automatic Identification System (AIS) Retrieve any material associated with the construction of the development that enters the water to prevent the obstruction of vessel movements Prepare a Communications Plan for implementation during the work which must include 24/7 contact details, protocols for enquiries, complaints and emergencies. <p>Any variation to the above will be agreed in advance with the Harbourmaster.</p>	Contractor	Pre-construction / construction

Impact	No.	Environmental safeguards	Responsibility	Timing
	T6	Commercial, recreational operators and private services that use the existing wharf will be advised of the wharf closure at least two weeks prior to closure.	Transport for NSW	Pre-construction / construction
Socio-economic	SE1	<p>A Communications and Stakeholder Engagement Plan will be developed prior to the commencement of construction and will be implemented during construction to provide timely and accurate information to stakeholders during construction. It will include (as a minimum):</p> <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents and local businesses, including changes to traffic, public transport services and access • A contact name and telephone number for complaints <p>The Plan will be prepared in accordance with the Community Involvement and Communications Resource Manual (RTA, 2008).</p>	Transport for NSW	Pre-construction / construction
	SE2	<ul style="list-style-type: none"> • A webpage and free-call number will be established for enquiries regarding the proposal, and will remain active for the duration of construction. • Contact details will be clearly displayed at the entrance to the site. • All enquiries and complaints will be tracked through a tracking system, and acknowledged within 24 hours of being received. 	Contractor	Pre-construction / construction
Sustainability	SE3	Investigate opportunities to encourage the Construction Contractor to purchase goods and services locally.	Contractor	Pre-construction / construction
	SE4	Investigate opportunities to incorporate community health and wellbeing initiatives in the design and construction of the project.	Transport for NSW / Contractor	Detailed design / construction
Air quality	AQ1	<p>Air quality during construction will be considered and addressed within the CEMP and would include methods to manage work during strong winds or other adverse weather conditions as required. As a minimum, the following measures will be included:</p> <ul style="list-style-type: none"> • Covering all loaded trucks and vessels • Machinery to be turned off rather than left to idle when not in use 	Contractor	Pre-construction / construction

Impact	No.	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> Maintenance of all vehicles, including trucks and vessels entering and leaving the site in accordance with the manufacturers specifications to comply with all relevant legislation Maintenance of all plant and equipment to ensure good operating conditions and exhaust emissions comply with the <i>Protection of the Environment Operations Act 1997</i> Maintaining the work site in a condition that minimises fugitive emissions such as minor dust Appropriate sediment and erosion controls for any exposed earth or stockpiled waste 		
Sustainability	AQ2	During construction, the construction contractor is to monitor performance of their non-road diesel plant and equipment against US EPA, EU or equivalent emissions standards using the Transport for NSW <i>Air Emissions Workbook - DMS-FT-439</i> .	Contractor	Construction
Waste	WM1	<p>A Waste Management Plan (WMP) will be prepared in accordance with the WARR Act. A WMP is to prepared as part of the CEMP and would include measures to minimise waste, outline methods of disposal, reuse and recycling and monitoring, as appropriate. This is to include the following:</p> <ul style="list-style-type: none"> Appropriate measures to avoid and minimise waste associated with the proposal should be investigated and implemented where possible. Waste management, littering and general tidiness will be monitored during routine site inspections. 	Contractor	Pre-construction / Construction
Resource use	WM2	Recycled, durable, and low embodied energy products will be considered to reduce primary resource demand in instances where the materials are cost and performance competitive and comparable in environmental performance (e.g. where quality control specifications allow).	Contractor	Pre-construction / construction
Sustainability	WM3	During construction, Construction Contractor is to monitor waste and recycling quantities using the Transport for NSW <i>Waste Data Collection Workbook – DMS-FT-436</i> .	Contractor	Construction

Impact	No.	Environmental safeguards	Responsibility	Timing
Hazards and risks	HR1	Appropriate emergency equipment such as flotation devices and first aid kits will be kept within the construction area.	Contractor	Construction
	HR2	Safe work method statements or similar will be implemented to manage health and safety risks for the works.	Contractor	Pre-construction / construction
	HR3	Weather forecasts will be monitored during construction. In the unlikely event of a major flood event or strong marine winds/waves, equipment and materials will be temporarily removed from the site, where possible.	Contractor	Construction
Utilities	HR4	An application to Ausgrid for connection of grid power for the new wharf and to Sydney Water for connection to the water mains will be required.	Transport for NSW / Contractor	Pre-construction
	HR5	Dial Before You Dig (DBYD) investigations will be carried out prior to undertaking any excavation or piling works to identify any additional cables not identified during design.	Contractor	Pre-construction
	HR6	All utilities within and adjacent to the proposal footprint will be located prior to the start of the works.	Contractor	Pre-construction
Climate change	CC1	During detailed design undertake a compliant carbon footprinting exercise in accordance with the Transport for NSW <i>Carbon Estimate and Reporting Tool Manual</i> (Transport for NSW, 2019). The carbon footprint will be used to inform decision making in design and construction.	Contractor	Detailed design / Construction
	CC2	During detailed design undertake a compliant climate risk assessment in accordance with the Transport for NSW <i>Climate Risk Assessment Guidelines – DMS-SD-081</i> .	Contractor	Detailed design
	CC3	The detailed design process will consider adaptation measures for climate change, including the following: <ul style="list-style-type: none"> • Design of pontoons, waiting areas and gangways • Integrate coastal erosion control techniques around landside infrastructure • Drainage and storm water infrastructure • Specifications of materials in design • Weather protection features. 	Contractor	Detailed design

Impact	No.	Environmental safeguards	Responsibility	Timing
Sustainability	S1	The Contractor shall propose a suitably qualified and experienced sustainability officer at a minimum 14 days prior to site establishment to be endorsed by Transport for NSW. The sustainability officer will be responsible for implementing the sustainability objectives for the Project. Details of the sustainability officer, including defined responsibilities, duration and resource allocation throughout the appointment are to be submitted to Transport for NSW prior to the preparation of the Sustainability Management Plan.	Contractor	Pre-construction
	S2	Prior to commencement of construction, a Sustainability Management Plan shall be endorsed by Transport for NSW. The Plan shall be provided at least 14 days prior to site establishment and include the following minimum components: <ul style="list-style-type: none"> • A completed electronic checklist demonstrating compliance with Transport for NSW's <i>NSW Sustainable Design Guidelines Version 4.0</i> (7TP-ST-114) • The Contractors sustainability goals and targets, internal procedures, and implementation strategy. 	Contractor	Pre-construction
	S3	The Contractor must comply with the Transport for NSW <i>Sustainable Design Guidelines version 4.0</i> .	Contractor	Construction
Cumulative construction impacts	C1	<ul style="list-style-type: none"> • Consultation will include notification prior to the start of the works • Updates on any delays or changes to the construction period will also be communicated. 	Transport for NSW	Pre-construction / construction

7.3 Licensing and approvals

A summary of the licences and approvals required for the proposal is provided in Table 7-2.

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
<i>Fisheries Management Act 1994</i>	Permit is required to relocate seahorses, if applicable	Prior to start of the activity.
<i>Roads Act 1993</i>	Notification to, and consent from, North Sydney Council is required for works on High Street	Prior to start of the activity.
<i>Ports and Maritime Administration Regulations 2012</i>	Written permission from the Harbour Master is required to disturb sediment in Sydney Harbour	Prior to start of the activity.
<i>Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005</i>	An application is required to Ausgrid for connection of grid power for the new wharf	Prior to start of the activity.
	An application is required to Sydney Water for connection of water mains for the new wharf	Prior to start of the activity.

8 Justification and conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

8.1 Justification

The proposal forms part of the TAP, which is an ongoing “initiative to deliver modern, safe and accessible transport infrastructure” in NSW (NSW, Transport for NSW, 2015). As part of the TAP, Transport for NSW assessed the condition of all ferry wharves across the transport network in 2009 in terms of:

- Safety and structural integrity
- Access for less mobile and disabled passengers
- Existing and predicted future patronage and use.

Initial justification for the proposal was provided through an assessment of the existing wharf, which was identified as needing upgrading due to its lack of accessible pathway throughout the interchange and non-DDA compliant wharf.

Consideration of alternatives and options was then carried out. The preferred design of the proposal selected to best achieve the objectives outlined in Section 2.3, which included meeting the project objectives by providing improvements in access, user experience including passenger comfort and amenity, and safety. The design efficacy was determined by comparison to the option of doing nothing and other options outlined in section 2.4.

Potential environmental and social impacts resulting from construction and operation of the proposal have been minimised through the safeguards and management measures outlined in Chapter 7.

The following sub-headings provide justification through considering the impacts and benefits of the proposal.

8.1.1 Social factors

The proposal would result in temporary social impacts whilst being built such as noise and visual impacts. However, all construction related impacts would be appropriately managed prior to and during construction.

Operation of the proposal provides justification over the above temporary impacts, as it would benefit the community through improving passenger amenity, safety and overall user experience. It is anticipated that the proposal would also have indirect wider community benefits, through ensuring continuation of the wharf for its expected lifespan (50 years). This extends to the cultural and amenity benefit of continuing to operate a wharf in this location.

8.1.2 Biophysical factors

As discussed in Chapter 6, no significant aquatic or terrestrial ecology impacts have been identified. Adverse impacts are expected as a result of tree removal to accommodate the new accessible footpath. Identified impacts would be managed through the safeguards and management measures outlined in these sections.

The design of the proposal includes tolerances to allow for sea level rise and extreme weather events, which would ensure the wharf continues to be operational throughout its 50-year design life.

8.1.3 Economic factors

Upgrade of the wharf would generate economic benefits over the next 50 years, with the wharf being an attractor for people to live in the area due to the recreational value of the ferry service and ability to access the CBD.

Design of the wharf has also incorporated measures to decrease the maintenance required for operation which are standardised across all newly constructed wharves. The implementation of these measures would result in cost savings for the ongoing operation of the ferry network.

8.2 Objects of the EP&A Act

The objects of the EP&A Act are considered in Table 8-1.

Table 8-1: Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	Through the assessment in Chapter 6, it has been identified that the proposal would not significantly impact on any natural or artificial resources. The proposal would result in community benefits through facilitation of a safe and reliable ferry service to North Sydney for the next 50 years.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	The proposal's urban design includes high quality, durable and low impact materials to minimise ongoing maintenance requirements. The design also provides thematic consistency across the entire network (refer to section 3). Both factors provide for a sustainable urban environment over its 50-year design life.
1.3(c) To promote the orderly and economic use and development of land.	The proposal includes continuation of the use of the proposal location as a ferry wharf.

Object	Comment
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	An aquatic ecology assessment has been prepared for the proposal, which is summarised in section 6.3. The assessment concluded that no significant impact to aquatic ecology would be caused by the proposal. Tree removal is expected to occur from the proposal.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The identified mitigation measures would mitigate any potential impacts of the proposal on Aboriginal and non-Aboriginal heritage items.
1.3(g) To promote good design and amenity of the built environment.	The proposal has been designed to be consistent with the urban design objectives identified in section 2.3.3.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	The proposal would benefit the community through improving passenger amenity, safety and overall user experience. The proposal aligns with this objective as it involves the maintenance of, and continued safe access to, the Wharf.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Stakeholder consultation would continue during the public display of this document to capture feedback. Should the proposal proceed to construction, consultation with the community and stakeholders would continue throughout the work.

8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the proposal.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

Through the assessment of the potential impacts of the proposal in Chapter 6, it has been demonstrated that threats of serious or irreversible environmental damage do not exist for the proposal.

Notwithstanding, to account for the subjectivity of professional judgement applied in environmental assessment and modelling uncertainty, worst-case assumptions have been incorporated into the assessment, including the following:

- Conservative ‘worst case’ scenarios were considered while assessing environmental impact.
- Specialist studies were incorporated to gain a detailed understanding of the existing environment including terrestrial and aquatic ecology, landscape character and visual assessment, noise and vibration, socio-economic, non-Aboriginal heritage.
- Undertaking verification monitoring to validate results and allow modification of safeguards and mitigation controls accordingly.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The proposal would result in benefit to the community through improvements to passenger amenity, safety and overall user experience of the ferry wharf for the next 50 years.

No potential impacts to future generations would be generated by the proposal.

Conservation of biological diversity and ecological integrity

Conservation of biological diversity and ecological integrity has been considered through the assessment of ecology provided in section 6.3, and Appendix D.

Providing the safeguard measures are implemented, the proposal would not have a material or significant impact on biological diversity and ecological integrity within the proposal footprint or surrounds.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

Environmental, economic and social issues were considered in the rationale for the proposal and design options. Construction planning for the proposal would also be progressed in the most cost-effective way.

Safeguards and management measures detailed in Chapter 6, including avoiding, reusing, recycling, managing waste during construction and operation, would be implemented.

8.3 Conclusion

The proposed North Sydney Wharf upgrade is subject to assessment under Division 5.1 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 (as relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on water quality, ecology, traffic and transport, landscape character and visual assessment, non-Aboriginal heritage, socio-economic values and noise and vibration. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would provide better commuter experience through improvements to passenger amenity, safety, access for people with a disability and overall user experience of the ferry wharf for the next 50 years, as well as contributing to unifying and standardising wharves in Sydney Harbour and Parramatta River. On balance the proposal is considered justified and the following conclusions are made.

8.3.1 Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

8.3.2 Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of Agriculture, Water and the Environment is not required.

9 Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential 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 proposal.



Belinda Crichton
Principal, Environment
Cardno (NSW/ACT) Pty Ltd
Date: 13 October 2020

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.

James Paddock
Project Manager
Infrastructure and Place
Date:

10 References

Artefact (2020) *North Sydney Wharf. Statement of Heritage Impact*. Report prepared by Artefact Heritage for Cardno (NSW/ACT) Pty Ltd on behalf of Transport for NSW, September 2020.

Aurecon (2019a) *North Sydney Wharf Interchange. Concept Design Report*. Prepared by Aurecon Australasia Pty Ltd on behalf of Roads and Maritime Services, July 2019.

Aurecon (2019b) *Ferry Hub Upgrade – North Sydney Wharf. Geotechnical Desktop Investigation*. Prepared Aurecon Australasia Pty Ltd on behalf for Transport for NSW, February 2019.

Aurecon (2019c) *Ferry Wharf Upgrade Package 3. Climate Change Risk Assessment*. Prepared by Aurecon Australasia Pty Ltd on behalf of Roads and Maritime Services, June 2019.

Aurecon (2019d) *Preliminary Landscape Character and Visual Impact Assessment: Ferry Wharf Upgrade Program Package 3 North Sydney Wharf Interchange*. Prepared by Aurecon Australasia Pty Ltd on behalf of Roads and Maritime Services, July 2019.

BMT (2018) *Greater Sydney Harbour Estuary Coastal Management Program Scoping Study*. Prepared by BMT WBM Pty Ltd in partnership with Greater Sydney Local Land Services, Office of Environment and Heritage and Council of the City of Sydney, Final Report, June 2018.

BoM (2020a) *NSW Tide Tables*. Bureau of Meteorology. Available online: <http://www.bom.gov.au/oceanography/projects/ntc/monthly/> Accessed 15 April 2020

BoM (2020b) *Climate data online. Observatory Hill and Wedding Cake Island*. Bureau of Meteorology. Available online: <http://www.bom.gov.au/climate/data/> Accessed 15 April 2020

Cardno (2020a) *North Sydney Wharf. Preliminary Site Investigation*. Prepared by Cardno (NSW/ACT) Pty Ltd on behalf of Transport for NSW, September 2020.

Cardno (2020b) *North Sydney Wharf Upgrade: Biodiversity Impact Assessment*. Prepared by Cardno (NSW/ACT) Pty Ltd on behalf of Transport for NSW, September 2020.

Cardno (2020c) *North Sydney Wharf Upgrade: Noise and Vibration Impact Assessment*. Prepared by Cardno (NSW/ACT) Pty Ltd on behalf of Transport for NSW, September 2020.

Cardno (2020d) *North Sydney Wharf Upgrade: Landscape Character and Visual Impact Assessment*. Prepared by Cardno (NSW/ACT) Pty Ltd on behalf of Transport for NSW, September 2020.

Cardno (2020e) *North Sydney Wharf Upgrade: Socio-economic Impact Assessment*. Prepared by Cardno (NSW/ACT) Pty Ltd on behalf of Transport for NSW, September 2020.

Cardno (2020f) *North Sydney Wharf – Ferry Wharf Upgrade Program TAP 3 – Communications and Stakeholder Engagement Plan 2020*. Prepared by Deborah Metcalf for Cardno on behalf of Transport for NSW, April 2020.

Chapman, G.A. and Murphy, C.L. (1989) *Soil Landscapes of the Sydney 1:100, 000 Sheet*. Sydney: Soil Conservation Service of NSW.

Coffey (2016a) *Geotechnical Assessment – North Sydney South Ferry Wharf*. Prepared by Coffey Geotechnics Pty Ltd on behalf of Hansen and Yucken, July 2016.

Coffey (2016b) *Stage 2 Contamination Assessment – North Sydney South Ferry Wharf*. Prepared by Coffey Geotechnics Pty Ltd on behalf of Hansen and Yucken, July 2016.

Creese, R. G., Glasby, T. M., West, G. & Callen, C. (2009). *Mapping the habitats of NSW estuaries*, s.l.: NSW DPI.

DECCW (2009) *State of the beaches 2008-2009*. Beachwatch Partnership Program. Department of Environment, Climate Change and Water.

DECCW (2010) *State of the beaches 2009-2010. Beachwatch, Harbourwatch and Partnership Programs*. Department of Environment, Climate Change and Water.

DECCW (2010) *Due Diligence Code of Practice for the Protection of Aboriginal objects in NSW*. Department of Environment, Climate Change and Water, September 2010.

DP&E (2001) *Crime Prevention through Environmental Design*. Department of Planning and Environment.

DPE (2018) *A Metropolis of Three Cities – The Greater Sydney Region Plan*. Department of Planning and Environment.

DPIE (2019a) *State of the beaches 2018-2019. Statewide summary and how to read this report. Beachwatch*. Department of Planning, Industry and Environment.

DPIE (2019b) *North Sydney Council 2019 NSW Population Projections*. Available online: <https://www.planning.nsw.gov.au/-/media/Files/DPE/Factsheets-and-faqs/Research-and-demography/Population-projections/2019-North-Sydney.pdf>

DPIE (2020a) *Enterococci data download. North Sydney Council, 1989-2020*. Beachwatch Program. Department of Planning, Industry and Environment.

DPIE (2020b) Search for and download air quality data. Department of Planning, Industry and Environment. Available online: <https://www.dpie.nsw.gov.au/air-quality/search-for-and-download-air-quality-data/> Accessed 30 April 2020.

DPI (2013) *Policy and Guidelines for Fish Conservation and Management*, Wollongbar, NSW. Department of Primary Industries.

DPI (2016a) *Fish Communities and Threatened Species Distribution of NSW*. Department of Primary Industries.

DP) (2016b) *Caulerpa taxifolia*. Department of Primary Industries. Available online: <http://www.dpi.nsw.gov.au/fishing/pests-diseases/marine-pests/found-in-nsw/caulerpa-taxifolia> [Accessed 2016].

DPI(2020a) *Key Fish Habitat maps*. Department of Primary Industries. Available online: <https://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps> [Accessed 2020]

DUAP (1995/1996) *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines). Department of Urban Affairs and Planning.

DUAP (1996) *Marinas and Related Facilities – EIS Guidelines*. Department of Urban Affairs and Planning.

Earthscape Horticultural Services (2020) *Arboricultural Assessment Report: North Sydney Wharf High Street, North Sydney*. Prepared by Earthscape Horticultural Services on behalf of Hansen and Yuncken Pty Ltd, July 2020.

Engell-Sorensen (2000) *Evaluation of the Effect of Noise from Offshore Pile Driving on Marine Fish*, Bio/consult as, Johs. Ewaldsvej 42-44, DK-8230.

EPA (2017) *NSW Noise Policy for Industry*. Environment Protection Authority , October 2017.

Herbert C. (1983) *Sydney 1:100,000 Geological Series Sheer 9130*. NSW Department of Mineral Resources.

Jetty Research (2020). *North Sydney Council Customer Satisfaction Survey 2020*. Prepared for North Sydney Council, May 2020.

Kingsford, R. T. et al. (2004) Classifying landform at broad spatial scales: the distribution and conservation of wetlands in New South Wales, Australia. *Marine and Freshwater Research*, Volume 55, pp. 17-31.

LLS (2015) *Sydney Harbour Water Quality Improvement Plan*. Local Land Services, June 2015.

MHL (2019) Ocean and Tidal Summary 2018-2019. Manly Hydraulics Laboratory. Available online:
<https://mhl.nsw.gov.au/Publications/publications.php?content=oeh2019annualsummary> Accessed 15 April 2020

North Sydney Council (2018a) *North Sydney Community Strategic Plan 2018-2028*. North Sydney Council.

North Sydney Council (2018b) *North Sydney Council Delivery Program 2018/19-2020/21*. North Sydney Council.

North Sydney Council (2019a) *North Sydney Council Annual Report 2018/2019*. North Sydney Council.

North Sydney Council (2019b) *North Sydney Council Operational Plan 2019/20*. North Sydney Council.

NSW Government (2020) *North Sydney Wharf Upgrade. Community Consultation Report*. Prepared for Transport for NSW, March 2020. Available online: Available at: <https://www.rms.nsw.gov.au/projects/01documents/north-sydney-wharf-upgrade/north-sydney-wharf-consultation-report-2020-03.pdf>

OEH (2011a) *State of the beaches 2010-2011*. Beachwatch. Office of Environment and Heritage.

OEH (2011b) *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*. Office of Environment and Heritage, April 2011.

OEH (2012) *State of the beaches 2011-2012. Beachwatch, Harbourwatch and Partnership Programs*. Office of Environment and Heritage.

OEH (2013) *State of the beaches. Summary 2012-2013*. Office of Environment and Heritage

OEH (2014a) *State of the beaches 2013-2014. Summary and how to read this report. Beachwatch*. Office of Environment and Heritage.

OEH (2014b) *Metropolitan Sydney Climate change snapshot*. AdaptNSW. Office of Environment and Heritage.

OEH (2015) *State of the beaches 2014-2015. Summary and how to read this report. Beachwatch*. Office of Environment and Heritage.

OEH (2016a) *State of the beaches 2015-2016. Statewide summary and how to read this report. Beachwatch*. Office of Environment and Heritage.

OEH (2016b) *Native Vegetation of the Sydney Metropolitan Area – Version 3.1 VIS_ID 4489*. Office of Environment and Heritage.

OEH (2017) *State of the beaches 2016-2017. Statewide summary and how to read this report. Beachwatch*. Office of Environment and Heritage.

OEH (2018) *State of the beaches 2017-2018. Statewide summary and how to read this report. Beachwatch*. Office of Environment and Heritage.

Roads and Maritime (2011) *Procedure for Aboriginal Heritage Cultural Heritage Consultation and Investigation (PACHCI)*. Roads and Maritime Services, November 2011.

Roads and Maritime (2013) *Environmental Impact Assessment Practice Note – Socio-economic assessment (EIA-N05) (Practice Note)*. Roads and Maritime Services, July 2013.

Roads and Maritime (2015) *Unexpected Heritage Items. Heritage Procedure 02*. Roads and Maritime Services, November 2015.

Roads and Maritime (2016a) *Guidelines for Biodiversity Offsets*. Roads and Maritime Services, November 2016.

Roads and Maritime (2016b) *Construction Noise and Vibration Guideline*. Roads and Maritime Services, August 2016.

Roads and Maritime (2018) *Environmental Impact Assessment Practice Note EIA-N04 - Guideline for landscape character and visual impact assessment*. (EIA- N04 Guidelines) Roads and Maritime Services, December 2018.

RTA (2011) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects*. Roads and Traffic Authority, September 2011.

Sydney Institute of Marine Science (2014) *Sydney Harbour. A systemic review of the science 2014*, s.l.: Sydney Institute of Marine Science.

Tidetech (2020) *Tidemap: Sydney Harbour*. Available online: https://maps.tidetech.org/?layer=tidal_currents_sydney. Accessed 15 April 2020

Transport for NSW (2012) *NSW Long Term Transport Master Plan*. NSW Government, December 2012. Available online: <https://www.transport.nsw.gov.au/sites/default/files/media/documents/2017/nsw-transport-masterplan-final.pdf>

Transport for NSW (2013) *Sydney's Ferry Future Plan*. NSW Government.

Transport for NSW (2015) *Transport Access Program*. NSW Government.

Transport for NSW (2018) *Future Transport Strategy 2056*. NSW Government.

Transport for NSW (2019) *Carbon Estimate and Reporting Tool Manual*. NSW Government, November 2019.

Transport for NSW (2020) *Environment and Sustainability Policy*. NSW Government, January 2020.

Terms and acronyms used in this REF

Term/ Acronym	Description
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal heritage impact permit
ASMA	Australian Maritime Safety Authority
ASRIS	Australian Atlas of Acid Sulfate Soils
BC Act	<i>Biodiversity Conservation Act 2016</i>
BCA	Building Code of Australia
BoM	Bureau of Meteorology
BZ	background zone
Cardno	Cardno (NSW/ACT) Pty Ltd
CBD	Central Business District
CCTV	closed circuit television
CD	Chart datum
CEMP	Construction Environmental Management Plan
CHL	Commonwealth Heritage List
Coastal Management SEPP	<i>State Environmental Planning Policy (Coastal Management) 2018</i>
CNVG	Roads and Maritime Construction Noise and Vibration Guideline
Construction footprint	Area around the proposal footprint required for construction including the compound area. Construction footprint is shown on Figure 3-2.
Compound area	Temporary facility required for construction, including for example an office and amenities compound, construction compound and materials storage compound. Compound area is shown on Figure 3-2.
COVID-19	COVID-19 is the infectious disease caused by the most recently discovered coronavirus. COVID-19 is now a pandemic affecting many countries globally. COVID-19 was first confirmed in Australia in late January 2020.
DAWE	Australian Government Department of Agriculture, Water and Environment
DBYD	Dial Before You Dig
DDA	<i>Disability Discrimination Act 1992 (Commonwealth)</i>
DECCW	Former Department of Environment, Climate Change and Water
Disability Standards 2010	Disability (Access to Premises – Buildings) Standards (2010)
DP&E	Former Department of Planning and Environment
DPI	Department of Primary Industries
DPIE	Former Department of Planning, Industry and Environment
DSAPT	<i>Disability Standards for Accessible Public Transport 2002</i>
DUAP	Former Department of Urban Affairs and Planning
EIA	Environmental impact assessment

Term/ Acronym	Description
EIS	Environmental Impact Statement
EPA	Environment Protection Agency
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
EWMS	environmental work method statement
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
FZ	foreground zone
HAT	Highest Astronomical Tide
Heritage Act	<i>Heritage Act 1977</i>
ICNG	EPA's <i>Interim Construction Noise Guideline</i>
ISEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
KFH	key fish habitat
LALC	Local Aboriginal Land Council
LAT	Lowest Astronomical Tide
LCVIA	landscape and visual impact assessment
LCZ	Landscape Character Zones
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local Government Area
LV	low voltage
MNES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
MZ	middle ground zone
NCA	Noise Catchment Area
NCC	National Construction Code 2016 Volumes 1, 2 and 3 (Formerly Building Code of Australia)
NHL	National Heritage List
NML	Noise Management Level
NPW Act	National Parks and Wildlife Act 1974 (NSW)
OEH	Office of Environment and Heritage
OOHW	Out of hours work
PACHCI	<i>Procedure for Aboriginal Cultural Heritage Consultation and Investigation</i>
PAH	polycyclic aromatic hydrocarbons
PCTs	Plant Community Types

Term/ Acronym	Description
Proposal, the	The new wharf proposed to be constructed at North Sydney, and as described in Section 3.1.
Proposal footprint	The area directly impacted by proposed works, including the installation and removal of structures. Proposal footprint is shown on Figure 3-2.
PSI	Preliminary Site Investigation
RBL	rating background level
REF	Review of Environmental Factors
RNE	Register of the National Estate
RNP	EPA Road Noise Policy
RNTA	Register of the National Trust of Australia (NSW)
Roads and Maritime	NSW Roads and Maritime Services, now known as Transport for NSW
RTA	Former Roads and Traffic Authority
SEIA	Socio-economic impact assessment
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SHI	NSW State Heritage Inventory
SHR	State Heritage Register
SOHI	Statement of Heritage Impact
SRD SEPP	<i>State Environmental Planning Policy (State and Regional Development) 2011</i>
SWMP	Soil and Water Management Plan
Sydney Harbour SREP	<i>Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005</i>
TAP	Transport Access Program
TfNSW	Transport for NSW
TMP	Traffic Management Plan
TRH	total recoverable hydrocarbons
VIS	vegetation information system
WHL	World Heritage List
WMP	Waste Management Plan

Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance and Commonwealth land

Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the Environmental Planning and Assessment Regulation 2000, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
<p>a) Any environmental impact on a community?</p> <p>During construction of the proposal, there would be impact from construction related noise to surrounding receivers and impacts to traffic and transport due to temporary closure of the wharf.</p>	High, short-term negative
<p>Operation of the wharf would have improved public transport facilities at North Sydney</p> <p>Impacts would be minimised through implementing the safeguards and management measures identified in section 7.1 of the REF.</p>	Long term, positive
<p>b) Any transformation of a locality?</p> <p>The proposal would have a moderate impact to visual and landscape character. Impacts have been reduced through design of the wharf.</p>	Moderate, long term negative impact
<p>c) Any environmental impact on the ecosystems of the locality?</p> <p>The assessment of aquatic ecology indicates there would be a minor impact to marine biodiversity during construction.</p>	Minor, short term negative
<p>This would be offset by the creation of hard surfaces and newly exposed subtidal substrate.</p>	Minor, long term negative
<p>The proposal would remove 0.06 hectares of landscaped gardens.</p> <p>Further impact to aquatic and terrestrial ecology would be mitigated through implementing the safeguards and management measures identified in section 7.1 of the REF.</p>	Minor, long term positive
<p>d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</p> <p>There would be temporary aesthetic impacts during construction of the proposal.</p>	Moderate, short term negative
<p>Landscape character and visual impacts have been assessed as moderate. Impacts have been reduced through design of the wharf, including retention of the wharf in its location.</p>	Moderate, long term negative
<p>Impacts to environmental quality and value have been assessed as low to moderate, and would be limited to short-term impacts during construction of the proposal.</p> <p>No long-term impacts to environmental quality and value are anticipated</p>	Moderate, short term negative
<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>	

Factor	Impact
There would be some direct loss of landscaped areas of Kesterton Park.	Minor/ negligible long term
There would be negligible or neutral impacts to other non-Aboriginal heritage items in the visual range of the proposal. No known Aboriginal sites would be impacted.	Negligible
<p>f) Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)?</p> <p>Water-based activities have potential to impact habitat for the Black Rockcod and White's Seahorse. The foraging resource that the study area represents would be made available for these species following the completion of construction thus, proposal impacts to potential foraging habitat for these species are only temporary. The loss of potential habitat from the installation of piles on subtidal rocky reef and the removal impact of part of the existing structure is considered minimal for Black Rockcod and White's Seahorse. This is a very small proportion of available habitat in their distribution and the installation of new piles would provide similar, if not the same habitat for these species during operation. Additional controls would be implemented to survey for Black Rockcod and White's Seahorse at the start of construction so that individuals in the area at the start of construction are not harmed.</p>	Minor, short term, negative
The removal of vegetation as a result of the proposal would remove potential habitat for native fauna. However, the overstorey and groundcover species to be removed forms only a small portion of similar habitat along the fragmented and highly urbanised foreshores of Neutral Bay. The removal of habitat resources is unlikely to have a substantial impact on native fauna as there is an abundance of similar habitat across the study locality.	Negligible, long term
<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> <p>The proposal would not endanger any species of animal, plant or other form of life, whether living on land, in water or in the air.</p>	No impact
<p>h) Any long-term effects on the environment?</p> <p>The proposal would result in long term visual impacts. No other long-term negative effects on the environment are anticipated.</p>	Long term, negative
The proposal would result in improvements in user amenity for the wharf.	Long term, positive
<p>i) Any degradation of the quality of the environment?</p> <p>The proposal would result in localised sediment disturbance during piling activities, which would result in temporary impacts to water quality.</p> <p>There is potential for accidental spills/leaks of fuel, oil or other chemicals to impact water quality during construction.</p> <p>Impacts would be minor with implementation of the safeguards and management measures identified in section 7.1 of the REF.</p>	Minor, short term negative

Factor	Impact
<p>j) Any risk to the safety of the environment?</p> <p>Construction related activities pose potential risks to the safety of the environment through spills/leaks of fuel, oil or other chemicals.</p> <p>Impacts would be minor with implementation of the safeguards and management measures identified in section 7.1 of the REF.</p>	<p>Minor, short term negative</p>
<p>k) Any reduction in the range of beneficial uses of the environment?</p> <p>The proposal would not reduce the range of beneficial uses of the environment.</p>	<p>No impact</p>
<p>l) Any pollution of the environment?</p> <p>Construction related activities may result in pollution of the environment through spills/leaks of fuel, oil or other chemicals.</p> <p>Impacts would be minor with implementation of the safeguards and management measures identified in section 7.1 of the REF.</p>	<p>Minor, short term negative</p>
<p>m) Any environmental problems associated with the disposal of waste?</p> <p>All wastes generated by the proposal would be disposed of at an off-site facility which is licenced to receive such waste.</p> <p>There would be no significant environmental problems associated with waste disposal.</p>	<p>Minor, short term negative</p>
<p>n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</p> <p>All resources required by the proposal are readily available and are not likely to become in short supply.</p>	<p>No impact</p>
<p>o) Any cumulative environmental effect with other existing or likely future activities?</p> <p>Assessment of cumulative impacts for the proposal is provided in section 6.12.</p> <p>Other projects in the same timing of this proposal include upgrade of other wharfs in the ferry network, and building developments in the local Council area. There may be a minor increase in marine traffic, and noise impacts. No other significant cumulative impacts have been identified for the proposal.</p> <p>The proposal design includes an allowance for sea level rise.</p>	<p>Minor, short term negative</p>
<p>p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</p> <p>Consideration of coastal processes and coastal hazards is detailed in section 6.1.</p> <p>No impacts to these issues are anticipated for the proposal.</p>	<p>No impact</p>

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on the Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of Agriculture, Water and Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
<p>a) Any impact on a World Heritage property?</p> <p>There are no items within or in the immediate vicinity of the construction footprint listed on the WHL, NHL or CHL.</p> <p>The construction footprint is located about 350 metres from the edge of the visual buffer zone of the Sydney Opera House (WHL 166rev). The visual buffer zone assessed in this REF overlaps the visual buffer zone of the Sydney Opera House (WHL 166rev). There is one item listed on the CHL within the visual buffer zone: Customs Marine Centre (Place ID 105249).</p> <p>The proposed works would not impact upon the Commonwealth heritage values of Customs Marine Centre (CHL ID 105249), or the World heritage values of the Sydney Opera House (WHL 166rev).</p>	No impact
b) Any impact on a National Heritage place?	No impact
c) Any impact on a wetland of international importance?	No impact
<p>d) Any impact on a listed threatened species or communities?</p> <p>Black Rockcod (<i>Epinephelus daemeli</i>) listed as vulnerable under the EPBC Act.</p> <p>Water-based activities have potential to impact habitat for the Black Rockcod. The foraging resource that the study area represents would be made available for these species following the completion of construction thus, proposal impacts to potential foraging habitat for this species are only temporary. The loss of potential habitat from the installation of three piles on subtidal rocky reef and the removal impact of part of the existing structure is considered minimal for Black Rockcod. This is a very small proportion of available habitat in their distribution and the installation of new piles would provide similar, if not the same habitat for these species during operation. Additional controls would be implemented to survey for Black Rockcod at the start of construction so that individuals in the area at the start of construction are not harmed.</p>	Minor, short term
e) Any impacts on listed migratory species?	No impact
f) Any impact on a Commonwealth marine area?	No impact
g) Does the proposal involve a nuclear action (including uranium mining)?	No impact

Factor	Impact
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land?	No impact

Appendix B

Statutory consultation checklists

Infrastructure SEPP

Certain development types

Development type	Description	Yes/No	If 'yes' consult with	ISEPP clause
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	-	ISEPP cl. 95A
Bus Depots	Does the project propose a bus depot?	No	-	ISEPP cl. 95A
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	-	ISEPP cl. 95A

Development within the Coastal Zone

Issue	Description	Yes/No/NA	If 'yes' consult with	ISEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	N/A	-	ISEPP cl. 15A

Note: See interactive map here: <https://www.planning.nsw.gov.au/policy-and-legislation/coastal-management>. Note the coastal vulnerability area has not yet been mapped.

Note: a certified coastal zone management plan is taken to be a certified coastal management program

Council related infrastructure or services

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Stormwater	Is the work likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?	No	-	ISEPP cl.13(1)(a)
Traffic	Is the work likely to generate traffic to an	No	-	ISEPP

Issue	Potential impact	Yes/ No	If 'yes' consult with	ISEPP clause
	extent that will <i>strain</i> the capacity of the existing road system in a local government area?			cl.13(1)(b)
Sewerage system	Will the work involve connection to a council owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?	No	-	ISEPP cl.13(1)(c)
Water usage	Would the work involve connection to a council owned water supply system? If so, would this require the use of a <i>substantial</i> volume of water?	No	-	ISEPP cl.13(1)(d)
Temporary structures	Would the work involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, would this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?	Yes	North Sydney Council	ISEPP cl.13(1)(e)
Road & footpath excavation	Would the work involve more than <i>minor</i> or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	Yes	North Sydney Council	ISEPP cl.13(1)(f)

Local heritage items

Issue	Potential impact	Yes/ No	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the work? If yes, does a heritage assessment indicate that the	Yes	North Sydney Council	ISEPP cl.14

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
	potential impacts to the heritage significance of the item/area are more than <i>minor</i> or <i>inconsequential</i> ?			

Flood liable land

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Flood liable land	Is the work located on flood liable land? If so, would the work change flood patterns to more than a <i>minor</i> extent?	No	-	ISEPP cl.15
Flood liable land	Is the work located on flood liable land? (to any extent). If so, does the work comprise more than minor alterations or additions to, or the demolition of, a building, emergency work or routine maintenance	No	-	ISEPP cl.15AA

Note: 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.

Public authorities other than councils

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
National parks and reserves	Is the work adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> , or on land acquired under that Act?	No	-	ISEPP cl.16(2)(a)
National parks and reserves	Is the work on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	-	ISEPP cl.16(2)(b)
Aquatic reserves	Is the work adjacent to an aquatic reserve or a marine park declared under the <i>Marine Estate Management Act 2014</i> ?	No	-	ISEPP cl.16(2)(c)

Issue	Potential impact	Yes/ No	If 'yes' consult with	ISEPP clause
Sydney Harbour foreshore	Is the work in the Sydney Harbour Foreshore Area as defined by the <i>Place Management NSW Act 1998</i> ?	No		ISEPP cl.16(2)(d)
Bush fire prone land	Is the work for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	-	ISEPP cl.16(2)(f)
Artificial light	Would the work increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	-	ISEPP cl.16(2)(g)
Defence communications buffer land	Is the work on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	-	ISEPP cl. 16(2)(h)
Mine subsidence land	Is the work on land in a mine subsidence district within the meaning of the <i>Mine Subsidence Compensation Act 1961</i> ?	No	-	ISEPP cl. 16(2)(i)

Sydney Harbour SREP Consultation

Issue	Potential impact	Yes/ No	If 'yes' consult with	SREP clause
Provision of services	Do the works require the provision of services (including water, sewerage or stormwater systems)?	Yes	Ausgrid Sydney Water	SREP cl.31(2)(a)(ii)
Advertising	Do the works include advertisements or advertising structures?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Aviation	Do the works include aviation facilities?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Boat launching	Do the works include boat launching facilities?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Boat lifts	Do the works include boat lifts?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Boat repair	Do the works include boat repair facilities?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Boat sheds	Do the works include a boat shed or sheds?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Charter and tourism boating facilities	Do the works include charter and tourism boating facilities?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Marinas	Do the works include a commercial or private marina?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Commercial port facilities	Do the works include commercial port facilities?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Commercial or retail use of land	Do the works include the commercial or retail use of land below or partly below mean high water mark?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Dredging	Do the works involve any dredging?	No	-	SREP cl.31(2)(a)(i) & Schedule 2

Issue	Potential impact	Yes/ No	If 'yes' consult with	SREP clause
Flora and fauna enclosures	Do the works include any flora and/or fauna enclosures?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Houseboats	Do the works include a houseboat or houseboats?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Inclinators	Do the works include an inclinator?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Private landing facilities	Do the works include private landing facilities (including jetties, wharves and pontoons)?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Public boardwalks	Do the works include a public boardwalk?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Public water recreational facilities	Do the works include any public water recreational facilities?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Public water transport facilities	Do the works include public water transport facilities?	Yes	Foreshores and Waterways Development Advisory Committee	SREP cl.31(2)(a)(i) & Schedule 2
Reclamation works	Do the works require any reclamation?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Recreational or club facilities	Do the works include any recreational or club facilities?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Residential	Do the works include any residential use of land below or partly below mean high water mark?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Retaining walls	Do the works include retaining walls?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Sea walls	Do the works include sea walls?	No	-	SREP cl.31(2)(a)(i) & Schedule 2

Issue	Potential impact	Yes/ No	If 'yes' consult with	SREP clause
Skids	Do the works include skids (i.e. an inclined ramp used for the manual launching of small craft but not including a slipway)?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Swimming enclosures	Do the works include a swimming enclosure?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Water based restaurants and entertainment facilities	Do the works include water-based restaurants and/or entertainment facilities? (i.e. a vessel or structure that floats on, or is fixed in, the waterway, that is used as a club or restaurant or for entertainment (on a commercial basis) and that has a direct structural connection between the foreshore and the waterway).	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Stairs	Do the works include waterfront access stairs?	No	-	SREP cl.31(2)(a)(i) & Schedule 2
Demolition	Do the works include demolition – including demolition in relation to heritage items?	No	-	SREP cl.31(2)(a)(i) & Schedule 2

Appendix C

Preliminary site investigation

Preliminary Site Investigation

North Sydney Wharf Upgrade

AWE200198



Prepared for
Transport for NSW

9 October 2020

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

Executive Summary

Cardno NSW/ACT Pty Ltd (Cardno) was engaged by Transport for NSW (TfNSW) to undertake a Preliminary Site Investigation (PSI) of the North Sydney Ferry Wharf upgrade proposal. The study area for the PSI is defined by the construction footprint presented in **Figure 1** in **Appendix A** (the Site). It is proposed that part of the existing North Sydney Wharf is removed and a new wharf is constructed to the north to improve passenger accessibility. The existing ferry wharf would have the three northern landings removed, with the southern landing and walkway retained.

During completion of the investigation Cardno conducted a site inspection and reviewed previous environmental investigations, background information and historical aerial imagery. The investigation was undertaken to:

- > Identify historical sources of potential contamination or potentially contaminating activities that may have taken place on or adjacent to the proposal
- > To identify potential sources and indicators of contamination including potential sensitive receptors.

Site Contaminants of Concern

Following the review of background information and a site inspection, Cardno identified the following potentially contaminating activities as having occurred at the Site:

- > Quarrying
- > Whaling
- > Filling during construction of Kesterton Park.

The former Royal Australian Navy Submarine Base HMAS Platypus located to the north of the site has been subjected to highly contaminating activity since 1876 when it was a gasworks prior to becoming HMAS Platypus in 1967 and finally being decommissioned in 1999 and handed over to the Sydney Harbour Federation Trust (SHFT) in 2005. The sediment within Neutral Bay is considered to be impacted with a variety of analytes from historical industrial activities.

The following contaminants were identified as having potential of occurring at the Site:

- > Polycyclic Aromatic Hydrocarbons (PAH)
- > Total Recoverable Hydrocarbons (TRH)
- > Heavy metals
- > Organochlorine Pesticides/Organophosphorus Pesticides (OCP/OPP)
- > Polychlorinated Biphenyls (PCB).

Risk Assessment

The information sourced during the preparation of this investigation has been utilised to determine the likelihood for historical and current land use activities to have affected the suitability of the Site. Taking into consideration the available background data and the site inspection that occurred on the 12 March 2020, the main sources of possible contamination are outlined below:

- > The current impacts and origin of soils at the Site are unknown. The Site history indicates that there is medium risk that impacted soils are present at the Site
- > Previous assessment by Coffey (2016) indicates that sediment within the project footprint is contaminated with concentrations of various analytes above the adopted criteria. Sediment would be displaced during piling works
- > It is considered that groundwater at the Site is potentially impacted by tidal influences from Sydney Harbour. The condition of water entering the Site from the harbour can change depending on tides and storm events (Birch & Taylor, 2004). If subsurface soil is impacted, it is likely that tidal flows could be transporting contaminants into Sydney Harbour from the Site.

Conclusions

Soil

Soil impacts at the Site are currently unknown. Due to the age of the Site and the previous industrial activity, there is a potential that soils are impacted from leaching of materials, interaction with tidal flow of Sydney Harbour and fill of unknown quality.

Sediment

Previous investigations by Coffey (2016) indicate that sediment at the Site is impacted with the following analytes:

- > Copper
- > Lead
- > Mercury
- > Zinc
- > Dichlorodiphenyldichloroethane (DDD)
- > Endrin
- > PAHs.

Groundwater

Impacts to groundwater are currently unknown, there are no groundwater bores on-site. It is considered likely that groundwater would be impacted at the Site due to tidal interaction with Sydney Harbour and possible leaching from impacted subsurface soil materials.

Recommendations

Given the results of the assessment, the following is recommended:

- > An intrusive soil investigation to the depth of excavation to ensure the safety of construction workers and provide waste classification of the materials to be removed
- > The piling methodology shall seek to mitigate the risk of sediment dispersal
- > The above works be undertaken by a suitably qualified contaminated land specialist.

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1 Introduction

1.1 Background

Cardno NSW/ACT Pty Ltd (Cardno) was engaged by Transport for NSW (TfNSW) to undertake a Preliminary Site Investigation (PSI) of the North Sydney Wharf upgrade proposal. The study area for the PSI is defined by the construction footprint presented in **Figure 1** in **Appendix A** (the Site). It is proposed that the current North Sydney Wharf is partly decommissioned, and a new wharf is constructed to the north which would be accessible for all passengers. The existing ferry wharf would have the three northern landings removed, with the southern landing and walkway retained.

It is expected that harbour sediment would be disturbed during piling and demolition of the existing wharf. Earthworks during construction of the existing land based elements would include demolition of existing pavements and excavation and build up earthworks for the construction of the new accessible ramp. Construction of the new parking area, pavement and kerbs may also involve limited earthworks.

The Transport Access Program (TAP) is an ongoing 'initiative to deliver modern, safe and accessible transport infrastructure' in NSW (Transport for NSW, 2015). The focus of the program is improving access to the transport network for less mobile passengers. As a result, Roads and Maritime (now Transport for NSW) assessed the condition of all ferry wharves across the transport network in 2009 in terms of:

- > Safety and structural integrity
- > Access for less mobile and disabled passengers
- > Existing and predicted future patronage and use.

The aims behind the above objective of the TAP are to:

- > Improve the accessibility for passengers who use wheelchairs and prams by removing stairs and supplying ramps
- > Build facilities for all transport modes to meet the needs of a growing population
- > Provide an effective and seamless interchange that supports an integrated transport network.

1.2 Purpose and Objectives

The purpose of the PSI is to provide TfNSW with preliminary advice on the potential constraints at the Site from a contamination perspective. The objectives of the investigation are to:

- > Identify historical sources of potential contamination or potentially contaminating activities that may have taken place on or adjacent to the project Site
- > To identify potential sources and indicators of contamination including potential sensitive receptors.

1.3 Scope

Cardno carried out the following tasks to satisfy the purpose and objectives of the PSI:

- > Defined the Site features and immediate surrounds based on site observations during the assessment activities
- > Reviewed available background information for the Site, including searches of public databases, previous reports, historical aerial imagery and NSW Environment Protection Agency (EPA) maintained registers
- > Identified nearby sensitive receptors
- > Reviewed regional and local geology and hydrogeology, including details on registered bores
- > Development of a conceptual site model (CSM) to evaluate potential risks to identified sensitive receptors
- > Preparation of this PSI report.

1.4 Guidelines and Legislation

The scope of work outlined above was completed in general accordance the following guidelines and legislation:

- > National Environment Protection Council (NEPC)(1999). *National Environment Protection (Assessment of Site Contamination) Measure (NEPM)*, December 1999
- > NSW Department of Urban Affairs and Planning (DUAP)(1998) *Managing Land Contamination: Planning Guidelines: SEPP 55 Remediation of Land*, April 1999
- > NSW Environment Protection Authority (EPA)(2014) *Waste Classification Guidelines*, November 2014
- > NSW EPA (2020) *Consultants reporting on contaminated land Contaminated land guidelines*, April 2020
- > North Sydney Council (2013) *North Sydney Council Local Environment Plan 2013*.

2 Site Condition and Surrounding Environment

The Site is located on the foreshore of Kesterton Park, High Street, North Sydney NSW. The Site is bounded by Kesterton Park to the north and west and Neutral Harbour to the east and Sydney Harbour / Careening Cove to the South.

The Site location is shown in **Figure 1** in **Appendix A** with Site details provided in **Table 2-1** below.

Table 2-1 Site Identification

Item	Details
Site Address	High Street, North Sydney
Approximate Site Area	0.5 ha
Title Details	Lot 1124 DP752067, Lot A DP396389, Lot B DP396389, Lot 7 DP 12302, Lot 8 DP 12302 and Lot 9 DP 12302 Works below mean high water mark
Local Government Area (LGA)	North Sydney Council
Suburb	North Sydney
Site Owners at the time of this engagement	North Sydney Council NSW Maritime,

2.2 Site Description

The Site is irregular in shape and located on the North Sydney peninsula. It is understood that Kesterton Park has remained unchanged since at least 1930, although the footprint of the ferry wharf has changed. Currently the Site consists of grass-covered public open space, a concrete footpath and the ferry wharf adjoining from the southern extent of the peninsula.

An inspection of the Site was undertaken on 12 March 2020 with details and observations made during the site inspection provided in **Table 2-2**. Photographs from the site inspection are presented in **Appendix B**.

Table 2-2 Site Inspection Observations

Item	Observations
Site use	The Site is currently used as a public park and berthing point for the F5 Neutral Bay ferry network.
Weather condition	Clear and sunny.
Site Slope and Drainage Features	The Site is located on the toe of the North Sydney peninsula which slopes in a south-easterly and easterly direction toward Neutral Harbour. It is a mixture of grass-covered and hardstand, with grassed areas within Kesterton Park, a concrete footpath and sandstone blocks forming the retaining wall that separates the park from Sydney Harbour. During rainfall events it is expected that overland flow from High Street will be directed toward the Site due to the sloping topography. Water is then expected to infiltrate into the grass-covered areas, where it is likely it will interact with Sydney Harbour due to tidal influences.
Nearby water bodies	A portion of the Site lies within Sydney Harbour, which adjoins the Site to the east and south.
Site surface coverings	The Site is a mixture of hardstand and grass-covered areas.
Site cut and fill	The natural environment the site has been heavily modified to form grassed parkland. There is the potential for material to have been imported to site to recontour the landscape and form Kesterton Park area.
Surface soils	Sandy silts, silty loam
Buildings	There is a heritage listed bus shelter adjacent to the existing North Sydney Wharf within the construction footprint.

Item	Observations
Potential asbestos in building materials	A hazardous materials assessment was not undertaken on the heritage listed bus shelter.
Manufacturing, industrial or chemical processes and infrastructure	Ferry wharf which acts as a berthing point for ferries on the F5 Neutral Bay Network.
Fuel storage tanks (USTs/ASTs)	Not observed.
Dangerous goods	Not observed.
Solid waste deposition	General waste and recycling receptacles were observed to the west of the Site.
Liquid waste disposal features	Not observed.
Evidence of previous site contamination investigations	Preliminary Site Investigation, Coffey (2016).
Evidence of land contamination (staining or odours)	Not observed.
Evidence of groundwater contamination	Not observed.
Groundwater use	Not observed.
Vegetation	Four small trees are located on the western side of the footpath in the northern portion, two shrubs are located on the eastern side of the footpath in the southern portion, with dense shrubs located on the eastern side of the footpath in the northern portion. The remainder of the Site is grass-covered.

2.3 Surrounding Land Use

Land uses surrounding the Site are detailed in **Table 2-3**.

Table 2-3 Surrounding Land Use

Direction	Land Use	Description of Land
North	Recreational	Kesterton Park and a playground approximately 15 m to the north, beyond which is Sub Base Platypus approximately 150 m from the Site
West	Residential	Kesterton Park, beyond which is High Street and residential properties
East	Waterways	Neutral Harbour
South	Waterways	Sydney Harbour / Careening Cove

2.4 Topography and Drainage

The Site is located on the toe of the North Sydney peninsula. Kesterton Park has a slight slope to the east, with the highest portion being approximately 4 m AHD and the most eastern point approximately 1-2 m AHD. Currently the Site is a mixture of a hardstand footpath and grass-covered areas, with no stormwater drainage systems observed. It is understood that surface water drainage discharges into Neutral Harbour during rainfall events.

The bathymetry at the proposed ferry wharf site slopes steeply down from 0 m Chart Datum (CD) at the seawall to -7.5 m CD about 24 m from the seawall at the eastern side of the pontoon location.

2.5 Flood Potential

The *North Sydney Local Environmental Plan 2013* (North Sydney LEP) does not contain flood risk maps. A Flood Study was prepared by WMA Water (2017) for the North Sydney Local Government Area (LGA), however ongoing floodplain risk management plans are being prepared to provide information for flood planning controls. The results from the Flood Study indicate that the area is not subject to flooding in 20%, 10% or 5% Annual Exceedance Probability modelling.

2.6 Regional Geology and Hydrology

The Sydney 1:100,000 Geological Map Sheet 9130 (1983) accessed from NSW Resources and Energy indicates that the Site is underlain by Hawkesbury Sandstone from the Mesozoic Era, which is characterised by medium to coarse grained quartz sandstone, very minor shale and laminite lenses. A sandstone outcrop was visible to the north of the Site.

2.6.1 Acid Sulfate Soils

During the review of the North Sydney LEP Acid Sulfate Soils (ASS) risk maps were not identified. As there are no ASS risk maps available for the landside area it is considered unlikely that ASS are present. A review of the Australian Atlas of Acid Sulfate Soils (ASRIS) on the 5 April 2020 indicated that there is a high probability of occurrence for ASS in the subtidal marine environments.

2.6.2 Salinity

During the background information review, salinity risk maps were not identified for the Site. Cardno considers that there is low risk for salinity hazards to be present at the Site.

2.7 Groundwater Database

A search of the Australian Groundwater Explorer database did not identify any groundwater bores within the Site boundary. The search identified nine groundwater wells within 500 m of the Site used for groundwater monitoring.

Three of the monitoring wells are clustered approximately 350 to 370 m to the south of the Site at Kirribilli near the Royal Sydney Yacht Squadron. The other cluster of six monitoring wells are located to the north near Kurraba Road in Neutral Bay.

A summary of the groundwater bores is found in **Table 2-4**.

Table 2-4 Groundwater Bore Details

Bore ID	Bore Depth (mBGL)	Drilled Date	Purpose	Distance (m) / Direction
GW114493	10	4/05/2011	Monitoring	356 south
GW114494	10	4/05/2011	Monitoring	367 south
GW114492	10	4/05/2011	Monitoring	368 south
GW109601	2	2/05/2003	Monitoring	437 north
GW109602	8.4	2/05/2003	Monitoring	442 north
GW109603	5	1/05/2003	Monitoring	450 north
GW109604	1.7	6/05/2003	Monitoring	453 north
GW109605	4	6/05/2003	Monitoring	458 north
GW109600	6.5	2/05/2003	Monitoring	462 north

The waterside portion of the Site includes Neutral Bay which is contained within Sydney Harbour. It is expected that there would be tidal influence to groundwater in the landside section of the Site. Sydney Harbour has been identified as having high levels of contamination which would vary from tide and storm flows (Birch & Taylor, 2004).

2.8 Previous Environmental Reports

The following report was used as a reference for sediment contamination in Sydney Harbour:

- > Birch & Taylor, 2004. *The Contaminant Status of Sydney Harbour Sediments, A handbook for the Public and Professionals*. January 2004
- > Coffey, 2016. *Stage 2 Contamination Assessment – North Sydney South Ferry Wharf*. 20 July 2016.

Summaries of these reports are provided below.

2.8.1 Birch & Taylor, 2004. The Contaminant Status of Sydney Harbour Sediments, A handbook for the Public and Professionals. January 2004

The study into the contaminant status of Sydney Harbour primarily assessed four groups of contaminants:

- > Heavy metals
- > Organochlorine Pesticides (OCP) residues
- > Polycyclic Aromatic Hydrocarbons (PAH)
- > Polychlorinated Biphenyls (PCB).

Assessment of organic compounds such as Total Recoverable Hydrocarbons (TRH) was not undertaken due to cost.

The following analytes were identified as the most enriched in the Neutral Bay embayment within Sydney Harbour:

- > Aldrin
- > Heptachlor
- > PCBs
- > Dieldrin
- > DDT
- > Lead
- > HCBs
- > PAHs.

The following analytes were identified in the water from creeks, streams, rivers and stormwater canals discharging into Neutral Bay:

- > Copper
- > Zinc
- > Total chlordane
- > PCBs
- > Aldrin
- > Heptachlor.

Following sampling and laboratory analysis of sediment from Neutral Bay, mean concentrations of analytes are provided in **Table 2-5**.

Table 2-5 Mean Analyte Concentrations in Neutral Bay

Analyte	Mean Concentration (mg/kg)
Aldrin	5
Heptachlor	12
HCB	2.5
Chlordane	235
Dieldrin	18
DDT	58
Lead	420
Copper	225
Zinc	850
PAH	119
PCB	215

The results indicated that the sediment within Neutral Bay contained high levels of contamination when compared to sediment in other areas of Sydney Harbour.

2.8.2 Coffey, 2016. Stage 2 Contamination Assessment – North Sydney South Ferry Wharf. 20 July 2016

Coffey Geotechnics Pty Ltd (Coffey) was commissioned by Hansen Yuncken (HY) to provide a contamination assessment for the proposed North Sydney Wharf upgrade. The project area for this assessment was within Neutral Bay and included taking two sediment samples to assess the contamination and ASS potential of soils as well as to provide an indicative waste classification.

During fieldwork, the sediment encountered was described as fine to coarse grained grey to dark grey clayey silty sand to approximately 3.0 to 4.0 m below the sea floor which was underlain by high plasticity sandy clay and sandstone bedrock. Analytical laboratory results indicated that the top 0.2 m below sea level sediment had concentrations above the ANZECC (2000) Australia and New Zealand Guidelines for Fresh and Marine Water Quality, Table 3.5.1 – Interim Sediment Quality Guidelines (ISQG) Low criteria for the following analytes:

- > Copper
- > Lead
- > Mercury
- > Zinc
- > Dichlorodiphenyldichloroethane (DDD)
- > Endrin.

Various PAHs were above ISQG High criteria, including:

- > Acenaphthylene
- > Anthracene
- > Benzo(a)anthracene
- > Benzo(a)pyrene
- > Chrysene
- > Fluoroanthene
- > Fluorene
- > Phenanthrene
- > Pyrene
- > Total PAH.

The results were compared to previous studies of sediment contamination within Sydney Harbour (Birch & Taylor 1998) and were considered to be similar. The study determined that the contamination risk arising from ferry wharf construction are considered medium to high.

The preliminary waste classification of the material classified the top 20 cm as Hazardous Waste. Further sampling was recommended to confirm the classification of the soil following excavation.

2.9 EPA Records Search

2.9.1 Contaminated Land Record of Notices

The Contaminated Land Record of Notices is maintained by the Department of Planning, Industry and Environment (DPIE) in accordance with Part 5 of the *Contaminated Land Management (CLM) Act 1997* and contains regulatory notices issued by the Environment Protection Authority (EPA) in relation to contaminated sites.

A search of the Contaminated Land Record of Notices on 2 April 2020 identified two notified sites within a 500m radius of the Site. Results are presented in **Table 2-6**.

Table 2-6 NSW EPA Contaminated Land Record of Notices

Name	Address	Notices	Distance (m) / Direction	Activity that Caused Contamination
Sub Base Platypus (previously HMAS Platypus)	High Street, North Sydney NSW	Contamination formerly regulated under the CLM Act	68 / north-west	<ul style="list-style-type: none"> Gasworks; and Defence Site.
Neutral Bay Sediments	Adjacent to HMAS Platypus, 118 High Street, North Sydney NSW	Contamination formerly regulated under the CLM Act	68 / north-west	<ul style="list-style-type: none"> Gasworks; and Defence Site.

Due to the proximity of the Site to the formerly regulated areas, the likelihood of soils interacting with contaminated groundwater is considered high.

2.9.2 PoEO Public Register

The Public register under Section 308 of the *Protection of the Environment Operations Act 1997* (PoEO Act) contains Environment Protection Licences (EPLs), applications and notices issued by the EPA. The Public Register was searched on 2 April 2020 within 500 m of the Site and identified one (1) site with a current license. Results are summarised in **Table 2-7**.

Table 2-7 PoEO Public Register

Site Name	Address	Activity	Status	Distance (m) / Direction
Royal Sydney Yacht Squadron	33 Peel Street, Kirribilli NSW	Boat construction / maintenance	Active	295 / south-east

2.9.3 List of Contaminated Sites Notified to the EPA

A search of the list of Contaminated Sites Notified to the EPA on 2 April 2020 identified four notified sites within 500 m of the Site. The Sites notified as contaminated are detailed in **Table 2-8**.

Table 2-8 Sites Notified as Contaminated to the NSW EPA

Site Name	Address	Activity	EPA Management	Status	Distance (m) / Direction
Sub Base Platypus (previously HMAS Platypus)	High Street, North Sydney NSW	Gasworks and Defence Site	Contamination formerly regulated under the CLM Act	Current EPA List	68 / north-west
Neutral Bay Sediments	Adjacent to HMAS Platypus, 118 High Street, North Sydney NSW	Gasworks and Defence Site	Contamination formerly regulated under the CLM Act	Current EPA List	68 / north-west
Iora Complex	1 Kiara Place, North Sydney NSW	Gasworks	Regulation under the CLM Act not required	Current EPA List	153 / north-west

2.10 Planning Information

Review of the North Sydney LEP (Map LZN_004) indicates that the majority of the Site is within an area zoned as RE1 – Public Recreation. At the western extent of the Site, where the footpath is likely going to be re-graded, it is zoned R4 – High Density Residential. The zones have the following objectives:

- > 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 ensure sufficient public recreation areas are available for the benefit and use of residents of, and visitors to, North Sydney.
- > R4 – High Density Residential:
 - To provide for the housing needs of the community within a high-density residential environment
 - To provide a variety of housing types within a high-density residential environment
 - To enable other land uses that provide facilities or services to meet the day to day needs of residents
 - To encourage the development of sites for high density housing if such development does not compromise the amenity of the surrounding area or the natural or cultural heritage of the area
 - To ensure that a reasonably high level of residential amenity is achieved and maintained.

The waterway surrounding North Sydney Wharf falls within the authority of the *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005*. The zoning of these waters is W1 Maritime Waters. The objectives of this zone are as follows:

- > To give preference to and protect waters required for the effective and efficient movement of commercial shipping, public water transport and maritime industrial operations generally
- > To allow development only where it is demonstrated that it is compatible with, and will not adversely affect the effective and efficient movement of, commercial shipping, public water transport and maritime industry operations
- > To promote equitable use of the waterway, including use by passive recreation craft.

3 Site History

3.1 Historical Aerial Photograph Review

Fifteen historical aerial photographs were obtained for the proposal dating back to 1930. An interpretation of aerial photographs from 1930 until 2020 are presented in **Table 3-1**.

Table 3-1 Historical Aerial Photograph Review

Year	Description of Site	Off-Site Direction	Description
1930 (low resolution)	The Site is comprised of Kesterton Park and the North Sydney Ferry wharf. The footprint of the wharf appears to be square.	North	Neutral Bay and the Neutral Bay Gas Works.
		South	North Sydney peninsula, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
1943	There is industrial activity, possibly storage of equipment, on the landside portion of the Site associated with the gasworks.	North	Neutral Bay and torpedo workshop.
		South	North Sydney peninsula, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
1955	The industrial activity / storage is no longer present at the Site.	North	A reduction in the number of buildings associated with the torpedo workshop.
		South	North Sydney peninsula, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
1965	The Site appears to be unchanged.	North	Neutral Bay and the torpedo workshop.
		South	North Sydney peninsula, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
1971 (low resolution)	The Site appears to be unchanged.	North	Neutral Bay and HMAS Platypus which has a structure being constructed
		South	North Sydney peninsula, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
1975	The Site appears to be unchanged.	North	Neutral Bay and HMAS Platypus
		South	North Sydney peninsula, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
1986	The North Sydney Ferry Wharf footprint has changed, which is now in a dog leg shape; extending to the north.	North	Decommissioning of gasometers associated with the gas works. Submarines are present.
		South	Vegetation is present on the peninsula immediately adjacent to the Site
		East	Neutral Bay

Year	Description of Site	Off-Site Direction	Description
		West	High Street and residential properties, a pool has been constructed at 181 High Street
1991	The Site appears to be unchanged.	North	Neutral Bay and Neutral Bay and torpedo workshop. The location of the gasometers have been replaced with high density residential structures.
		South	North Sydney peninsula with vegetation, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
1998	The Site appears to be unchanged.	North	Growth of vegetation in Kesterton Park and change in the structures associated with the submarine base
		South	North Sydney peninsula with vegetation, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
2004	The Site appears to be unchanged.	North	Kesterton Park and unused HMAS Platypus
		South	North Sydney peninsula with vegetation, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
2009	The Site appears to be unchanged.	North	Kesterton Park and unused HMAS Platypus
		South	North Sydney peninsula with vegetation, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
2011	The Site appears to be unchanged.	North	Kesterton Park and unused HMAS Platypus which has had a structure demolished
		South	North Sydney peninsula with vegetation, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
2014	The Site appears to be unchanged.	North	Kesterton Park and unused HMAS Platypus. The northern portion of HMAS Platypus has been demolished with a new large structure possibly associated with remediation works
		South	North Sydney peninsula with vegetation, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
2017		North	Kesterton Park and unused HMAS Platypus The northern portion of HMAS Platypus is now

Year	Description of Site	Off-Site Direction	Description
	The trees on the landside portion of the Site have been planted.		grass-covered with a new structure, the current Sub Base Platypus site
		South	North Sydney peninsula with vegetation, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties
2020		North	Kesterton Park and Sub Base Platypus with a new wharf/walkway across the water to meet up with Sub Base Platypus
		South	North Sydney peninsula with vegetation, beyond which is Careening Cove / Sydney Harbour
		East	Neutral Bay
		West	High Street and residential properties

3.2 Heritage

A search of the DPIE website indicated that there are twelve heritage items listed within 200 m of the Site. A summary of the heritage items is presented in **Table 3-2**.

Table 3-2 Heritage Sites

Site Name	Significance	Distance (m)
Kesterton Park	Local	On-Site
North Sydney bus shelters	Local	On-site
Careening Cove	Local	9 west
Rockcliff Mansions	Local	19 north-west
Gasworks remains, HMAS Platypus	Local	60 north-west
House	Local	100 north-west
House	Local	155 north-west
Careening Cove slipways and seawall, east end	Local	177 west
House	Local	181 south-west
Sydney Harbour Landscape Area	Register of the National Estate	On-Site
Careening Cove Conservation Area	Register of the National Estate	12 south-west
HMAS Platypus	Register of the National Estate	60 north-west

3.3 Historical Information

3.3.1 North Sydney Council

A review of information on the North Sydney Council website (April, 2020) found that Kesterton Park was originally the site of Whaling allotments, taken up by Kemmis and Brown in 1830. In the 1870's, the Site was the location of sandstone quarrying. Following this, the land was acquired by North Sydney Council to be used as a park, however the date that this occurred is unknown.

3.3.2 Harbour Trust

A review of the history of the Harbour Trust Sub Base Platypus website (April, 2020) found that the Neutral Bay Gas Works was operational from 1876, which included a coal store on-site which was constructed around 1889. As a result of the Great Depression, the Neutral Bay Gas Works ceased operation in 1932.

In 1942, the Commonwealth Government took possession of the Neutral Bay Gas Works site and converted it to a torpedo workshop in response to the event of World War II, which continued to serve the British Navy and Australian Navy until 1967. Following this, the torpedo workshop became the HMAS Platypus and served as the operational headquarters and communications base for the Australian Submarine Squadron. HMAS Platypus was closed in 1999 as the site was considered unsuitable for the new class of submarine.

In 2005, the Commonwealth Government gave the Harbour Trust control of the site to rehabilitate it and provide the space as a public park. In 2018, the site was opened to the public as Sub Base Platypus, with further works to revitalise the site being undertaken.

3.4 Summary of Relevant Historical Activities

The Site has remained largely unchanged since 1955, as described in **Table 3-1**. Historical land uses and potential activities occurring at the Site are summarised in **Table 3-3**. Activities with the potential to cause contamination are noted.

Table 3-3 Summary of Historical Activities and Potential Causes of Contamination

Year	Information Source	Interpretation	Site Activities
1830- 1870	North Sydney Council Website	<ul style="list-style-type: none"> ▪ Coal ash containing PAH and heavy metals; and ▪ Fuels containing TRH from vessels. 	<ul style="list-style-type: none"> ▪ Whaling Station
1870	North Sydney Council Website	<ul style="list-style-type: none"> ▪ The use of steam powered machinery and equipment producing PAH 	<ul style="list-style-type: none"> ▪ Quarrying
1943	Historical Aerial Photograph	<ul style="list-style-type: none"> ▪ Storage of equipment, fuels and industrial activity 	<ul style="list-style-type: none"> ▪ Storage area associated with the defence base and gas works
1876 - 1986	Historical Aerial Photograph and Harbour Trust website	<ul style="list-style-type: none"> ▪ Coal ash containing PAH and heavy metals; ▪ Fuels containing TRH from boats; and ▪ Chemical and fuel storage 	<ul style="list-style-type: none"> ▪ HMAS Platypus base and gas works

3.5 Contaminants of Potential Concern

Based on the available site history the contaminants of potential concern (COPCs) identified by Cardno are listed in **Table 3-4**.

Table 3-4 Identified Contaminants of Potential Concern

Area of Concern	Potential Source	Potential Contaminant
Landside	<ul style="list-style-type: none"> ▪ Atmospheric fallout from gas works; ▪ Historical industrial activity within the vicinity (submarine base and gas works) ▪ Fill material of unknown origin; and ▪ Tidal flows of contaminated water into subsurface profile. 	<ul style="list-style-type: none"> ▪ PAH; ▪ TRH; ▪ Heavy metals; ▪ OCP/OPP; and ▪ PCBs.
Waterside	<ul style="list-style-type: none"> ▪ Discharge and waste disposal from previous industrial activities; ▪ Contaminant transport from the greater Sydney Harbour; and ▪ Fuel leaks from vessels. 	<ul style="list-style-type: none"> ▪ PAH; ▪ TRH; ▪ Heavy metals; ▪ OCP/OPP; and ▪ PCBs.

4 Preliminary Site Conceptual Model

A conceptual site model (CSM) provides an assessment of the potential fate and transport of COPCs relative to site-specific subsurface conditions with regard to their potential risk to human health and the environment. The CSM considers site-specific factors including:

- > Source(s) of contamination
- > Identification of COPCs associated with past (and present) source(s)
- > Vertical, lateral and temporal distribution of COPCs
- > Actual or potential receptors considering both current and future land use both for the Site and adjacent properties, and any sensitive ecological receptors.

Based on the information sourced in this report, a preliminary CSM has been developed and is outlined in **Table 4-1**. Additional details are included in the sections that follow as necessary.

Table 4-1 Preliminary Conceptual Site Model

Conceptual Site Model Element	Description
Site History/Contaminant Sources	The Site has been used for various commercial/industrial activities including whaling and quarrying, however has been used as a public open space since between 1870 and 1930. Sources of contamination at the Site are considered to be off-site sources from the former submarine base, gasworks, potentially contaminated fill materials and historical storage of machinery, chemicals and fuels at the Site.
Site Current and Future Use	The current use of the Site includes public open space adjoining a ferry wharf. A play ground is located to the north of the Site. The future use of the Site will remain the same.
Site Geology	The Site is underlain by Hawkesbury Sandstone from the Mesozoic Era, which is characterised by medium to coarse grained quartz sandstone, very minor shale and laminite lenses. A sandstone outcrop was visible to the north of the Site.
Site Hydrogeology	The depth of groundwater on the landside portion of the Site is unknown. The waterside portion of the Site includes Neutral Bay which is contained within Sydney Harbour. It is expected that there would be tidal influence to groundwater in the landside section of the Site. Sydney Harbour has been identified as having high levels of contamination which vary from tides and storm flows (Birch & Taylor, 2006).
COPCs – Soil & Sediment	<ul style="list-style-type: none"> ▪ PAH ▪ TRH ▪ Heavy metals ▪ OCP/OPP ▪ PCBs.
Potential Human Receptors	<ul style="list-style-type: none"> ▪ Current maintenance workers ▪ Kesterton Park visitors and future users ▪ Future construction workers ▪ Users of Neutral Bay and the greater Sydney Harbour.
Potential Environmental Receptors	<ul style="list-style-type: none"> ▪ Sydney Harbour ▪ Aquatic biota and vegetation ▪ Soil biota and vegetation.
Potential Human Exposure Pathways	<ul style="list-style-type: none"> ▪ Inhalation of particles ▪ Dermal contact and ingestion of contaminated soils.
Potential Environmental Exposure Pathways	<ul style="list-style-type: none"> ▪ Tidal influences transporting contaminants to and from the Site ▪ Uptake of contaminants from surrounding soil biota and vegetation.

5 Conceptual Risk Assessment

A preliminary risk ranking for potential contaminants has been developed for the Site based on the background review, aerial photographs, previous site investigations and Site inspections/observations. For a contaminant to represent a risk to human health or the environment, the following must be present:

- > Evidence of a contaminant exceeding a generic threshold of toxicological concern (TTC) being present on-Site
- > A potential exposure pathway is present
- > A human or environmental receptor is present.

The relative risks of the COPC identified in **Table 3-4** have been estimated by assessing the potential risk of the contaminant as well as the probability that the contaminant is present at the Site using the risk matrix provided in **Table 5-1**.

Table 5-1 Risk Matrix Table

		Consequence (Potential Impact)				
		1. Minor	2. Moderate	3. High	4. Major	5. Critical
Likelihood (Possibility of Presence)	Highly Likely	MEDIUM	HIGH	HIGH	EXTREME	EXTREME
	Likely	LOW	MEDIUM	HIGH	EXTREME	EXTREME
	Possible	LOW	MEDIUM	MEDIUM	HIGH	HIGH
	Unlikely	LOW	LOW	MEDIUM	MEDIUM	HIGH
	Rare	LOW	LOW	LOW	LOW	MEDIUM

Based on the review of the provided reports, historical aerials and observations from the Site inspection, the Site represents a high risk.

The preliminary risk assessment is limited to the data obtained from provided reports by others, historical aerials and our Site observations. Due to heterogeneity of fill materials subsurface conditions may vary considerably from the surficial conditions encountered and have COPCs present that were not apparent during the previous investigations.

The conceptual risk assessment presented in **Table 5-1** was developed to identify and rank potential risks to the project and future cost predictions to make the Site suitable for future land use. The relative risk of the COPC identified in **Table 5-2** have been estimated by assessing the potential impact of the risk as well as the probability that the contaminant is present at the Site.

Table 5-2 Residual Risk Assessment

Identified COPCs (potential source)	Project Location	Hazard	Consequence	Probability	Residual Risk Rating	Cost Implications
Subsurface materials	Landside	Unknown if impacted from previous industrial activity or tidal influences	High	Possible	Medium	Potential increased Work and health and Safety requirements.
Groundwater	Landside	Potential migration of contaminants out of the Site from tidal influences.	High	Possible	Medium	Potential for contaminated groundwater to migrate into Sydney Harbour.
Sediment	Waterside	Impacted sediment material	Low	Likely	Medium	Potential remediation of materials if removed.

5.2 Risk Evaluation

The information sourced during the preparation of this investigation has been utilised to determine the likelihood for historical and current land use activities to have affected the suitability of the Site. Taking into consideration the available background data and the site inspection that occurred on the 12 March 2020, the main sources of possible contamination are outlined below:

- > The current impacts and origin of soils at the Site are unknown. The Site history indicates that there is medium risk that impacted soils are present at the Site
- > Previous assessment by Coffey (2016) indicates that sediment within the project footprint is contaminated with concentrations of various analytes above the adopted criteria. Sediment would be displaced during piling works
- > It is considered possible that groundwater at the Site is impacted by tidal influences from Sydney Harbour. The condition of water entering the Site from the harbour can change depending on tides and storm events (Birch & Taylor, 2004). If subsurface soil is impacted, it is likely that tidal flows could be transporting contaminants into Sydney Harbour from the Site.

6 Conclusions

Cardno has prepared a PSI at North Sydney Ferry Wharf for the project footprint of the ferry wharf upgrade on behalf of TfNSW.

It is understood that the Site has remained largely unchanged as a location of public use and recreation since approximately 1955, consisting of Kesterton Park and the ferry wharf. Prior to this, industrial activities such as whaling stations, gas works and submarine base have occurred within the vicinity. Based on the previous investigation, historical aerials a summary of the contamination is provided below.

6.1 Soil

Soil impacts at the Site are currently unknown. Due to the age of the Site and the previous industrial activity, there is a potential that soils are impacted from leaching of materials, interaction with tidal flow of Sydney Harbour and fill of unknown quality.

6.2 Sediment

Previous investigations by Coffey (2016) indicate that sediment at the Site is impacted with the following analytes:

- > Copper
- > Lead
- > Mercury
- > Zinc
- > Dichlorodiphenyldichloroethane (DDD)
- > Endrin
- > PAHs.

6.3 Groundwater

Impacts to groundwater are currently unknown, there are no groundwater bores on-site. It is considered likely that groundwater would be impacted at the Site due to tidal interaction with Sydney Harbour and possible leaching from impacted subsurface soil materials.

6.4 Recommendations

Given the results of the assessment, the following is recommended:

- > An intrusive soil investigation to the depth of excavation to ensure the safety of construction workers and provide waste classification of the materials to be removed
- > The piling methodology shall seek to mitigate the risk of sediment dispersal
- > The above works be undertaken by a suitably qualified contaminated land specialist.

7 References

ANZECC (1999) *Guidelines for the Assessment of On-Site Containment of Contaminated Soil*, Australian and New Zealand Environment and Conservation Council (ANZECC), September 1999.

Birch & Taylor (2004) *The Contaminant Status of Sydney Harbour Sediments, A handbook for the Public and Professionals*. January 2004.

CCME (2010), *Canadian soil quality guidelines: carcinogenic and other polycyclic aromatic hydrocarbons (PAHs) (environmental and human health effects), Scientific criteria document (revised)*, Canadian Council of Ministers for the Environment, 2010.

Coffey Geosciences Pty Ltd (2016) *Stage 2 Contamination Assessment – North Sydney Ferry Wharf*. 20 July 2016.

CRC Care (2011) *Technical Report No. 10 Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater Part 1: Technical Development Document*, September 2011.

CRC Care (2011) *Technical Report No. 39 Risk-Based Management and Remediation Advice for Benzo(a)pyrene*, January 2017.

CCME (2010), *Canadian soil quality guidelines: carcinogenic and other polycyclic aromatic hydrocarbons (PAHs) (environmental and human health effects), Scientific criteria document (revised)*, Canadian Council of Ministers for the Environment, 2010.

DUAP (1998), *Managing Land Contamination: Planning Guidelines: SEPP 55 Remediation of Land*. NSW Department of Urban Affairs and Planning, April 1999.

NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure (NEPM)*. National Environment Protection Council (NEPC) 1999.

NSW EPA (2014) *Waste Classification Guidelines*. New South Wales Environment Protection Authority (EPA), November 2014.

NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*. New South Wales Office of Environment & Heritage (OEH), November 1997, Reprinted September 2000, Reprinted August 2011.

8 Limitations

This assessment has been undertaken in general accordance with the current “industry standards” for a PSI for the purpose and objectives and scope identified in this report. These standards are set out in:

- > National Environment Protection [Assessment of Site Contamination] Measure (NEPM), December 1999, National Environment Protection Council (NEPC)
- > National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (NEPC, 1999) as varied May 2013 (the ‘NEPM 2013’)
- > AS4482.1- 2005: Guide to the sampling and investigation of potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds. Standards Australia (2005).

The agreed scope of this assessment has been limited for the current purposes of the Client. The assessment may not identify contamination occurring in all areas of the site, or occurring after sampling was conducted. Subsurface conditions may vary considerably away from the sample locations where information has been obtained.

This Document has been provided by Cardno subject to the following limitations:

- > This Document has been prepared for the particular purpose outlined in Cardno’s proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose
- > The scope and the period of Cardno’s services are as described in Cardno’s proposal, and are subject to restrictions and limitations. Cardno did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Cardno in regards to it
- > Conditions may exist which were undetectable given the limited nature of the enquiry Cardno was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required
- > In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Cardno’s opinions are based upon information that existed at the time of the production of the Document. It is understood that the services provided allowed Cardno to form no more than an opinion of the actual conditions of the site at the time this Document was prepared and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations
- > Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document
- > Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Cardno for incomplete or inaccurate data supplied by others
- > Cardno may have retained sub consultants affiliated with Cardno to provide services for the benefit of Cardno. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Cardno’s affiliated companies, and their employees, officers and directors.

This assessment report is not any of the following:

- > A Site Audit Report or Site Audit Statement as defined under the *Contaminated Land Management Act, 1997*
- > A Detailed ESA or Environmental Site Investigation sufficient for an Environmental Auditor to be able to conclude a Site Audit Report and Site Audit Statement
- > A geotechnical report and the bore logs or test pit logs may not be sufficient as the basis for geotechnical advice
- > A detailed hydrogeological assessment in conformance with NSW DEC (2007) Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination
- > An assessment of groundwater contaminants potentially arising from other sites or sources nearby.

A total assessment of the site to determine suitability of the entire parcel of land at the site for one or more beneficial uses of land.

APPENDIX

A

FIGURES

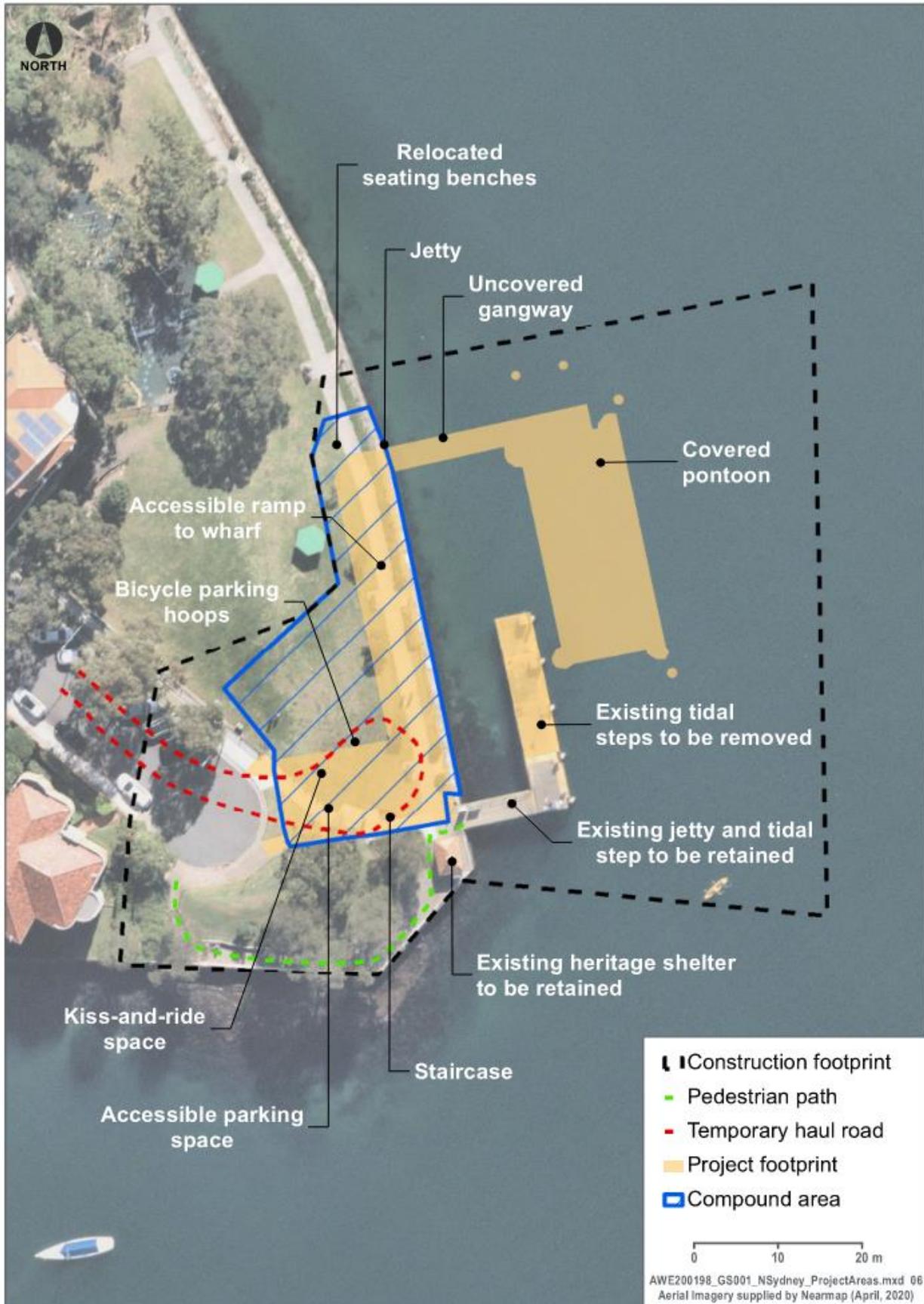


Figure 1: Proposal footprint and construction footprint

APPENDIX

B

SITE PHOTOGRAPHS



Photograph 1: Kesterton Park with footpath along the foreshore of Neutral Bay, facing north.



Photograph 2: Existing North Sydney ferry wharf, Kesterton Park in the foreground, facing east.



Photograph 3: Kesterton Park with sandstone outcrop, playground and residential properties in the background, facing north-west.



Photograph 4: Kesterton Park foreshore contained by sandstone retaining wall.

Appendix D

Biodiversity assessment report



North Sydney Wharf Upgrade

Biodiversity Assessment Report

Transport for NSW

North Sydney Wharf Upgrade

Biodiversity Assessment Report

Transport for NSW | October 2020

Prepared by Cardno (NSW/ACT) Pty Ltd



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Document controls

Approval and authorisation

Title	North Sydney Wharf Upgrade Biodiversity Assessment Report
Accepted on behalf of Transport for NSW by:	Bob Rimic Senior Project Manger
Signed:	
Dated:	

Document status

Document status		Date	Prepared by	Reviewed by
Rev A	Draft for client review	27 May 2020	Dilys Zhang	Kevin Roberts
Rev B	Final draft for client review	4 August 2020	Dilys Zhang	Kevin Roberts
Rev C	Final	17 August 2020	Dilys Zhang	Belinda Crichton
Rev 0	Final for issue	9 October 2020	Dilys Zhang	Belinda Crichton

Executive summary

The North Sydney Wharf Upgrade project (the proposal) forms part of the Ferry Wharf Upgrade Program and the NSW Government's Transport Access Program (TAP). The proposal includes a number of land and water-based features which complement the new wharf and the removal of a portion of the existing wharf.

A biodiversity assessment has been completed which investigates the existing coastal and marine environment within the study area to assess impacts to coastal and marine biodiversity as a result of proposal construction and operation. The biodiversity assessment was informed by a review of existing information in the study area and the wider study locality, as well as a field survey of the study area.

The study area is located in Neutral Bay, an embayment on the northern foreshore of Sydney Harbour. The terrestrial (land) portion of the study area includes Kesterton Park and is likely to be on reclaimed land. The marine (water) portion of the study area is comprised of a vertical sandstone seawall bound by a corridor of subtidal low-medium relief rocky reef and soft sediment habitat in deeper areas. There was no remnant native vegetation in the study area but rather a landscape park with native and exotic plantings thus, no native plant community types occurred within or next to the study area. There were no mangroves, saltmarsh or seagrass in or next to the study area. The subtidal rocky reef (Type 2 Key Fish Habitat, KFH) and large debris/rubble in soft sediment habitats (Type 3 KFH) were colonised by a mosaic of macroalgae.

The vegetation and habitat in the study area provides potential habitat for a number of urban, disturbance tolerant native species. Vegetation and habitat in the study area forms potential habitat for six terrestrial and two marine threatened fauna species:

- White's Seahorse (*Hippocampus whitei*) listed as endangered under the NSW *Fisheries Management Act 1994* (FM Act)
- Black Rockcod (*Epinephelus daemeli*) listed as endangered under the FM Act and vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Five microchiropteran bats (microbats):
 - Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) listed as vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act)
 - Little Bent-winged Bat (*Miniopterus australis*) listed as vulnerable under the BC Act
 - Large Bent-winged Bat (*Miniopterus orianae oceanensis*) listed as vulnerable under the BC Act
 - Southern Myotis (*Myotis macropus*) listed as vulnerable under the BC Act
 - Greater Broad-nosed Bat (*Scoteanax rueppellii*) listed as vulnerable under the BC Act
- Grey-headed Flying Fox (*Pteropus poliocephalus*) listed as vulnerable under the BC Act and the EPBC Act.

The proposal would remove up to 0.06 hectares of landscaped gardens and parks which includes the removal of three juvenile Wildfire (*Corymbia ficifolia*) and one Smooth-barked Apple (*Angophora costata*) plantings. Of this, 0.05 hectares would be landscaped and reintegrated into Kesterton Park following construction completion. Proposal impacts on vegetation and terrestrial habitat are considered to be largely temporary and would not substantially fragment or isolate existing habitat. The risks of the spread/introduction of weeds and diseases and the potential for erosion and sediment mobilisation associated with vegetation clearing and construction activities would be managed during construction in accordance with the relevant TfNSW guidelines. In doing so, these risks would be removed or minimised substantially.

Three piles (508 millimetres in diameter) would be drilled into low-medium relief rocky reef, close to the existing seawall. Four pontoon piles (914 millimetres in diameter), two pivot piles and two protection piles (457 millimetres in diameter) would be driven into subtidal soft sediment habitat in deeper water. The area of low-medium relief rocky reef and soft sediment habitat under the footprint of the piles would be permanently impacted. Areas used for anchoring of the barge during construction would be temporarily impacted. This would include the direct removal of macroalgae and sessile marine fauna from subtidal rocky reefs and epifauna and infauna from soft sediment habitats. The new wharf structures would shade less than 0.01 hectares of subtidal rocky reef habitat and about 0.05 hectares of soft sediment habitat and a small section of vertical intertidal rocky reef habitat. These are not considered substantial impacts to marine biodiversity as the type of rocky reef and soft sediment habitats in the study area constitutes the majority of subtidal habitat in the harbour. These community assemblages are ubiquitous and are quick to recolonise temporarily disturbed areas.

The removal of part of the intertidal steps and associated piles would result in the removal of marine vegetation, habitat and sessile/less mobile fauna currently colonising the piles and concrete steps. However, the majority of these species are common in subtidal rocky reefs and would quickly colonise the piles of the new wharf and pontoon.

Under Section 199 of the FM Act, consultation with NSW Department of Primary industries (NSW DPI) (Fisheries) is required for any dredging and reclamation works. 'Dredging' under the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI, 2013) is classified as disturbance of the seabed/streambed. In this case, this refers to removal of piles and the installation of new piles. Section 205 of the FM Act states that a permit to 'harm' marine vegetation would be required. However, through consultation with NSW DPI (Fisheries) (dated 18 August 2020), this is not required for the piling and pile removal works associated with this project.

Sediment mobilisation from piling and other water-based construction activities and vessel wash and scour were also identified as potential proposal impacts. However, the study area is likely to be frequently exposed to elevated levels of sediment, associated with rainfall, sea conditions and vessel traffic in Neutral Bay. Thus, with the appropriate controls, a slight, temporary increase in these impacts is not expected to substantially impact marine biodiversity. Vessel traffic to the new wharf during operation would likely be similar to current conditions.

There is currently no evidence of marine pests or disease in the study area. Impacts from the potential introduction/spread of marine pests would be managed during construction.

The proposal is unlikely to significantly impact threatened species. Disturbances to potential habitat would largely be temporary and constitute a very small proportion of available habitat. The proposal would not fragment or isolate threatened species populations or substantially impact any species' lifecycle. Mitigation measures are proposed to survey for Black Rockcod and White's Seahorse at the start of construction so that individuals in the area are not harmed.

Species impact statements (SIS) were not considered to be required.

Considering the above and assuming controls (ie mitigation measures) are implemented, the proposal is unlikely to significantly impact biodiversity.

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Terms

Commonwealth Minister	Australian Minister for the Environment
Compound area	Temporary facility for construction, including for example an office and amenities compound, construction compound and materials storage compound. Compound area is shown on Figure 1.3.
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
The estuary	Parramatta River estuary
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014).
The harbour	Sydney Harbour
Indirect impact	Where an event or circumstance is a direct consequence of the action (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Microbats	Microchiropteran bats
Mitigation	Action to reduce the severity of an impact.
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Population	All the individuals that interbreed within a given area.
The proposal	The new wharf interchange proposed to be constructed at North Sydney and as described in Section 3.1 of the Review of Environmental Factors.
Proposal footprint	The area directly impacted by the proposed works including installation and removal of structures. Proposal footprint is shown in Figure 1.3.
Study area	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly.
Study locality	Refers to an area within 5 kilometres of the project area (for the purpose of the background search).

Abbreviations

AASS	Actual acid sulfate soils/sediments
AOBV	Area of Outstanding Biodiversity Value
AoS	Assessment of Significance
ASS	Acid sulfate soils/sediments
BAR	Biodiversity Assessment Report
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
BoM	Bureau of Meteorology
Coastal Management SEPP	NSW <i>State Environmental Planning Policy (Coastal Management) 2018</i>
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DDD	Dichlorodiphenyldichloroethane
DoE	Commonwealth Department of the Environment (former)
DPIE	NSW Department of Planning, Industry and Environment
DPI	NSW Department of Primary Industries
DSAPT	Disability Standards for Accessible Public Transport 2002
EAC	East Australian Current
EES	Environment, Energy and Science group (in DPIE)
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i> (Federal).
EPI	Environmental planning instruments
FM Act	NSW <i>Fisheries Management Act 1994</i>
GDE	Groundwater dependent ecosystems
HAT	Highest astronomical tide
IBRA	Interim Biogeographically Regionalisation of Australia
KFH	Key Fish Habitat
LGA	Local government area
MNES	Matters of National Environmental Significance
NP&W Act	NSW <i>National Parks and Wildlife Act 1974</i>
OCP	Organochlorine pesticides
OEH	NSW Office of Environment and Heritage (former)
PAH	Polycyclic aromatic hydrocarbons
PASS	Potential acid sulfate soils/sediments
PCT	Plant community type
PMST	Protected Matters Search Tool
POMS	Pacific Oyster Mortality Syndrome
RBG	Royal Botanic Garden Sydney
REF	Review of Environmental Factors

ROV	Remotely operated vehicle
SIS	Species impact statement
TAP	NSW Government's Transport Access Program
TAPs	Threat Abatement Plans
TEC	Threatened ecological community
TfNSW	Transport of New South Wales

1 Introduction

1.1 Proposal background

Transport for NSW (TfNSW) proposes to construct a new wharf interchange at North Sydney (the proposal) as part of the NSW Government's Transport Access Program (TAP, <https://www.transport.nsw.gov.au/projects/tap>). This is detailed in Section 2.1 of the Review of Environmental Factors (REF).

The proposal is located within the local government area (LGA) of North Sydney Council. North Sydney wharf interchange is located in Neutral Bay, at the tip of a small peninsula to the east of the Warringah Freeway on Sydney's Lower North Shore. North Sydney wharf interchange sits at the water's edge of Kesterton Park. The wharf is accessed through the Kesterton Park from High Street, which runs along the ridge of the peninsula terminating at the wharf interchange.

1.2 The proposal

The proposal is to upgrade the North Sydney Wharf as part of the TAP.

The water-based features of the proposal would include:

- Installation of a new 3.3-metre long by 3.3-metre wide concrete jetty, supported by three new piles
- Installation of a new 12-metre by 27-metre pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with pivot piles (to assist vessel berthing) provided at either end of the pontoon
- Installation of a new 18-metre uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- Installation of two protection piles on the northern side of the gangway
- Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- Safety and security features on the pontoon including an emergency help point, lighting, CCTV, ladders to the water and a life buoy and tactile indicators where required.

The land-based features of the proposal would include:

- One accessible parking space at the cul-de-sac end of High Street
- One kiss-and-ride space or zone at the cul-de-sac end of High Street
- Three new bicycle parking hoops
- Footpath regrading to produce a Disability Standards for Accessible Public Transport 2002 (DSAPT) compliant grade
- Installation of a new accessible ramp between the existing footpath and the new gangway
- One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- Installation of new wayfinding signage, information boards, and opal card readers
- Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter
- Removal and replacement of up to four trees to construct the accessible pathway.

Figure 1.1 shows the key features of the proposal including the water-based and land-based components.

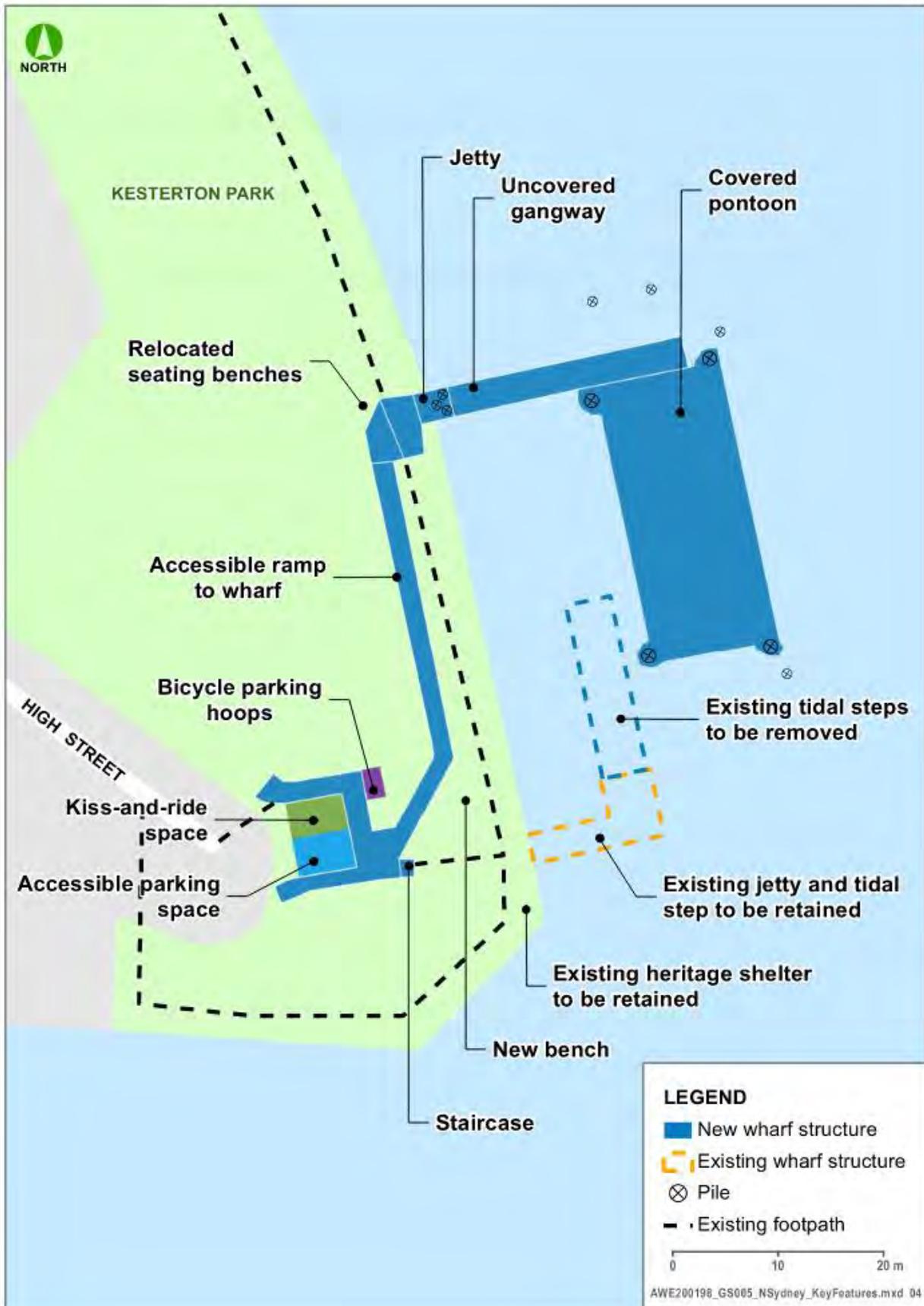


Figure 1.1 Key features of the proposal

1.3 Legislative context

A REF is prepared to satisfy TfNSW's duties under section 5.5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for the North Sydney Ferry Wharf Upgrade, and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

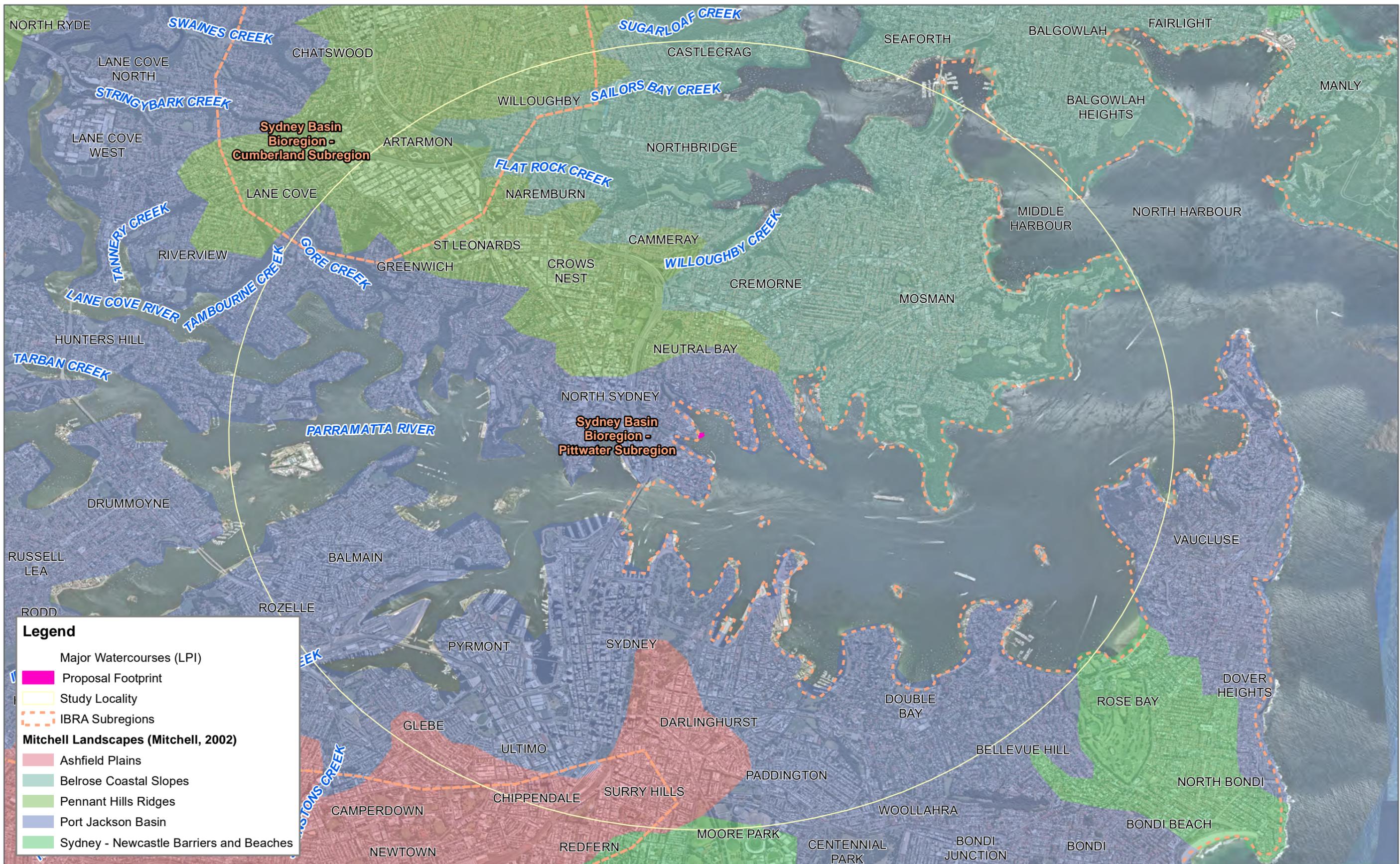
Section 7.2A of the BC Act and Part 7A of the *Fisheries Management Act 1994* (FM Act) require that the significance of the impact on threatened species, and endangered ecological communities is assessed using a five-part test (BC Act) or the 7-part test (FM Act). Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Environment Agency Head's requirements or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM).

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The approval applies to TfNSW road works being assessed under Division 5.1 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species. Since this proposal is not considered under "road works", the strategic assessment approval does not apply. Significance of impacts on nationally listed threatened species, ecological communities and migratory species are to be assessed in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment (DoE), 2013). If significant impacts are considered likely, then the action is deemed a controlled action and a referral is required.

1.4 Definitions

The following definitions are used in this report:

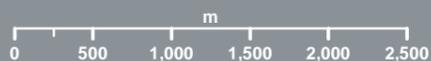
- Biodiversity Assessment Report (BAR) - this report
- The proposal - refers to that described in Section 1.2
- Proposal footprint - refers to the area directly impacted by the proposed works including the installation and removal of structures (Figure 1.3)
- Compound area - refers to the temporary facility required for construction (Figure 1.3)
- Study area - refers to the proposal and surrounding areas covered by this BAR (about 1.17 hectares and excludes private properties) (Figure 1.3)
- Study locality - refers to an area within five kilometres of the Study area (for the purpose of the background research) (Figure 1.2).



Legend

- Major Watercourses (LPI)
- Proposal Footprint
- Study Locality
- IBRA Subregions
- Mitchell Landscapes (Mitchell, 2002)**
- Ashfield Plains
- Belrose Coastal Slopes
- Pennant Hills Ridges
- Port Jackson Basin
- Sydney - Newcastle Barriers and Beaches

1:45,000 Scale at A3



Study Locality
FIGURE 1.2
NORTH SYDNEY

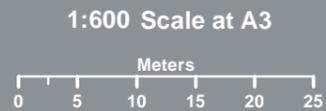


Map Produced by National Water & Environment
 Date: 2020-05-19 | Project: AWE200198
 Coordinate System: GCS_GDA_1994
 Map: AWE200198_GS005_NSydney_StudyLocality.mxd 01
 Aerial Imagery supplied by Nearmaps (2020)



Legend

- Compound Area
- Proposal Footprint
- Biodiversity Study Area



Project, Compound and Study Areas
 FIGURE 1.3
 NORTH SYDNEY



Map Produced by National Water & Environment
 Date: 2020-05-27 | Project: AWE200198
 Coordinate System: GCS GDA 1994
 Map: AWE200198_GS006_NSydney_ProjectStudyArea.mxd 02
 Aerial Imagery supplied by Nearmaps (2020)

2 Methods

2.1 Personnel

The Biodiversity Assessment Report was prepared by the following personnel:

- Dilys Zhang (BSc (Hons)) – Senior Ecologist
- Dr Brendan Alderson (BSc (Hons), PhD) – Senior Ecologist
- Jake Ludlow (BSc) - Ecologist
- Kevin Roberts (BSc (Hons), MSc, EMPA) – Senior Principal Environmental Scientist.

2.2 Background research

A review of information and data was completed in April 2020 to gain an understanding of biodiversity values within the study area and the broader study locality. Reviewed sources included:

- Soil Landscapes of the Sydney 1:100, 000 Sheet (Chapman & Murphy, 1989)
- Native Vegetation of the Sydney Metropolitan Area – Version 3.1 VIS_ID 4489 (NSW Office of Environment and Heritage (OEH), 2016)
- NSW Department of Planning, Industry and Environment – Environment, Energy and Science (DPIE-EES) vegetation information system (VIS) Classification:
<https://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx?ReturnUrl=%2fNSWVCA20PRapp%2fdefault.aspx>
- NSW BioNet: <http://www.bionet.nsw.gov.au>
- NSW DPIE-EES Threatened Biodiversity Data Collection:
<http://www.environment.nsw.gov.au/threatenedspecies>
- NSW Department of Primary Industries (DPI) Fish Communities and Threatened Species Distribution of NSW (NSW DPI, 2016)
- NSW DPI Threatened species lists: <https://www.dpi.nsw.gov.au/fishing/species-protection/what-current>
- NSW DPI Listed Protected Fish Species:
<https://www.dpi.nsw.gov.au/fishing/closures/identifying>
- NSW DPI *Mapping the Habitats of NSW Estuaries* (Creese, et al., 2009)
- Commonwealth DAWE (formerly DoE) Protected Matters Search Tool (PMST):
<http://www.environment.gov.au/epbc/protected-matters-search-tool>
- Atlas of Living Australia: <http://www.ala.org.au/>
- National System for the Prevention and Management of Marine Pest Incursions:
<http://www.marinepests.gov.au/Pages/default.aspx>.

Aerial imagery from Nearmap (available from: <http://apps.nearmap.com/>) was used to identify potential vegetation and habitat to assist in the creation of presumptive maps.

Any sensitive ecological sites and areas protected by State and local environmental planning instruments (EPIs) due to their ecological significance (eg marine protected areas, aquatic reserves, National Parks/Reserves, wetlands and other conservation areas and reserves) were also identified using:

- Regional Conservation Plans prepared by the former NSW OEH:
<http://www.environment.nsw.gov.au/biodiversity/reqconsplans.htm>
- Areas of Outstanding Biodiversity Value register:
<https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/areas-of-outstanding-biodiversity-value/area-of-outstanding-biodiversity-value-register>

- NSW DPI Critical Habitat register: <http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/register>
- NSW DPI key fish habitat maps: <http://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps>
- Commonwealth DAWE Register of Critical Habitat: <http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl>.
- the Bureau of Meteorology's (BoM's) Groundwater Dependent Ecosystems (GDEs) Atlas: <http://www.bom.gov.au/water/groundwater/gde/>
- Commonwealth DAWE Directory of Important Wetlands Australia: <https://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands>
- NSW *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP) maps: http://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement
- Locations of NSW marine parks and reserves available from NSW DPI Marine Parks website: <https://www.dpi.nsw.gov.au/fishing/marine-protected-areas/marine-parks>.

The North Sydney wharf interchange: Concept design report (Aurecon Australasia Pty Ltd, 2019) included a concept design assessment which contains a summary of the biodiversity values to be considered in the REF (Section 10.3) as well as other environmental considerations. The relevant sections of the document were reviewed and incorporated into this report.

This report considers all coastal marine/estuarine and terrestrial species and ecological communities. Freshwater and oceanic species and ecological communities have been excluded from this report as no habitat occurs in or near the study area. Diadromous species have been included.

As the study area is located within Coastal Waters (three nautical mile limit seaward of the state/territorial sea baseline), matters in Commonwealth waters have not been considered in this report.

2.3 Habitat assessment

A habitat assessment was completed to assess the likelihood of occurrence of each threatened or migratory species, threatened population or ecological community identified to occur within the study locality. The likelihood of occurrence criteria is detailed in Table 2.1.

Species are considered likely to occur (ie moderate to high likelihood of occurrence) where:

- The geographic distribution of the species is known or predicted to include the Interim Biogeographic Regionalisation for Australia (IBRA) subregion in which the proposal is located, and
- The proposal footprint contains habitat features or components associated with the species, or
- Past or current surveys undertaken in the proposal footprint indicate the species is present.

A test of significance (under the BC Act or FM Act) and/or an assessment of significance (under the EPBC Act) for species considered likely to occur has been completed from the habitat assessment.

Table 2.1: Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (ie. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently (within 20 years) in the locality (5 kilometre) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (5 kilometre). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the study area.

2.4 Field survey

Field surveys of the foreshore and marine areas within the study area were completed on 20 April 2020. The aims of the surveys were to ground-truth the results of the background research and habitat assessment with particular consideration given to species of conservation concern likely to occur. Presumptive vegetation and habitat maps based on the results of the background research were developed to facilitate the field survey. Presumptive vegetation and habitat maps were created for the study area using ArcGIS 10.7 from an orthorectified aerial Nearmap imagery captured on 28 February 2020. Potential vegetation and habitat were outlined on a preliminary map layer via on-screen digitising at a scale of no more than 1:800 to demarcate boundaries as polygons determined from imagery and from existing vegetation and habitat mapping (Creese, et al., 2009; NSW OEH, 2016).

Presumptive map data were loaded onto a tablet connected to a GPS receiver (for added accuracy) and field survey data collected on the tablet.

2.4.1 Weather and sea conditions

The weather and sea conditions during the field survey are summarised in Table 2.2 (BoM, 2020a; WillyWeather, 2020). It was mostly overcast with light winds during the field survey. There was no recorded rainfall in Sydney within seven days prior to the field survey. The marine field survey was completed on an ebbing tide.

Table 2.2: Weather and sea conditions during the field survey (source: BoM, 2020; WillyWeather, 2020)

Date	Temperature range (°C)	Rainfall (mm)	Wind direction	Max wind speed (km/h)	High tide	Low tide
20/04/2020	15.5-21.3	0	WNW	39	6:37am (1.58 m) 7:09pm (1.55 m)	12:30am (0.64 m) 12:57pm (0.5 m)

2.4.2 Vegetation surveys

The terrestrial portion of the study area includes the southern section of Kesterton Park to the limit of the playground and the seawall, the existing wharf structure and about 56 metres of the south-eastern section of High Street. A vegetation survey was carried out in all vegetated areas within the terrestrial portion of the study area. A walkover of the study area was completed to describe and map the type, extent and condition of vegetation. The floristics of the site was also recorded albeit a plot-based full floristic survey was not considered in a substantially landscaped study area.

Where native vegetation was recorded, the formation, class and plant community type (PCT) was described (where possible) in accordance with the NSW Department of Planning, Industry and Environment – Environment, Energy and Science group (DPIE – EES) VIS classification. Any commensurate threatened ecological communities (TECs) were also identified for those PCTs. Priority weeds listed for the Greater Sydney region were recorded and the extent of infestation described, if detected.

2.4.3 Targeted flora surveys

As the background research and habitat assessment did not identify any threatened flora with a moderate or high likelihood of occurrence, no targeted flora surveys were completed.

2.4.4 Targeted fauna surveys

No targeted fauna surveys were completed and threatened fauna presence was determined/assumed from an assessment of habitat features.

2.4.5 Aquatic surveys

Fieldwork was carried out from a five metre Cardno survey vessel using a combination of an underwater remotely operated vehicle (ROV) and/or bathyscope. The intertidal areas were limited by the seawall thus, all areas below highest astronomical tide (HAT) were surveyed from the vessel.

Weather conditions at the time of sampling were good with reasonable underwater visibility (about one to two metres). The vessel navigated to areas of potential seagrass or subtidal rocky reef and soft sediment areas to verify, describe and classify the presumptive map into categories below.

Seagrasses were classified as follows:

- Species:
 - *Zostera* (*Zostera muelleri* subsp. *capricorni* (previously *Zostera capricorni*))
 - *Posidonia* (*Posidonia australis*)
 - *Halophila* (*Halophila* spp.)
- Density:
 - High (greater than 50 per cent cover)
 - Medium (between 15 and 50 per cent cover, inclusive)
 - Low (less than 15 per cent cover).

Reef habitat was classified into two major groups:

- Reef with monospecific macroalgal communities
- Reef with mixed macroalgal communities.

The complexity of reef habitat was also classified, given complexity was considered to be a reasonable indicator of the potential for an area of reef to be habitat for threatened species such as Black Rockcod (*Epinephelus daemeli*). Habitat complexity was categorised as:

- High (greater than one-metre-high relief complex habitat associated with natural, unmodified shoreline, includes consolidated or boulder reef with/without macroalgae) (example illustrated in Plate E1 in Appendix C)
- Medium (0.5 to one metre medium relief complex habitat associated with natural or modified shoreline, includes consolidated or boulder reef with/without macroalgae) (example illustrated in Plate E2 in Appendix C)
- Low = (less than 0.5 metres low relief reef with/without macroalgae) (example illustrated in Plate E3 in Appendix C).

2.5 Data analyses and mapping

Following completion of the field survey, polygons drawn on the presumptive maps were refined and reclassified as per the field data collected. Where areas comprised more than one species (eg *Zostera* with an understorey of *Halophila*), these were differentiated by the most abundant species albeit other species present are described.

2.6 Limitations

Survey efficacy is influenced by a range of factors. Fieldwork for this study was completed during autumn. For this type of survey, limitations are generally due to a single, short duration survey that does not account for seasonal or other temporal variation. The detection of certain species may be affected by:

- Seasonal migration (particularly migratory and transient species)
- Seasonal availability of food for fauna
- Weather conditions during the survey period (some species may go through cycles of activity related to specific weather conditions)
- Species lifecycle (cycles of activity related to breeding).

These potential limitations have been addressed by applying the precautionary principle in cases where the survey methodology may have given a false negative result (eg a species that could reasonably be expected to occur, based on previous records and available habitat, was not observed). All species (including threatened species) have been assessed on the basis of the presence of their habitat and the likely significance of that habitat to a viable local population.

3 Existing environment

The proposal is located along the foreshores of Sydney Harbour (the harbour), in the Parramatta River estuary (the estuary). Sydney Harbour is a drowned valley, tidal estuary (Roy, et al., 2001; Sydney Institute of Marine Science, 2014) about 30 kilometres long and occupies about 5000 hectares (Birch, 2006). The Parramatta River is deeply incised in Hawkesbury sandstone between 15 and 29 million years ago. Subsequent sea level rise, about 17,000 years ago, resulted in the flooding of the river valley, deposition of sediments and the formation of the tidal estuary.

Sydney Harbour is of high aesthetic, ecological and socio-economic importance to the most populated city in Australia. The foreshores of the estuary are highly urbanised and the harbour itself conducts a large volume of commercial and private boating activities. The estuary is the final destination for runoff from about 50,000 hectares of catchment, of which at least 86 per cent is urbanised and/or industrialised through a long history since the 1800s (Birch, 2006). Reclamation and vegetation clearing have resulted in major alterations to ecological function, hydrology and physio-chemical attributes of the estuary (Birch, 2006). Despite these alterations the estuary has shown signs of recovery in more recent times (Johnston, et al., 2015).

The study area lies within the waters and foreshores of Sydney Harbour in the Pittwater Subregion of the Sydney Basin Bioregion (NSW National Parks and Wildlife Service, 2003) and the Port Jackson Basin (Mitchell, 2002). The Pittwater Subregion and the Port Jackson Basin are characterised by small beach, dune and lagoon barrier systems and steep coastal cliffs and rock platforms. The coastal cliffed margins are on Triassic quartz while Quaternary muddy sands and pocket beaches are at the head of most tributary streams. The bathymetry of the study area is a composite of the natural geology and anthropogenic alterations. A wide depth range is a result of dredged shipping channels and deep holes (28 to 45 metres) separated by shoals of three to five metre depths (Sydney Institute of Marine Science, 2018). A number of shallow bays fringe the main channel on the northern and southern sides. The study area is located on the foreshores of Neutral Bay, which is one of these bays on the northern side of the main harbour channel (Figure 1.1).

3.1 Coastal processes and hydrology

The poleward flowing East Australian Current (EAC) brings nutrient depleted waters to the entrance of the harbour. Hence, the water at the entrance of the harbour is continually being renewed (Sydney Institute of Marine Science, 2014). Water circulation in drowned valley estuaries is dominated by tidal currents as opposed to wind stress (Roy, et al., 2001; Sydney Institute of Marine Science, 2014). Tides are predominately semi-diurnal, reverse every six hours but can vary considerably spatially and temporally. Tidal velocities can reach up to 0.25 metres per second with the most distal branches of the estuary usually experiencing slower velocities, sometimes up to an order of magnitude less (Sydney Institute of Marine Science, 2014). In some areas of the estuary, tide-induced residual circulation forms a number of gyres at regions of complex geometry which may force the retention of biota or pollutants (Das, et al., 2000).

Three common wind patterns are known on Sydney Harbour. The strongest of the three originate from the south (southerlies) and occur about 17 per cent of the time. The most frequent of the three (about 22 per cent of the time) are north-easterlies while the least common of the three patterns are westerlies which usually occur during the winter months (Sydney Institute of Marine Science, 2014).

The Hawkesbury Sandstone is a recognised aquifer and elsewhere across Sydney provides a source of potable groundwater, though it often has elevated levels of iron (up to 300 ppm) and manganese (up to 15 ppm).

3.2 Soil and sediment properties

The estuary lies on the southern edge of the Hornsby Plateau, an upland area of massive, vertically jointed Hawkesbury sandstone capped with Wianamatta Group shales (McLoughlin, 2000). Northern tributaries have deep, steep-side valleys with little capacity for shoreline sediment accumulation without substantial filling of the valley. The Wianamatta Group shales weather rapidly to fine-grained and easily transported clays. Sediment deposits over bedrock range between 25 and 50 metres vertical depth downstream of the Harbour Bridge and 20 to 35 metres in channels and bays upstream of the Harbour Bridge. The acceleration of sedimentation within the estuary was triggered by the advent of vegetation clearing and soil disturbance from 1788 across the catchment (McLoughlin, 2000). This was followed by the process of removing accumulating silt, reshaping foreshores and seabeds for shipping and amenities virtually continuously for 140 years from 1842. Reclamation aimed to eliminate and replace mudflats and marshes with flat waterside land for industry and recreation. The foreshore reclamation areas also became the final destination for dredged material which otherwise would be taken out to sea.

The present-day estuary comprises five environmental/sedimentological units including:

- Harbour entrance (marine flood-tide delta sands)
- Lower estuary (sands)
- Central estuary (muddy sands)
- Upper estuary (muds)
- Off-channel bays (muds) (Birch, 2006).

Generally, sediments west of Sow and Pigs Reef (west of units 1 and 2 and where the study area is located) are dominated by terrestrial mud (OzCoasts, 2015).

3.2.1 Acid sulfate soils/sediments

Acid sulfate soils/sediments (ASS) is the common name given to naturally occurring soils and sediments that contain iron sulfate (pyrite). Acid sulfate soils/sediments are defined as either:

- Actual ASS (AASS) - highly acidic soils or sediments with pH <4, or
- Potential ASS (PASS) - soils or sediments containing sulphuric material that have not been oxidised but have potential for oxidation to generate high acidity.

The marine/estuarine portion of the study area is considered high-risk ASS (mostly sediments that have been eroded from the land and deposited in the deeply cut bays) while there is no ASS data for the adjoining land (Coffey Geotechnics Pty Ltd, 2016; Aurecon Australasia Pty Ltd, 2019). However, the reducible sulfur concentrations of marine sediments in the proposal footprint were found to be lower than the minimum action criteria as defined in the Acid Sulfate Soils Assessment Guidelines (Ahern, et al., 1998).

3.2.2 Soil and sediment quality

Soils and sediments of the estuary contain heavy metals, asbestos, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and organochlorine pesticides (OCPs) (Birch, 2006). Although sediments have been remediated and industrial activities on the foreshores of the estuary have greatly reduced, leachates have been documented to enter the estuary from rainwater filtration and tidal action at various locations in the estuary. Thus, high sediment contaminant concentrations in bays in the estuary, such as Homebush Bay, are likely to be the result of historical reclamation. Stormwater discharge locations also coincide with these bays rendering the identification of sources of sediment contamination complex. Stormwater has been identified as the main contemporary source of heavy metal contamination in the estuary (Montoya, 2015).

Some concentrations of heavy metals in sediments in Sydney Harbour have been documented to be the highest in Australia and internationally (Montoya, 2015). About 20 per cent of all copper,

lead and zinc were found in four bays in the estuary in the early 2000s: (1) Iron Cove; (2) Rozelle and Blackwattle Bays; (3) Homebush Bay; and (4) Hen and Chicken Bay. These bays are at least two kilometres upstream of the study area. Other areas where heavy metals have been detected in sediments are located in small, highly concentrated areas of upper parts of tributaries and bays but are usually low in concentrations.

Burning of waste, chemical manufacturing and certain industrial processes have introduced dioxins into estuary sediments (Montoya, 2015). Once in an aquatic environment, dioxins can absorb quickly to particulate organic matter before settling in bottom sediments. This group of chemicals is mostly resistant to biological and chemical breakdown in the aquatic or terrestrial environment hence, its persistence in estuary sediments. Following detection of this substance in the late 1980s, total fin-fish bans were implemented in Homebush Bay in 1989 extending to a commercial fishing ban upstream of the Gladesville Bridge in 1990.

Microplastics are tiny plastic fragments, fibres and granules (generally smaller than 5 millimetres in diameter) (Montoya, 2015). These can either be manufactured as microplastics or a result of breakdown of larger plastic debris. Microplastics in the water column can settle in the sediment following accumulation of microbial films, algae and invertebrates and/or the adherence to other particles. A large number of compounds in plastics can interfere with biologically important processes resulting in endocrine disruption and carcinogenesis. Furthermore, marine plastic debris has been found to accumulate waterborne pollutants up to 100 times greater than sediments (Browne, et al., 2013). The highest concentrations of microplastics in sediments have been recorded in Sydney Harbour and Middle Harbour with some areas containing an order of magnitude greater than other estuaries internationally (Montoya, 2015). Berrys Bay and Balls Head Bay are two bays with the highest concentration (21 to 40 fragments per 100 millilitres of sediment) of microplastics in Sydney Harbour albeit both are about two kilometres west of the study area. Although many manufacturers are phasing out or have phased out the use of microplastics and microbeads into their products, the persistence of larger plastic debris and existing microplastics in the marine environment still presents a problem to biota.

Previous investigations by Coffey Geotechnics Pty Ltd (2016) indicate that sediment in the study area is impacted with the following analytes:

- Copper
- Lead
- Mercury
- Zinc
- Dichlorodiphenyldichloroethane (DDD)
- Endrin
- PAHs.

Soil impacts at the study area are currently unknown. Due to the age of the study area and the previous industrial activity, there is a potential that soils are impacted from leaching of materials, interaction with tidal flow of Sydney Harbour and fill of unknown quality (Cardno, 2020).

3.3 Water quality

The quality of the waters within the estuary reflect the balance between the upstream catchment loads of varying quality (depending on the land use and practices within the catchment), the downstream ocean inputs and the tidal flushing that mixes the different water masses (Cardno, 2018). Tidal flushing intensity diminishes from the ocean entrance at the heads to the upstream extremities near the river and creek inputs. During the frequent rainfall events, creek and river flows carry suspended particles and dissolved substances into the estuary causing the estuarine waters to become turbid. Following runoff events, these particles are dispersed into the estuary by

tidal and wind-induced currents and settle to the bed where they can be resuspended by subsequent events. The dispersion process effectively dilutes the introduced constituents and over time their concentrations diminish toward the pre-event concentration. In general, the turbidity varies along the estuary from clearer, low turbidity oceanic waters near the mouth to higher values near the river/creek inputs. In addition, the temporal variability is characterised by higher turbidity following significant inflow events and relatively low values during dry periods.

Suspended sediments attenuate light penetration through the water column and thereby limit pelagic and benthic primary production (the process of converting light energy into biomass). As the suspended matter settles to the seabed it may also smother benthic organisms and affect the type of organisms and plants that can exist in this environment. Fluctuations in light and rates of sedimentation occur naturally in Sydney Harbour due to regular resuspension of particulate matter by the tidal currents, wind-driven mixing and runoff events. Any activities which involve seabed disturbance have the potential to increase sedimentation and turbidity beyond the natural range.

3.4 Terrestrial vegetation

The study area is located on reclaimed land thus, the vegetation within the study area is not remnant or classified as PCTs. The foreshores of Neutral Bay are highly urbanised with little to no remnant vegetation. Commercial and residential buildings closely fringe the foreshores and are mostly surrounded by hardstands or landscaped gardens, street plantings and open parks. Landscaped gardens, plantings and open park areas characterised the vegetated areas within the study area (Figure 3.1). These gardens and open park areas occupy about 0.18 hectares of the study area (Figure 3.4). The remaining areas above HAT were hardstands (e.g. roads, footpaths etc.).



Figure 3.1 Landscaped gardens, planting and open park areas within the study area

Mature trees in the study area included Smooth-barked Apple (*Angophora costata*), Spotted Gum (*Corymbia maculata*), Bangalay (*Eucalyptus botryoides*) and Swamp Oak (*Casuarina glauca*) and were planted at the northern and southern ends of Kesterton Park (Figure 3.2). A row of three young Wildfire (*Corymbia ficifolia*) and one Smooth-barked Apple fringed the footpath along the water's edge (Figure 3.3). Another Wildfire, of around the same age, was recorded with the cluster of Swamp Oaks at the southern end of Kesterton Park. Wildfire is a re-flowering Eucalypt native to the south coast of Western Australia and frequently planted in other states.

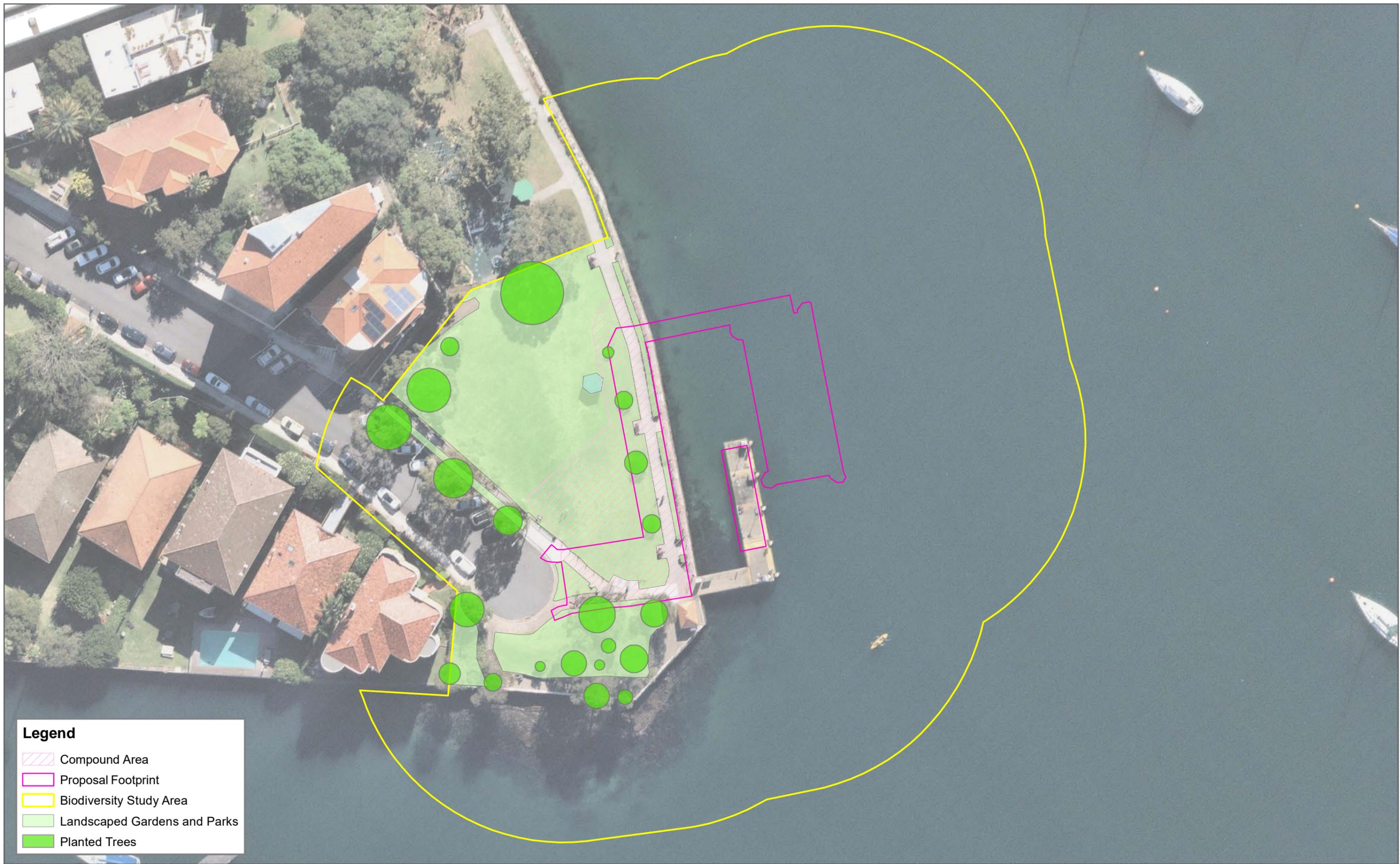


Figure 3.2 Cluster of Swamp Oaks at the southern end of Kesterton Park



Figure 3.2 Wildfire and Smooth-barked Apple fringing the water's edge

The understorey of the landscaped gardens comprised of native and exotic, ornamental species including Pigface (*Carpobrotus glaucescens*), *Carex* sp., *Phyllica* sp., Climbing Guinea Flower (*Hibbertia scandens*) and *Impatiens* sp.. Mown Buffalo (*Stenotaphrum secundatum*) grass covered the open park areas. The list of flora species recorded during the field survey is listed in Appendix A.



Legend

- Compound Area
- Proposal Footprint
- Biodiversity Study Area
- Landscaped Gardens and Parks
- Planted Trees

1:700 Scale at A3



Terrestrial Vegetation
FIGURE 3.4
NORTH SYDNEY



Map Produced by National Water & Environment
 Date: 2020-05-27 | Project: AWE200198
 Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Map: AWE200198_GS007_NSydney_TerrestriaVeg.mxd 02
 Aerial Imagery supplied by Nearmaps (2020)

3.5 Terrestrial fauna habitat

The landscaped gardens and open park areas form potential habitat for a number of species. Trees and shrubs provide potential foraging habitat for birds and arboreal and aerial mammals, particularly when in bloom/fruited. Birds and arboreal mammals may also roost in mature trees and shrubs. The trees and shrubs can also provide breeding habitat for birds common to urban areas albeit no tree hollows were observed during the field survey. Disturbance tolerant birds may forage in the open park areas and the majority of the study area forms foraging habitat for microchiropteran bats (microbats). Microbats may also roost in the crevices of existing wharf and terminal structures during the day.

Local and vagrant seabirds may use the foreshores and existing wharf and terminal structures as perching areas while foraging in the area or attracted to recreational fishing activities from the existing wharf. The volume of pedestrian and vessel traffic in the study area is likely to be a deterrent for species that are not adapted to disturbance. Thus, species likely to use the study area are those common to urban areas including Silver Gull (*Chroicocephalus novaehollandiae*), cormorants (*Phalacrocorax* spp.) and Australian Pelican (*Pelecanus conspicillatus*).

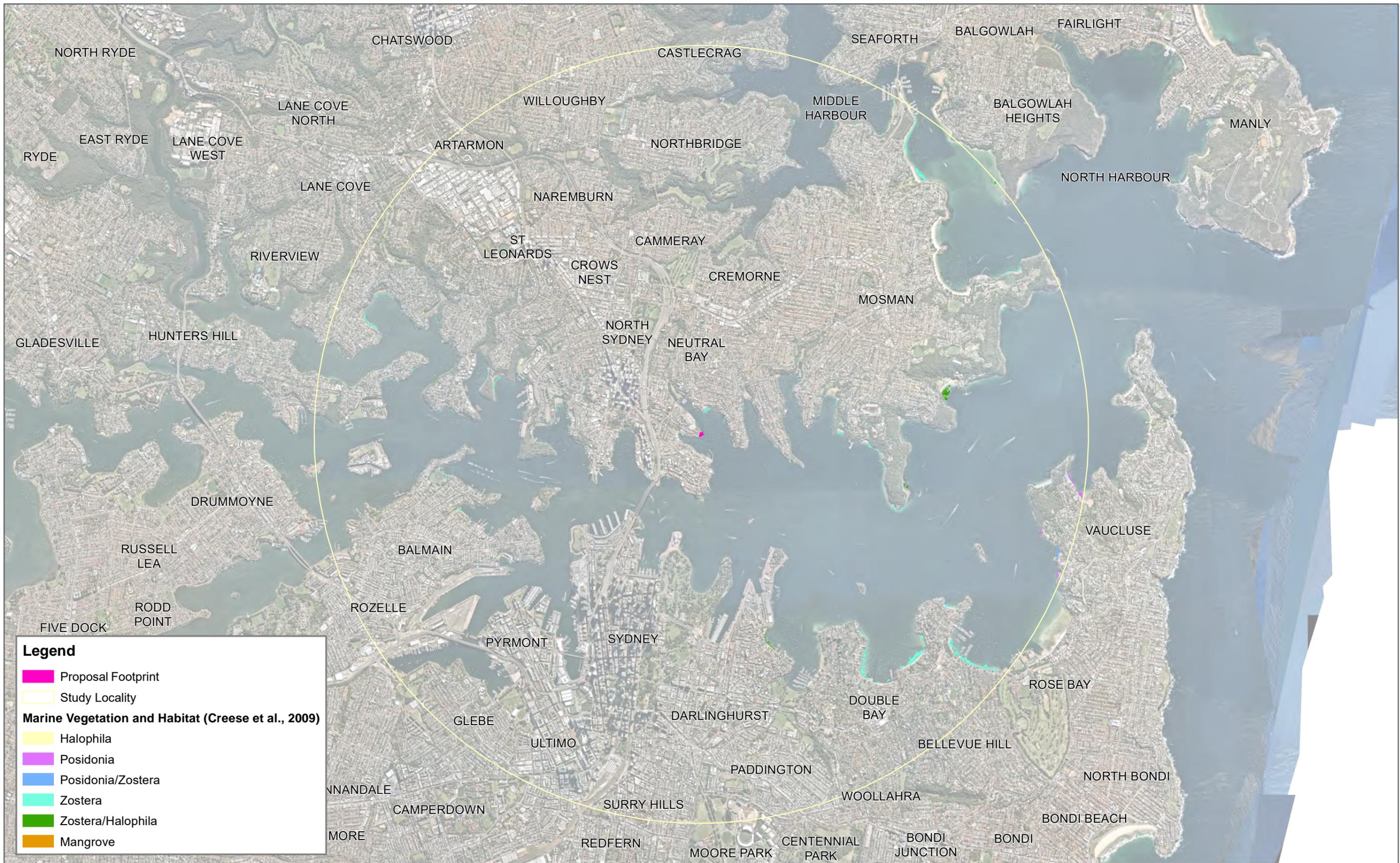
3.6 Priority weeds

No priority weeds listed under the *Biosecurity Act 2015* were recorded in the study area.

3.7 Marine vegetation and habitat

The marine study area comprised of the artificial seawall and the subtidal areas surrounding Kesterton Park. The harbour is mapped as Key Fish Habitat (KFH) and is estuarine thus, considered a Class 1 waterway – Major KFH (NSW DPI, 2013; NSW DPI, 2020a).

No seagrass, mangroves or saltmarsh were recorded within the study area. The closest occurrence of these types of marine vegetation are mapped patches of seagrass and mangroves along the eastern foreshores of Neutral Bay about 0.25-0.35 kilometres north-east of the study area (Creese, et al., 2009; NSW OEH, 2016) (Figure 3.5).



1:55,000 Scale at A3



Marine Vegetation and Habitat in Study Locality

FIGURE 3.5
NORTH SYDNEY



Cardno

Map Produced by National Water & Environment
 Date: 2020-05-19 | Project: AWE200198
 Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Map: AWE200198_GS009_NSydney_MarineVegHabLocality.mxd 01
 Aerial imagery supplied by Nearmaps (2020)

The intertidal area was limited to the vertical sandstone seawall, the upper portions of the existing piles and the tidal steps, although the abutting rocky reef may be exposed during low spring tides (Table 3.1). Sydney Rock Oyster (*Saccostrea glomerata*) clusters with Mulberry Whelk (*Morula marginalba*) and Black Nerites (*Nerita atramentosa*) colonised the seawall and extended about 40 centimetres up the wall from the base of the reef below (Figure 3.6). A series of habitat plates were installed in the intertidal area along the south-eastern-facing seawall which formed part of an ecological experiment in 2010 (Ivesa, et al., 2010) (Figure 3.14). These plates did not appear to be maintained or monitored as they were in various stages of disintegration (Figure 3.7). A number of stormwater outlets were also observed along the seawall in the study area.



Figure 3.6 The intertidal area along the sandstone seawall

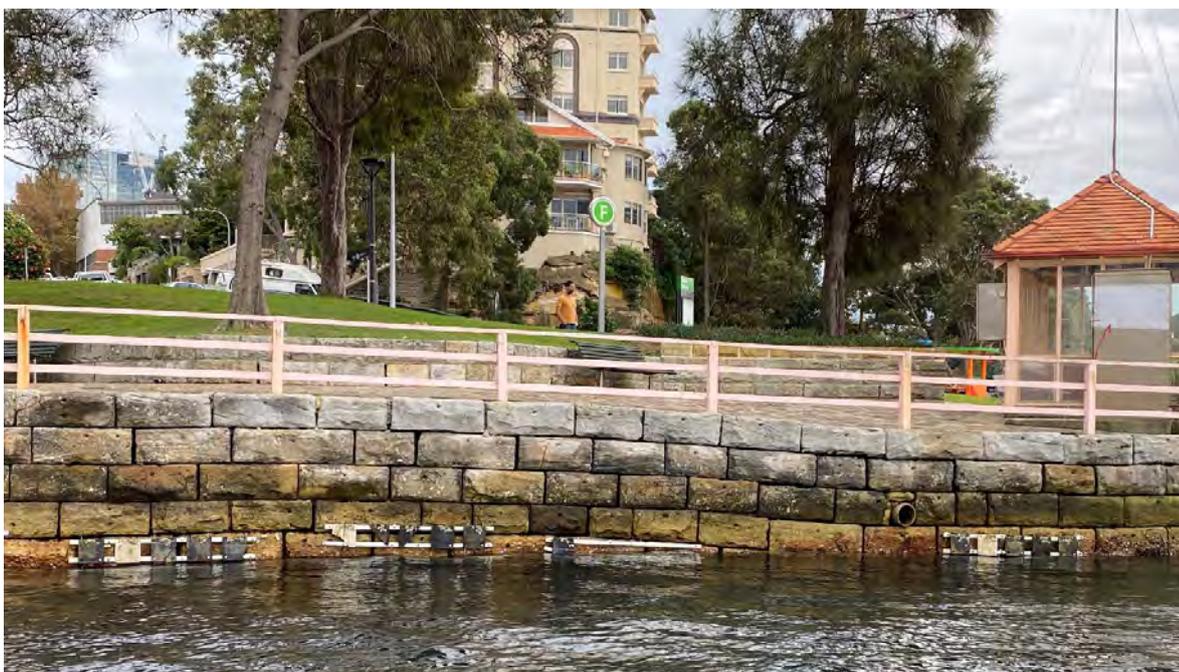


Figure 3.7 Habitat plates installed along the south-eastern seawall

Subtidal rocky reefs abutted the sandstone seawall and extended further into Neutral Bay at the southern end of the study area than along the foreshores of the existing wharf (Figure 3.14). These areas comprised of low and medium relief reefs and occupied about 0.10 hectares within the study area (Table 3.1). The construction of subtidal rocky reefs appeared to be of natural bedrock, dislodged natural rock and seawall fragments and trapped soft sediment (localised or transported from other areas of the harbour). The south- and south-eastern-facing seawalls abut low to medium relief reef. Low relief reefs in this area transitioned to soft sediment habitats towards the channel of Neutral Bay. Subtidal rocky reef communities also colonised the vertical areas on existing piles and the bottom one and a half tidal steps.

Soft sediment habitats were sparsely littered with rock rubble, shell grit and solid waste materials. These consolidated materials formed a colonisation platform for some habitat-forming species including *Ecklonia radiata*, *Sargassum* spp., *Padina* sp. and sponges (Phylum Porifera; Figure 3.8). This was characteristic of all 0.76 hectares of soft sediment habitat throughout the study area (Table 3.1). Soft sediment habitats generally lack the habitat complexity of consolidated rocky reef habitat. Only visible epifauna were surveyed in this study, however, soft sediment infauna occur in these habitats and have been linked to pelagic processes and play a central role in ecosystem functions by forming basal elements of many food chains (Gadd & Griffiths, 1977; Eyre & Ferguson, 2005; Connell & Gillanders, 2007).

Table 3.1: Areas of marine vegetation and habitat within the study area

Marine vegetation and habitat	Area in study area (ha)
Intertidal rocky reef	0.01 (vertical area only)
Low and medium relief subtidal rocky reef	0.10 (horizontal area only)
Soft sediment	0.76



Figure 3.8 Typical soft sediment habitat within the study area

Medium relief reefs were recorded along the east-facing seawall, where the existing wharf structures are attached. The reefs along the east-facing seawall were limited to about two metres from the seawall (Figure 3.9).



Figure 3.9 Medium relief subtidal reef along the east-facing seawall

Low and medium subtidal rocky reefs were colonised by similar habitat-forming species. Depending on the aspect of the reef, the abundance of species differed. Vertical and high gradient faces of subtidal reefs were mostly colonised by lower profile habitat-forming species including turfing algae (ie *Halimnion* sp., *Corallina* sp.), *Padina* sp., *Colpomenia* sp., *Zonaria* sp., *Sargassum* sp., *Ulva* sp. and mussels (Class Bivalvia) (Figure 3.9). *Ecklonia radiata* forest mosaics were generally found on horizontal or low gradient faces of subtidal reefs (Figure 3.10) although the assemblage of some higher energy, low relief reefs were similar to that along the vertical/high gradient faces (Figure 3.11).

The subtidal rocky reefs of the study area are considered Type 2 – Moderately sensitive KFH as they meet the descriptions of estuarine rocky reefs and are colonised by *Ecklonia* sp. and *Sargassum* sp. (NSW DPI, 2013). Soft sediment areas are considered Type 3 – Minimally sensitive KFH as these areas are generally characterised by unstable or unvegetated sand or mud substrate.



Figure 3.10 Typical *E. radiata* forest mosaics in the study area



Figure 3.11 Low relief subtidal reef along the south-facing seawall of the study area

The piles of the existing wharf also formed a platform for colonisation for intertidal and subtidal habitat-forming species. The species assemblages on the piles resembled those observed in the intertidal seawall and the vertical/high gradient faces of subtidal rocky reefs of the study area (Figure 3.12 and 3.13).



Figure 3.12 Typical intertidal assemblage on wharf piles



Figure 3.13 Typical subtidal assemblage on wharf piles

The marine vegetation and habitat within the study area is characteristic of many nearshore areas in the harbour. Subtidal rocky reefs in the harbour and their habitat-forming species provide habitat for a number of local and vagrant fish and other mobile species. This includes threatened and migratory species known to occur in the harbour (see sections 3.11 and 3.17.1). No threatened or migratory species were observed during the field survey, however, fish species frequently observed in the harbour were recorded. These included Yellowfin Bream (*Acanthopagrus australis*), Sawtails (*Prionurus* spp.), Rough Leatherjacket (*Scobinichthys granulatus*) and Eastern Hulafish (*Trachinops taeniatus*).

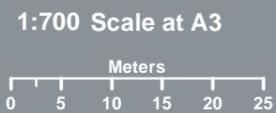


Legend

- Compound Area
- Project Area
- Biodiversity Study Area
- Low - medium relief rocky reef
- Soft sediment

KFH Type

- Type 2 - Moderately sensitive KFH
- Type 3 - Minimally sensitive KFH



Marine Vegetation and Habitat in Study Area
 FIGURE 3.14
 NORTH SYDNEY



Map Produced by National Water & Environment
 Date: 2020-06-18 | Project: AWE200198
 Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Map: AWE200198_GS008_NSydney_MarineVegHab.mxd 03
 Aerial Imagery supplied by Nearmaps (2020)

3.8 Marine pests and diseases

Labyrinthula spp. is a Stramenopile protist that causes seagrass wasting disease (Trevathan-Tackett, et al., 2018). This genus of protists is ubiquitous to coastal and marine ecosystems and are important to nutrient cycling as they excrete enzymes to breakdown plant or algal detritus (Raghukumar, 2002). However, *Labyrinthula* spp. has been known to infect living seagrass leaf cells leading to the necrosis of chloroplast, leaving distinct black lesions. The potential infection of seagrass wasting disease is linked to the virulence of species in this genus and the immunity of the host (Martin, et al., 2016). *Labyrinthula* spp. are also less tolerant to low salinities. Hence, seagrass meadows occurring in areas such as estuaries have the opportunity to clear their load of *Labyrinthula* spp. during freshwater influx events (McKone & Tanner, 2009). Seagrass wasting disease has not been described in NSW but has been known to occur in Queensland, Victoria and Western Australia but little is understood of its ecology. Thus, Trevathan-Tackett et al. (2018) highlights the importance of monitoring the disease in Australian seagrass populations.

Like a great number of other estuaries and waterways, Sydney Harbour is at risk of infestation from the marine pest *Caulerpa taxifolia* (NSW DPI 2013). *Caulerpa taxifolia* is a fast-growing marine alga native to tropical Australia and the South Pacific (NSW DPI, 2016b). This species is known to alter physical and chemical habitat affecting biodiversity. Populations have been recorded in Port Jackson at Neutral Bay, Mosman, Clifton Gardens, Rushcutters Bay, Double Bay, Rose Bay and many locations in North Harbour and Middle Harbour. Although this species has been mapped to occur in Neutral Bay, it was not detected in the study area. *Caulerpa taxifolia* is known to spread via fishing and boating activities as well as natural hydrology and has potential to occur in the study area.

A large number of viral, bacterial and parasitic diseases affecting finfish, molluscs, crustacean and amphibians are known within NSW waterways. The most renowned include Red Spot Disease, QX oyster disease and Pacific Oyster Mortality Syndrome (POMS) (NSW DPI, 2018a). Red Spot Disease (or Epizootic ulcerative syndrome) is a fungal disease endemic in a number of waterways in NSW. This disease can affect many species of finfish and shows as red lesions or deep ulcers which can then be susceptible to secondary bacterial infections. Although the freshwater and estuarine waterways of the Sydney region have not recorded Red Spot Disease outbreaks, it is known to occur in all NSW waterways. QX oyster disease and POMS are high risk to oyster aquacultures, of which none currently reside within the study area.

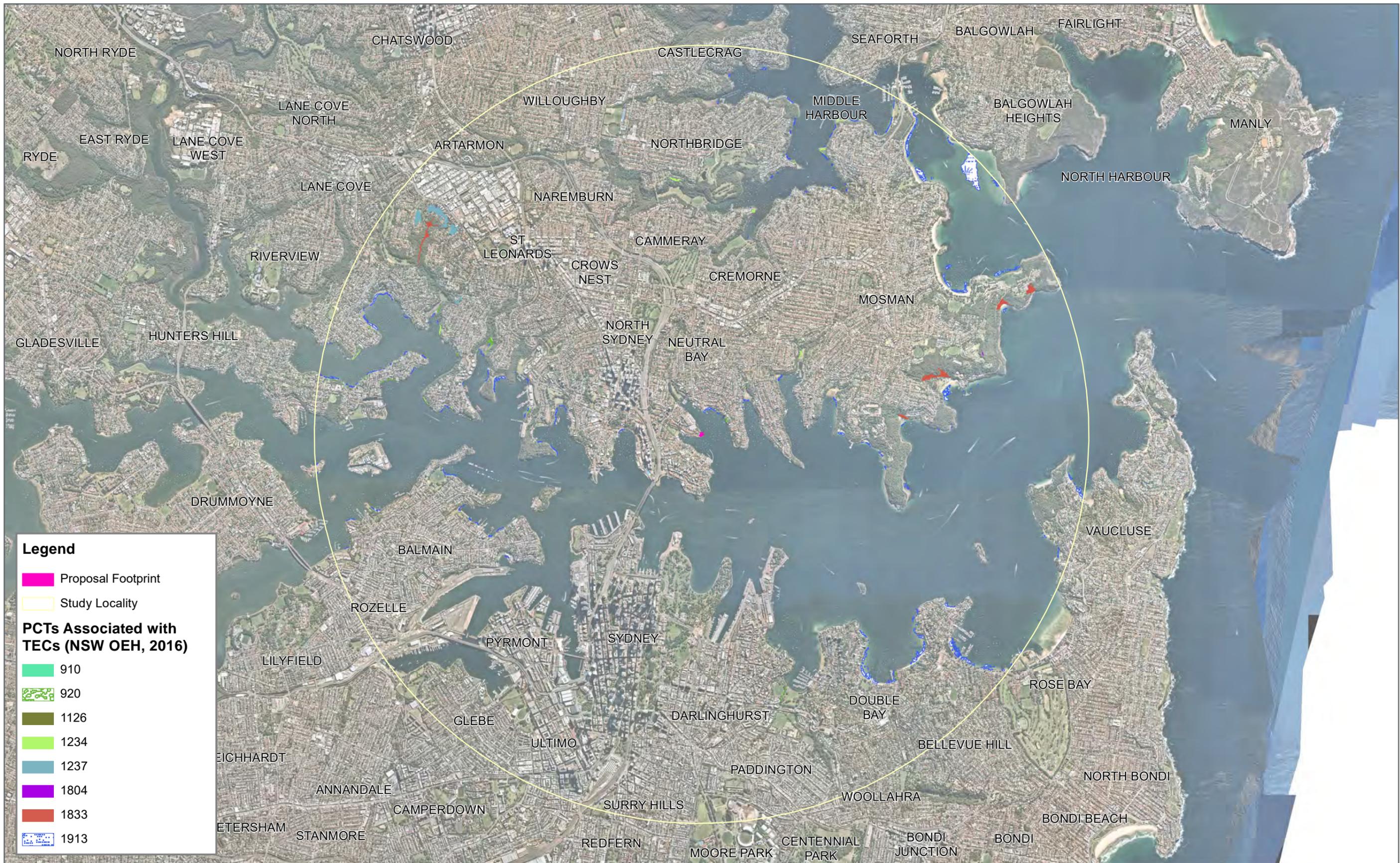
3.9 Threatened ecological communities

No remnant vegetation or PCTs occur within the study area thus, no TECs occur within the study area. However, six TECs have been mapped within the locality (Figure 3.15) (NSW OEH, 2016). These, and their proximity to the study area, are detailed in Table 3.2.

Table 3.2: Threatened ecological communities (TECs) mapped within the study locality and their proximity to the study area

Plant community type (PCT)	Associated TECs BC Act	EPBC Act	Area in locality (ha)	Bearing and proximity of the closest occurrence to the study area
Coastal headland littoral thicket (PCT 910) Coastal escarpment littoral rainforest (PCT 1833)	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (endangered)	Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (critically endangered)	12.84	~2.9 km east
Estuarine mangrove forest (PCT 920)* Estuarine saltmarsh (PCT 1126)*	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (endangered)	Subtropical and Temperate Coastal Saltmarsh (vulnerable)	1.27	~0.4 km north-east in Neutral Bay
Estuarine Swamp Oak forest (PCT 1234)	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (endangered)	Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland Ecological Community (endangered)	2.69	~0.9 km north-east
Blue Gum high forest (PCT 1237)	Blue Gum High Forest in the Sydney Basin Bioregion (critically endangered)	Blue Gum High Forest of the Sydney Basin Bioregion (critically endangered)	7.01	~4.2 km north-west
Coastal upland wet heath swamp (PCT 1804)	Coastal Upland Swamp in the Sydney Basin Bioregion (endangered)	Coastal Upland Swamps in the Sydney Basin Bioregion (endangered)	0.06	~4.6 km east
Seagrass meadows (PCT 1913)*	<i>Posidonia australis</i> seagrass endangered populations in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie (endangered population under the FM Act)	<i>Posidonia australis</i> Seagrass Meadows of the Manning-Hawkesbury Ecoregion (endangered)	29.49	~0.3 km north in Neutral Bay

*Marine vegetation discussed in Section 3.7.



Legend

- Proposal Footprint
- Study Locality

PCTs Associated with TECs (NSW OEH, 2016)

- 910
- 920
- 1126
- 1234
- 1237
- 1804
- 1833
- 1913

1:55,000 Scale at A3



TECs in Study Locality
 FIGURE 3.15
 NORTH SYDNEY



Map Produced by National Water & Environment
 Date: 2020-05-26 | Project: AWE200198
 Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Map: AWE200198_GS010_NSydney_TEClocality.mxd 01
 Aerial Imagery supplied by Nearmaps (2020)

3.10 Groundwater dependent ecosystems

There are no aquatic or terrestrial GDEs in or next to the study area (BoM, 2020b)

3.11 Threatened species and populations

A review of the DPIE-EES BioNet database, NSW DPI Threatened species list and the DAWE PMST revealed 104 threatened species with potential to occur in the study locality. Those with records in the study locality are illustrated in Figure 3.16. Of these 104 threatened species, four were amphibians, 24 were flora, one was an invertebrate, 44 were birds, three were fish/Syngnathids, 19 were mammals, six were reptiles and three were elasmobranchs. Migratory species listed under the EPBC Act are discussed in Section 3.17.1.

No threatened species were observed during the field survey, however, potential habitat for some threatened species were recorded in the study area. An assessment of the likelihood of occurrence of all threatened species based on the study area habitat were carried out to determine the potential for these species to occur within the study area. Table 2.1 provides the likelihood of occurrence criteria used in the assessment and Table 3.3 provides a summary of the assessment. The rationale behind the assessment is attached in Appendix B.

The likelihood of occurrence assessment found the majority of 104 threatened species were either unlikely to occur or have a low likelihood of occurrence in the study area. However, due to the presence of suitable habitat in the study area and/or known populations in the harbour, eight species were considered to have a moderate to high likelihood of occurrence. These include:

- White's Seahorse (*Hippocampus whitei*) listed as endangered under the FM Act
- Black Rockcod (*Epinephelus daemeli*) listed as endangered under the FM Act and vulnerable under the EPBC Act
- Five microbats:
 - Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) listed as vulnerable under the BC Act
 - Little Bent-winged Bat (*Miniopterus australis*) listed as vulnerable under the BC Act
 - Large Bent-winged Bat (*Miniopterus orianae oceanensis*) listed as vulnerable under the BC Act
 - Southern Myotis (*Myotis macropus*) listed as vulnerable under the BC Act
 - Greater Broad-nosed Bat (*Scoteanax rueppellii*) listed as vulnerable under the BC Act
- Grey-headed Flying Fox (*Pteropus poliocephalus*) listed as vulnerable under the BC Act and the EPBC Act.

White's Seahorse is listed as endangered under the FM Act and was considered to have a high likelihood of occurrence in the study area due to the presence of suitable habitat and known populations in the harbour. Resident populations of White's Seahorse have been reported in the harbour, some of which attract recreational divers. Recent conservation efforts by Sea Life Sydney Aquarium in collaboration with NSW DPI and University of Technology, Sydney released individuals from a breeding program to Clifton Gardens at Mosman. White's Seahorse are endemic to the estuaries and coastal embayments between Hervey Bay in Queensland and Sussex Inlet in NSW (NSW DPI, 2020b). They are usually found in sponge gardens, seagrass meadows and soft corals as well as artificial habitats such as swimming nets and jetty/wharf pylons like those within the study area. The proposal has potential to present a risk to this species due to the presence of preferred habitat and known populations in the harbour and their limited mobility. Thus, an Assessment of Significance (AoS) under the FM Act has been prepared to inform the impact assessment (Appendix D). White's Seahorse has also been nominated for listing as an endangered species under the EPBC Act. Invitation to comment on the proposed listing came to a close 15 April 2020 and DAWE are currently reviewing the proposition.

The Black Rockcod is listed as vulnerable under the FM Act and the EPBC Act and was considered to have a high likelihood of occurrence in the study area due to the presence of suitable habitat and anecdotal evidence of sightings of individuals in the harbour. This species is known to occur in warm temperate to subtropical waters of the south-western Pacific Ocean (Aquaculture, Conservation and Marine Parks Unit, Port Stephens Fisheries Institute, 2012). It has been recorded along the east coast of Australia from southern Queensland to Kangaroo Island off South Australia and around Lord Howe and Norfolk Islands. The Black Rockcod distribution is centred around the NSW coast and adults are usually found in caves, gutters and beneath bommies on rocky reefs up to 50 metres in depth. Juveniles of this species prefer coastal rock pools while larger juveniles prefer rocky reefs in estuaries. This species has high site fidelity and is territorial. Significant habitat for the species have been identified, of which the intertidal rocky shore within the coastal depth zone between 0 and 20 meters of the Hawkesbury Shelf is a considered as significant. Although the study area does not extend to the coastal areas of the Hawkesbury Shelf, the subtidal rocky reefs of the harbour have potential to provide habitat for larger juvenile Black Rockcod. Suitable habitat within the study area for the Black Rockcod included subtidal, medium relief rocky reef areas (up to 0.10 ha) which abut the stretch of seawall in the study area. Due to the presence of suitable habitat within the study area and the species' characteristic high site fidelity, AoSs under the FM Act and the EPBC Act have been completed for the species (Appendix D).

Five microbats, listed under the BC Act, were considered to have a moderate likelihood of occurrence in the study area. There is no breeding habitat in the study area however, some of the existing wharf structures have potential to provide roosting habitat and the entire study area form potential foraging habitat for these five species, albeit suboptimal for some species. All of these five species prefer to roost in caves or tree hollows however, are known to roost in man-made structures including in/under bridges/wharves and buildings. The Eastern Coastal Free-tailed Bat is often recorded in coastal areas and has a number of records dated from 2006 on Goat Island, west of the Sydney Harbour Bridge and about 2.4 kilometres south-west of the study area. The Southern Myotis is known to forage over water and can be found roosting in small groups near water (NSW DPIE, 2017a). Although, the study area forms potential roosting habitat for the Little Bent-winged Bat, it is not optimal foraging habitat for the species as this species prefers densely vegetation forests (NSW DPIE, 2020). As these species are sedentary during the day when construction is likely to occur and difficult to detect, an AoS under the BC Act has been completed for this group of species (Appendix D).

The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 kilometres of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. There are no roosting camps in or near the study area. The closest roosting camp is in the Royal Botanic Garden Sydney (RBG) about 1.8 kilometres south of the study area, across the harbour channel. Individuals are likely to disperse from this camp and others and forage on flowering and fruiting shrubs and trees in the study area. The impacts of the proposal on foraging resources for the Grey-headed Flying-fox is assess in the AoSs completed under the BC Act and the EPBC Act (Appendix D).

Table 3.3: Likelihood of occurrence summary of threatened species

Scientific Name	Common Name	BC Act/FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
Amphibians					
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	(PMST)	None
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	(PMST)	None

Scientific Name	Common Name	BC Act/FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
<i>Mixophyes balbus</i>	Stuttering Frog	E	V	(PMST)	None
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	-	44 (BioNet)	None
Flora					
<i>Acacia bynoeana</i>	Bynoe's Tiny Wattle	E	V	(PMST)	None
<i>Acacia pubescens</i>	Downy Wattle	V	V	(PMST)	None
<i>Acacia terminalis subsp. terminalis</i>	Sunshine Wattle	E	E	62 (BioNet) (PMST)	None
<i>Allocasuarina glareicola</i>	-	E	E	(PMST)	None
<i>Allocasuarina portuensis</i>	Nielson Park She-oak	E	E	39 (BioNet) (PMST)	None
<i>Asterolasia elegans</i>	-	E	E	(PMST)	None
<i>Caladenia tessellata</i>	Thick-lipped Spider-orchid	E	V	(PMST)	None
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	(PMST)	None
<i>Doryanthes palmeri</i>	Giant Spear Lily	V	-	1 (BioNet)	None
<i>Darwinia biflora</i>	-	V	V	(PMST)	None
<i>Epacris purpurascens var. purpurascens</i>	-	V	-	5 (BioNet)	None
<i>Eucalyptus camfieldii</i>	Camfields Stringybark	V	V	(PMST)	None
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	4 (Bionet)	None
<i>Genoplesium baueri</i>	Yellow Gnat-orchid	E	E	(PMST)	None
<i>Hygrocybe reesiae</i>	-	V		1 (Bionet)	None
<i>Melaleuca biconvexa</i>	Biconvexa Paperbark	V	V	(PMST)	None
<i>Persicaria elatior</i>	Tall Knotweed	V	V	(PMST)	None
<i>Persoonia hirsuta</i>	Hairy Geebung	E	E	(PMST)	None
<i>Pimelea curviflora var. curviflora</i>	-	V	V	(PMST)	None
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	(PMST)	None
<i>Prostanthera junonis</i>	Somersby Mintbush	E	E	(PMST)	None
<i>Rhodamnia rubescens</i>	Scrub Turpentine	CE	-	1 (Bionet)	None
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V	V	25 (Bionet) (PMST)	None
<i>Thesium australe</i>	Austral Toadflax	V	V	(PMST)	None
Invertebrates					

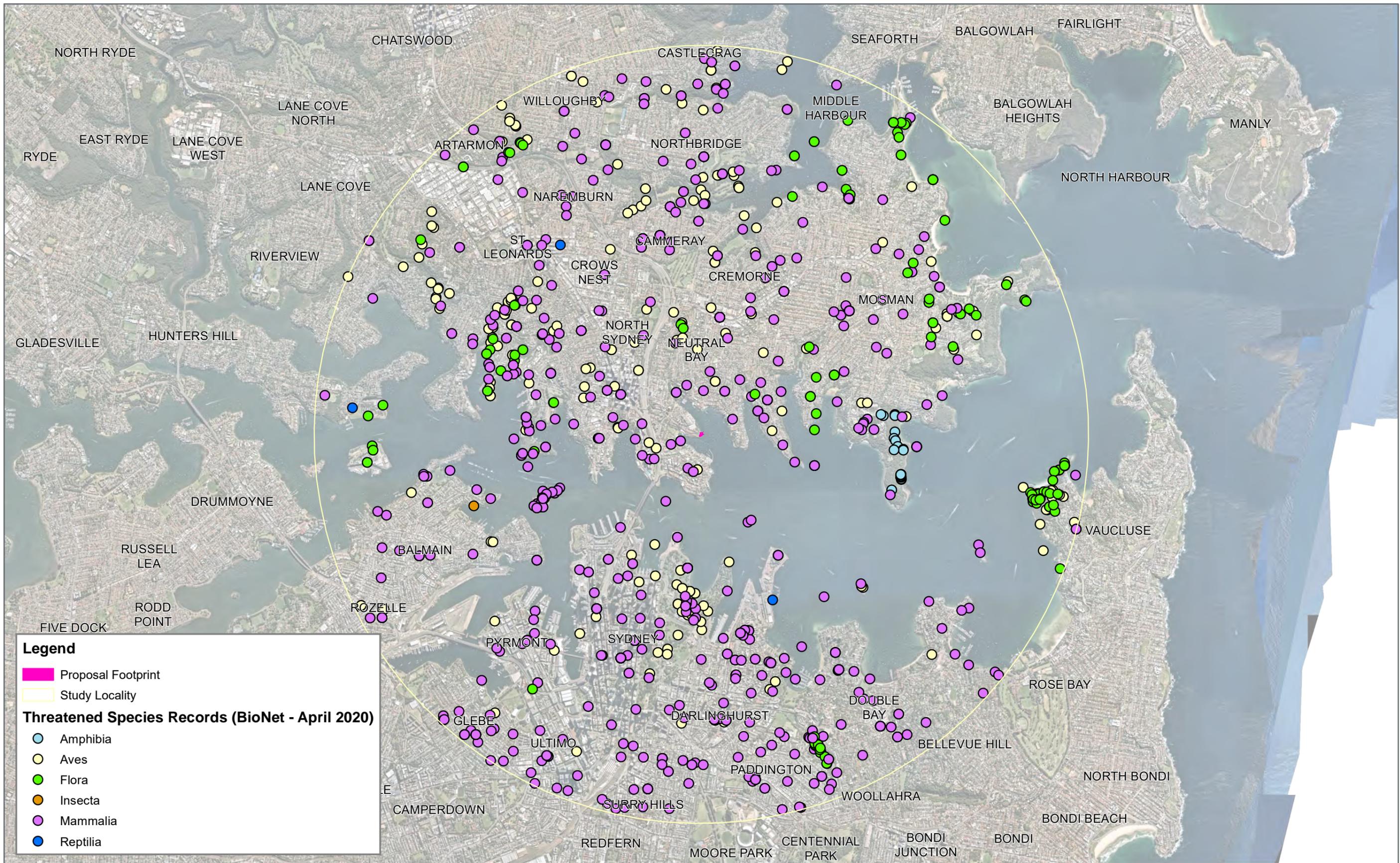
Scientific Name	Common Name	BC Act/FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
<i>Synemon plana</i>	Golden Sun Moth	E	CE	(PMST)	None
Birds					
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	(PMST)	Low
<i>Ardenna carneipes</i>	Flesh-footed Shearwater	V	M, Ma	(PMST)	Low
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	1 (BioNet) (PMST)	Low
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	2 (BioNet)	Low
<i>Calidris canutus</i>	Red Knot	-	E, Mi, Ma	(PMST)	Low
<i>Calidris ferruginea</i>	Curlew Sandpiper	E	CE, Mi, Ma	(PMST)	Low
<i>Calidris tenuirostris</i>	Great Knot	V	CE, Mi, Ma	(PMST)	Low
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	1 (BioNet)	None
<i>Calyptorhynchus lathamii</i>	Glossy Black Cockatoo	V	-	2 (BioNet)	None
<i>Charadrius leschenaultii</i>	Greater Sand Plover	V	V, Mi, Ma	(PMST)	Low
<i>Charadrius mongolus</i>	Lesser Sand Plover	V	E, Mi, Ma	(PMST)	Low
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	1 (BioNet)	None
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	(PMST)	None
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	6 (BioNet)	Low
<i>Grantiella picta</i>	Painted Honeyeater	V	V	(PMST)	None
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V	-	2 (BioNet)	Low
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	Ma	34 (BioNet) (PMST)	Low
<i>Hirundapus caudacutus</i>	White-throated Needle-tail		V, Mi, Ma	(PMST)	Low
<i>Ixobrychus flavicollis</i>	Black Bittern	V	-	2 (BioNet)	Low
<i>Lathamus discolor</i>	Swift Parrot	E	CE, Ma	4 (BioNet) (PMST)	Low
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	1 (BioNet)	Low
<i>Limosa lapponica baueri</i>	Bar-tailed Godwit	-	V	(PMST)	Low
<i>Limosa lapponica menzbieri</i>	Northern Siberian Bar-tailed Godwit	-	CE	(PMST)	Low
<i>Limosa limosa</i>	Black-tailed Godwit	V	Mi, Ma	(PMST)	Low
<i>Macronectes halli</i>	Northern Giant Petrel	V	V, Mi, Ma	(PMST)	Low

Scientific Name	Common Name	BC Act/FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
<i>Ninox connivens</i>	Barking Owl	V	-	3 (BioNet)	None
<i>Ninox strenua</i>	Powerful Owl	V	-	212 (BioNet)	Low
<i>Numenius madagascariensis</i>	Eastern Curlew	-	CE, Mi, Ma	(PMST)	Low
<i>Onychoprion fuscata</i>	Sooty Tern	V	Ma	1 (BioNet)	Low
<i>Pachyptila turtur subantarctica</i>	Fairy Prion (Southern)	-	V	(PMST)	Low
<i>Pandion cristatus</i>	Eastern Osprey	V	Mi, Ma	1 (BioNet) (PMST)	Low
<i>Pterodroma leucoptera leucoptera</i>	Gould's Petrel	V	E, Ma	(PMST)	Low
<i>Pterodroma neglecta neglecta</i>	Kermadec Petrel	V	V, Ma	(PMST)	Low
<i>Ptilinopus superbus</i>	Superb Fruit-dove	V	Ma	4 (BioNet)	None
<i>Rostratula australis</i>	Australian Painted Snipe	E	E, Ma	(PMST)	Low
<i>Sternula albifrons</i>	Little Tern	E	Mi, Ma	1 (BioNet) (PMST)	Low
<i>Sternula nereis nereis</i>	Australian Fairy Tern	-	V	(PMST)	Low
<i>Thalassarche bulleri</i>	Buller's Albatross	-	V, Ma, Mi	(PMST)	Low
<i>Thalassarche bulleri platei</i>	Northern Buller's Albatross	-	V, M, Ma	(PMST)	Low
<i>Thalassarche cauta cauta</i>	Shy Albatross	V	V, Ma, Mi	(PMST)	Low
<i>Thalassarche melanophris</i>	Black-browed Albatross	V	V, Ma, Mi	(PMST)	Low
<i>Thalassarche salvini</i>	Salvin's Albatross	-	V, Ma, Mi	(PMST)	Low
<i>Thinornis rubricollis rubricollis</i>	Hooded Plover	CE	V, Ma	(PMST)	Low
<i>Tyto tenebricosa</i>	Sooty Owl	V	-	1 (BioNet)	None
Fish and Syngnathids					
<i>Hippocampus whitei</i>	White's Seahorse	E (FM Act)	Ma (nominated for endangered listing)	(DPI) (PMST)	High
<i>Epinephelus daemeli</i>	Black Rockcod	E (FM Act)	V	(DPI) (PMST)	High
<i>Prototroctes maraena</i>	Eastern Grayling	E (FM Act)	V	(DPI) (PMST)	Low
Mammals					
<i>Arctocephalus forsteri</i>	New Zealand Fur Seal	V	Ma	4 (BioNet)	Low

Scientific Name	Common Name	BC Act/FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
<i>Arctocephalus pusillus</i>	Australian Fur Seal	V	Ma	3 (BioNet)	Low
<i>Cercartetus nanus</i>	Eastern Pygmy Possum	V	-	1 (BioNet)	None
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	(PMST)	Low
<i>Dasyurus maculatus maculatus</i>	Spotted-tail Quoll	V	E	(PMST)	None
<i>Eubalaena australis</i>	Southern Right Whale	E	E, Mi	2 (BioNet) (PMST)	Low
<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern/south eastern)	E	E	(PMST)	None
<i>Megaptera novaeangliae</i>	Humpback Whale	V	V, Mi	6 (BioNet) (PMST)	Low
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	-	10 (BioNet)	Moderate
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	-	3 (BioNet)	Moderate
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	67 (BioNet)	Moderate
<i>Myotis macropus</i>	Southern Myotis	V	-	37 (BioNet)	Moderate
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	1 (BioNet)	None
<i>Petauroides volans</i>	Greater Glider	-	V	(PMST)	None
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	(PMST)	None
<i>Phascolarctos cinereus</i>	Koala (combined populations Qld, NSW and the ACT)	V	V	3 (BioNet) PMST	Low
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	(PMST)	None
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox	V	V	1,067 (BioNet) (PMST)	High
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	1 (BioNet)	Moderate
Reptiles					
<i>Caretta caretta</i>	Loggerhead Turtle	E	E, Mi, Ma	3 (BioNet) (PMST)	Low
<i>Chelonia mydas</i>	Green Turtle	V	V, Mi, Ma	(PMST)	Low
<i>Dermochelys coriacea</i>	Leatherback Turtle	E	E, Mi, Ma	1 (BioNet) (PMST)	Low

Scientific Name	Common Name	BC Act/FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	-	V, Mi, Ma	(PMST)	Low
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	(PMST)	None
<i>Natator depressus</i>	Flatback Turtle	-	V, Mi, Ma	(PMST)	Low
Elasmobranchs					
<i>Carcharias taurus</i>	Grey Nurse Shark (east coast population)	CE (FM Act)	CE	(DPI) (PMST)	Low
<i>Carcharodon carcharias</i>	Great White Shark	V (FM Act)	V, Mi	(PMST)	Low
<i>Rhincodon typus</i>	Whale Shark	-	V, Mi	(PMST)	Low

*V = vulnerable; E = endangered; CE = critically endangered; Mi = migratory (EPBC Act); Ma = marine (EPBC Act)
Moderate or high likelihood of occurrence species are in **bold**.



Threatened Species Records in Study Locality

FIGURE 3.16
NORTH SYDNEY

1:55,000 Scale at A3



Map Produced by National Water & Environment
 Date: 2020-05-19 | Project: AWE200198
 Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Map: AWE200198_GS011_NSydney_TSLocality.mxd 01
 Aerial Imagery supplied by Nearmaps (2020)

3.12 Protected species

Some species of fish have been formally protected because they are naturally scarce or their numbers have been substantially reduced over recent decades. These species are protected to help prevent them becoming threatened in the future. Twenty-five marine fauna protected under the FM Act have potential to occur within the study locality. Fishing and collecting of these species without a permit will incur a penalty in accordance with Section 19 of the FM Act. An assessment of the likelihood of occurrence of all FM Act protected species, in accordance with the criteria set out in Table 2.1, was carried out to determine the potential for these species to occur within the study area (Appendix B). A summary of the likelihood of occurrence assessment is provided in Table 3.4.

The EPBC Act also provides for the protection of species. These are referred to as ‘Marine’ listed species. Their listing under the EPBC Act highlights the need for their conservation and management as protecting them from being killed, injured, taken, traded, kept or moved. Similar to the FM Act, all Syngnathids (Family: Syngnathidae) are also listed as Marine under the EPBC Act. The Protected Matters Search Tool also identified/predicted the occurrence of six bird species listed as Marine under the EPBC Act with potential to occur in the study locality albeit all five species were considered to have a low likelihood of occurrence due to the absence of preferred habitat.

With the exception of the Ornate Ghost Pipefish (*Solenostomus paradoxus*), which prefers coastal habitats, all Syngnathids were considered to have a high likelihood of occurrence in the study area. The majority of the remaining 20 species have an affinity to marine vegetation and habitat in estuaries (ie seagrass, macroalgae, mangroves and rocky reef). These 20 species have a wide distribution and are not unique to the harbour or the habitat within the study area (endemic).

A further three fish species were also considered to have a high likelihood of occurrence within the study area, including:

- Elegant Wrasse (*Anampses elegans*)
- Estuary cod (*Epinephelus coioides*)
- Eastern blue devil (*Paraplesiops bleekeri*).

The subtidal areas of the study area form potential habitat for all three species however, these subtidal habitat features are not unique to the study area and are widespread throughout the harbour, similar to the distribution of these species.

All marine vegetation, including seagrass, saltmarsh, mangroves and macroalgae, are protected under the FM Act. The study area does not encompass seagrass, saltmarsh or mangroves however, macroalgae was observed colonising intertidal and subtidal rocky reefs (see Section 3.7). Macroalgae are considered as marine vegetation and Division 4 of the FM Act protects marine vegetation from ‘harm’ in the form of gathering, cutting, pulling up, destroying, poisoning, digging up, removing, injuring or preventing light from reaching or otherwise harm marine vegetation or any part of it.

Table 3.4: Likelihood of occurrence summary of protected species

Scientific Name	Common Name	FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
Birds					
<i>Ardea alba</i>	Great Egret	-	Ma	(PMST)	Low
<i>Ardea ibis</i>	Cattle Egret	-	Ma	(PMST)	Low
<i>Charadrius ruficapillus</i>	Red-capped Plover	-	Ma	(PMST)	Low

Scientific Name	Common Name	FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
<i>Himantopus himantopus</i>	Pied Stilt	-	Ma	(PMST)	Low
<i>Merops ornatus</i>	Rainbow Bee-eater	-	Ma	(PMST)	Low
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet	-	Ma	(PMST)	Low
Fish and Syngnathids					
<i>Acentronura tentaculata</i>	Shortpouch Pygmy Pipehorse	P	Ma	(DPI) (PMST)	High
<i>Anampses elegans</i>	Elegant Wrasse	P	-	(DPI)	High
<i>Epinephelus coioides</i>	Estuary Cod	P	-	(DPI)	High
<i>Epinephelus lanceolatus</i>	Queensland Groper	P	Ma	(DPI)	Moderate
<i>Festucalex cinctus</i>	Girdled Pipefish	P	Ma	(DPI) (PMST)	High
<i>Filicampus tigris</i>	Tiger Pipefish	P	Ma	(DPI) (PMST)	High.
<i>Heraldia nocturna</i>	Upside-down Pipefish	P	Ma	(DPI) (PMST)	High
<i>Hippichthys penicillus</i>	Beady Pipefish	P	Ma	(DPI) (PMST)	High
<i>Hippocampus abdominalis</i>	Big-belly Seahorse	P	Ma	(DPI) (PMST)	High
<i>Histiogamphelus briggsii</i>	Crested Pipefish	P	Ma	(DPI) (PMST)	High
<i>Lissocampus runa</i>	Javelin Pipefish	P	Ma	(DPI) (PMST)	High
<i>Maroubra perserrata</i>	Sawtooth Pipefish	P	Ma	(DPI) (PMST)	High
<i>Notiocampus ruber</i>	Red Pipefish	P	Ma	(DPI) (PMST)	High
<i>Paraplesiops bleekeri</i>	Eastern Blue Devil	P	-	(DPI)	High
<i>Pelamis platurus</i>	Yellow-bellied Seasnake	-	Ma	(PMST)	Low
<i>Phyllopteryx taeniolatus</i>	Weedy Seadragon	P	Ma	(DPI) (PMST)	High
<i>Solegnathus spinosissimus</i>	Spiny Pipefish	P	Ma	(DPI) (PMST)	High
<i>Solenostomus cyanopterus</i>	Robust Ghost Pipefish	P	Ma	(DPI) (PMST)	High

Scientific Name	Common Name	FM Act*	EPBC Act*	Number of records (source)	Likelihood of occurrence
<i>Solenostomus paradoxus</i>	Ornate Ghost Pipefish	P	Ma	(DPI) (PMST)	Low
<i>Stigmatopora argus</i>	Spotted Pipefish	P	Ma	(DPI) (PMST)	High
<i>Stigmatopora nigra</i>	Widebody Pipefish	P	Ma	(DPI) (PMST)	High
<i>Syngnathoides biaculeatus</i>	Double-end Pipefish	P	Ma	(DPI) (PMST)	High
<i>Trachyrhamphus bicoarctatus</i>	Bentstick Pipefish	P	Ma	(DPI) (PMST)	High
<i>Urocampus carinirostris</i>	Hairy Pipefish	P	Ma	(DPI) (PMST)	High
<i>Vanacampus margaritifer</i>	Mother-of-Pearl Pipefish	P	Ma	(DPI) (PMST)	High

*P=protected; Ma = marine (EPBC Act)

3.13 Commercial and recreational fishing

Drowned valley estuaries are the most productive of all estuary types in terms of commercial and recreational fishing (Roy, et al., 2001). In 1980-81, commercial fish catch was about 108 tonne, while the corresponding recreational fish catch was estimated as 165 tonne. Since then, prawn trawling has been phased out and because of elevated levels of dioxins in fish and crustaceans across Sydney Harbour, including Parramatta River and other connected tidal waterways, a ban was placed on commercial fishing in 2006. Recreational fishing in the harbour has not been banned, but fishers are urged to follow dietary advice on the levels of consumption of seafood from the Sydney Harbour, Parramatta River and other connected tidal waterways. Fishers can also continue to practise catch and release.

Henry (1984) found recreational fishing effort in Sydney Harbour to be generally greater in summer and autumn and on weekends and estimated over one million fish were caught in 1981. Recreational fishermen took 46 fish species from the estuary during the one-year survey period, with species occurring in a range of benthic, demersal and pelagic habitat. At that time, the top ten species by abundance were Yellowtail (*Trachurus novaezelandiae*), Tailor (*Pomatomus saltatrix*), Yellowfin Bream, Snapper, (*Pagrus auratus*), Silver Trevally (*Caranx georgianus*), Dusky Flathead (*Platycephalus fuscus*), Sweep (*Scorpius lineolatus*), Fanbelly Leatherjacket (*Monacanthus chinensis*), Yellowfin Leatherjacket (*Meuschenia trachylepis*) and Sand whiting (*Sillago ciliata*). More recent anecdotal information indicates Yellowtail Kingfish (*Seriola lalandi*) are now among the top ten common fish caught. Rod fishing and hand lining were the main recreational fishing methods observed during Henry's 1984 survey. Few fishers used traps (crab, lobster, fish), nets (prawn, scissors, dip) or spearfished in the harbour. Fishing from the shoreline was more popular than from boats. Fishing techniques may be attributed to the geography of the estuary. An extensive, convoluted shoreline provides many protected access points to the water's edge. Deep water can be reached by an easy cast of a lightly weighted line, and given Sydney Harbour is a major shipping waterway, the heavy water traffic is a hazard to small boats.

3.14 Critical habitats and Areas of Outstanding Biodiversity Value

No critical habitats listed under the FM Act or EPBC Act or AOBVs listed under the BC Act occurs within the study area or in Neutral Bay. The only critical habitat or AOBV in the Sydney metropolitan area is the Little Penguin (*Eudyptula minor*) population in Sydney's North Harbour which protects Little Penguin nesting areas and access to nesting areas. This AOBV is over seven kilometres north-east of the study area and outside of the study locality.

3.15 Wildlife connectivity corridors

The study area is located on a highly modified, urban foreshore. There is minimal natural foreshore habitat and no natural riparian corridors along and leading into Neutral Bay. Milson and Anderson Parks, next to the study area, Kesterton Park in the study area and many other gardens and parks in the study locality may form a fragmented corridor for highly mobile, disturbance tolerant species.

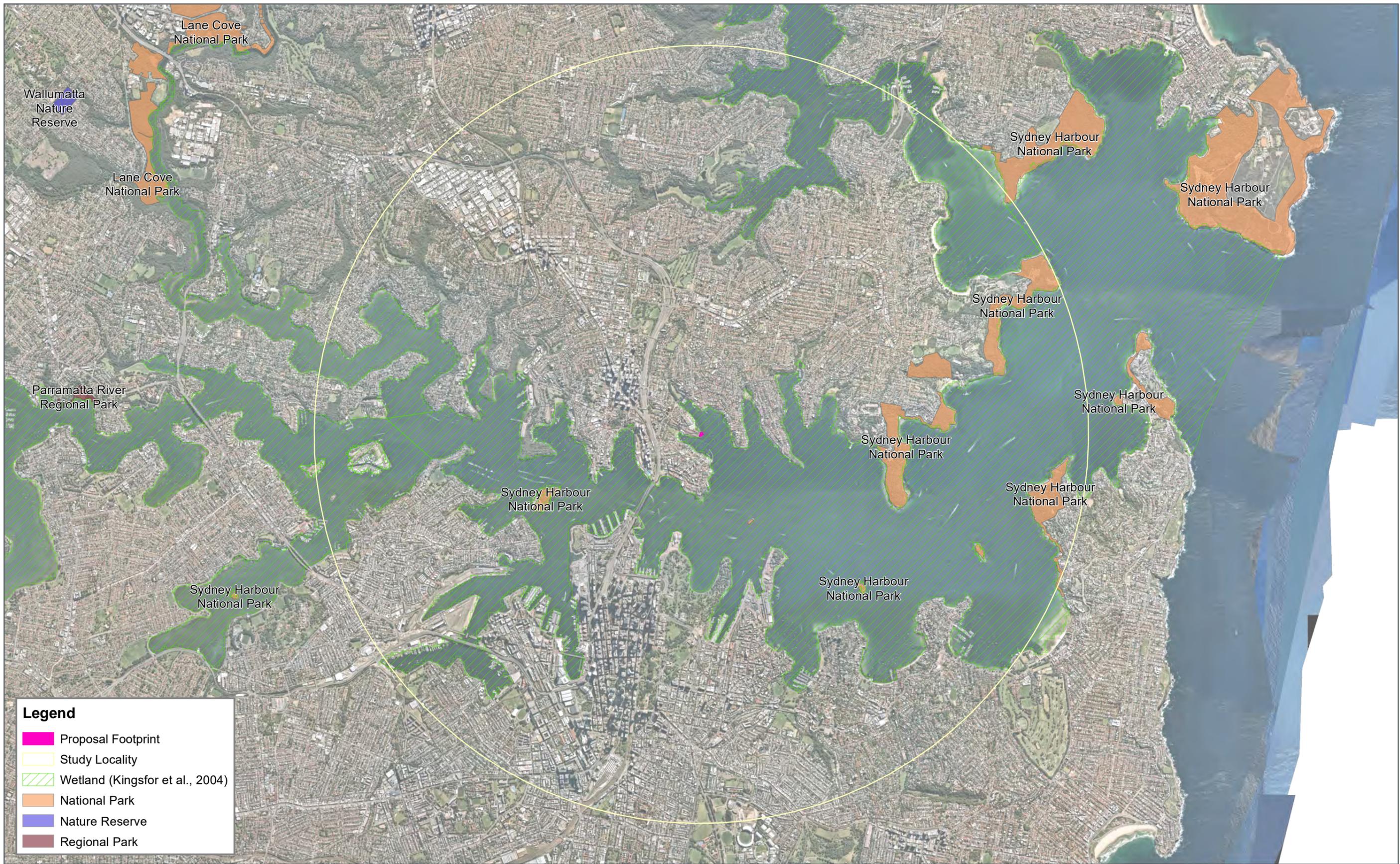
Neutral Bay forms part of the marine corridor that is the Parramatta Estuary and is easily accessible for marine and estuarine species.

3.16 Wetlands and other areas of conservation significance

There are no Coastal Wetland or Littoral Rainforests, as defined in the Coastal Management SEPP, in the study area. The closest Coastal Wetland is over three kilometres north-west of the study area at Gore Cove Reserve. The closest Littoral Rainforest is about two kilometres east of the study area at Little Sirius Cove.

There are no nationally important wetlands or Ramsar Wetlands in the study area or the wider study locality. The Parramatta Estuary is considered an estuarine wetland (Kingsford, et al., 2004) (Figure 3.17).

The study area does not fall in or is next to any National Parks, Conservation Reserves, Nature Reserves or Regional Parks. The closest National Parks estate is the Fort Denison, which forms part of Sydney Harbour National Park, about 1.5 kilometres south of the study area (Figure 3.17). No Aquatic Reserves or Marine Parks occur within the study area or the study locality.



Legend

- Proposal Footprint
- Study Locality
- Wetland (Kingsfor et al., 2004)
- National Park
- Nature Reserve
- Regional Park

1:55,000 Scale at A3



Conservation Areas and Wetlands in Study Locality

FIGURE 3.17
NORTH SYDNEY



Map Produced by National Water & Environment
 Date: 2020-05-19 | Project: AWE200198
 Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Map: AWE200198_GS012_NSydney_ConservationAreas.mxd 01
 Aerial Imagery supplied by Nearmaps (2020)

3.17 Matters of National Environmental Significance

There are nine types of Matters of National Environmental Significance (MNES) listed under the EPBC Act of which actions that have, or are likely to have, a significant impact on would require approval from the Australian Government Minister for the Environment (Commonwealth Minister). Of the nine types of MNES, four are potentially relevant to the proposal:

- Listed threatened species and ecological communities
- Wetlands of international importance
- Migratory species
- Commonwealth marine areas.

Threatened species and ecological communities listed under the EPBC Act are considered as MNES and are discussed in sections 3.9 and 3.11. The location and/or relevance of migratory species, Commonwealth marine areas and wetland of international importance are discussed in the following sections.

3.17.1 Migratory species

Migratory species are those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations. Listed migratory species may include any native species identified in an international agreement approved by the Minister. All listed migratory species are MNES under the EPBC Act. An action will require approval if the action has, will have, or is likely to have, a significant impact on a listed migratory species.

The PMST indicated 26 bird species and seven marine mammals/elasmobranchs have either been previously recorded or are predicted to occur within the study locality. An assessment of the likelihood of occurrence of all FM Act protected species, in accordance with the criteria set out in Table 2.1, was carried out to determine the potential for these species to occur within the study area (Appendix B). A summary of the likelihood of occurrence assessment is provided in Table 3.5.

No listed migratory species were considered to have a moderate or high likelihood of occurrence in the study area and will not be addressed further.

Table 3.5: Likelihood of occurrence summary of migratory species

Scientific Name	Common Name	EPBC Act*	Number of records (source)	Likelihood of occurrence
Birds				
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi, Ma	(PMST)	Low
<i>Anous stolidus</i>	Common Noddy	Mi, Ma	(PMST)	Low
<i>Apus pacificus</i>	Fork-tailed Swift	Mi, Ma	(PMST)	Low
<i>Ardenna grisea</i>	Sooty Shearwater	Mi, Ma	(PMST)	Low
<i>Arenaria interpres</i>	Ruddy Turnstone	Mi, Ma	(PMST)	Low
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi, Ma	(PMST)	Low
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mi, Ma	(PMST)	Low
<i>Calidris ruficollis</i>	Red-necked Stint	Mi, Ma	(PMST)	Low
<i>Calonectris leucomelas</i>	Streaked Shearwater	Mi, Ma	(PMST)	Low
<i>Charadrius bicinctus</i>	Double-banded Plover	Mi, Ma	(PMST)	Low

Scientific Name	Common Name	EPBC Act*	Number of records (source)	Likelihood of occurrence
<i>Cuculus optatus</i>	Oriental Cuckoo	Mi	(PMST)	None
<i>Fregata ariel</i>	Lesser Frigate Bird	M, Ma	(PMST)	Low
<i>Fregata minor</i>	Great Frigate Bird	Mi, Ma	(PMST)	Low
<i>Gallinago hardwickii</i>	Latham's Snipe	Mi, Ma	(PMST)	Low
<i>Limosa lapponica</i>	Bar-tailed Godwit	Mi, Ma	(PMST)	Low
<i>Monarcha melanopsis</i>	Black-faced Monarch	Mi, Ma	(PMST)	None
<i>Monarcha trivirgatus</i>	Spectacled Monarch	Mi, Ma	(PMST)	None
<i>Motacilla flava</i>	Yellow Wagtail	Mi, Ma	(PMST)	Low
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mi, Ma	(PMST)	None
<i>Numenius phaeopus</i>	Whimbrel	Mi, Ma	(PMST)	Low
<i>Philomachus pugnax</i>	Ruff	Mi, Ma	(PMST)	Low
<i>Pluvialis fulva</i>	Pacific Golden Plover	Mi, Ma	(PMST)	Low
<i>Rhipidura rufifrons</i>	Rufous Fantail	Mi, Ma	(PMST)	Low
<i>Tringa brevipes</i>	Grey-tailed Tattler	Mi, Ma	(PMST)	Low
<i>Tringa nebularia</i>	Common Greenshank	Mi, Ma	(PMST)	Low
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Mi, Ma	(PMST)	Low
Mammals and Elasmobranchs				
<i>Balaenoptera edeni</i>	Bryde's Whale	Mi	(PMST)	Low
<i>Caperea marginata</i>	Pygmy Right Whale	Mi	(PMST)	Low
<i>Lagenorhynchus obscurus</i>	Dusky Dolphin	Mi	(PMST)	Low
<i>Lamna nasus</i>	Porbeagle	Mi	(PMST)	Low
<i>Manta alfredi</i>	Reef Manta Ray	Mi	(PMST)	None
<i>Manta birostris</i>	Giant Manta Ray	Mi	(PMST)	None
<i>Sousa chinensis</i>	Indo-Pacific Humpback Dolphin	Mi	(PMST)	Low

*Mi = migratory; Ma = marine (EPBC Act)

3.17.2 Commonwealth marine areas

Commonwealth marine areas extends from three to 200 nautical miles from the coast of Australia. Thus, the study locality and the study area lies outside of any Commonwealth marine areas. However, the coastal waters to the east of the study area resides within the Temperate East Marine Region which covers 383,352 square kilometres and includes eight marine reserves. The study area does not reside within any Commonwealth marine reserves. The closest marine reserves are the Hunter Commonwealth Marine Reserve, about 170 kilometres north of the study area, and the Jervis Commonwealth Marine Reserve, about 127 kilometres south of the study area.

3.17.3 Wetlands of international importance

Wetlands of international importance are defined by the Ramsar Convention which recognises these areas as being of significant value for their respective countries as well as for humanity as a whole. There are no nationally important wetlands or Ramsar Wetlands in the study area or the wider study locality.

4 Impact assessment

This section assesses potential impacts to coastal and marine biodiversity in the study area as a result from the construction and operation of the proposal. The main components of the proposal with potential to impact biodiversity and assessed here are summarised below and detailed in Section 3.3 of the REF:

- Construction:
 - Vegetation clearing and grubbing during site establishment
 - Movement and use of equipment, plant and vessels
 - Disturbance of the seabed from vessel traffic, anchoring and piling
 - Installation and removal of structures in the harbour
 - Landscaping
- Operation:
 - Persistence of the new wharf structures/features
 - Vessel and pedestrian traffic.

This section details the extent and significance of impacts as a result of the proposal including:

- Removal of vegetation and habitat (terrestrial and marine)
- Mobilisation of soils, sediments and contaminants
- Alterations to hydrology
- Introduction/spread of weeds and/or marine pests and diseases
- Surface and underwater noise
- Vessel and pedestrian disturbance.

4.1 Construction impacts

4.1.1 Native vegetation and habitat (terrestrial)

The proposal would remove 0.06 hectares of landscaped gardens and parks. This includes mostly mown Buffalo grass in the open areas of Kesterton Park and *Carex* sp. and Guinea Flower in the garden bed along the water's edge. In this 0.06 hectares of landscaped gardens and parks, three juvenile Wildfire trees and one juvenile Smooth-barked Apple would also be removed (Table 4.1 and Figure 4.1).

Vegetation to be removed does not form any remnant PCTs but does form potential habitat for some highly mobile, disturbance tolerant native fauna. The removal of vegetation as a result of the proposal would remove potential habitat for native fauna. However, the overstorey and groundcover species to be removed forms only a small portion of similar habitat along the fragmented and highly urbanised foreshores of Neutral Bay. The removal of habitat resources is unlikely to have a substantial impact on native fauna as there is an abundance of similar habitat across the study locality. The majority of vegetation to be cleared is associated with the establishment of the construction compound. Thus, following the decommissioning of the construction compound (i.e. completion of construction), up to 0.05 hectares of the compound site would be restored and landscaped as part of Kesterton Park.

Disturbance of vegetation can result in the introduction or spread of exotic flora (ie weeds). This can occur by the spread of opportunistic exotic vegetation from adjacent private properties or new species can be introduced via equipment, plant and footwear. Any foreign equipment or materials brought onto the construction site also has potential to introduce diseases such as *Phytophthora* (*Phytophthora cinnamomi*) and Myrtle Rust (*Puccinia psidii*). The vegetation and habitat in the study area and the surrounding areas are susceptible to weeds and diseases if not managed during construction.

Vegetation clearing and grubbing would expose soils and components of landfill which can then be easily mobilised. Contaminants in the soil and landfill can also be subsequently released into the surrounding environment albeit material leaching is currently potentially occurring (Cardno, 2020). Erosion and sedimentation is most likely to impact harbour waters, particular during inclement weather (e.g. rainfall, high winds) if controls are not implemented. This could result in unfavourable, turbid conditions, the smothering of sessile marine vegetation, habitat and fauna and water, sediment and biota contamination in Neutral Bay and even the wider harbour.

4.1.2 Marine vegetation and habitat

The proposal would not require large-scale disturbance of the seabed. To install the jetty and pontoon components of the new wharf, 11 piles would be installed in the subtidal habitat in the harbour. Three of these piles (508 millimetres in diameter) would be drilled into low-medium relief rocky reef, close to the existing seawall to support the jetty structure while the remaining eight (four 914 millimetres in diameter and four 457 millimetres in diameter) would be driven into subtidal soft sediment habitat in deeper water. The area of low-medium relief rocky reef (Type 2 KFH) and soft sediment habitat (Type 3 KFH) under the footprint of the piles would be permanently lost while the anchor areas for the barge during construction would be temporarily impacted. This would include the direct removal of macroalgae and sessile marine fauna from subtidal rocky reefs and epifauna and infauna from soft sediment habitats. However, the rocky reef and soft sediment habitats in the study area are characteristic of the majority of subtidal habitat in the harbour and community assemblages are generally ubiquitous and quick to recolonise following disturbance. Thus, the loss of these small areas would not be a substantial loss and anchor areas in soft sediment would quickly recolonise following the removal of anchors.

The removal of the tidal steps and associated piles of the existing structure would also result in the removal of marine vegetation, habitat and sessile/less mobile fauna on the piles and concrete steps. This constitutes a total vertical marine vegetation/habitat area of about 0.01 hectares (Table 4.1). These existing structures are currently densely colonised and the majority of these species are common in other intertidal areas and subtidal rocky reefs and would quickly colonise the piles and pontoon of the new wharf. The total vertical submerged area of the new wharf available for colonisation is about double the vertical area to be removed (about 0.02 hectares). There is potential that the materials proposed for the new piles may not be suitable for colonisation in which case, the marine assemblage on the removed structures could be permanently lost. Considerations during detailed design to promote colonisation of habitat-forming species could include the installation of structures which provide habitat complexity (e.g. designs available as part of the Living Seawalls Project).

Under Section 199 of the FM Act, consultation with NSW DPI (Fisheries) is required for any dredging and reclamation works. 'Dredging' under the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI, 2013) is classified as disturbance of the seabed/streambed. In this case, this refers to removal and installation of piles. Section 205 of the FM Act states that a permit to 'harm' marine vegetation, as per the definition of 'harm' detailed in Section 3.12, would be required. However, through consultation with NSW DPI (Fisheries) (dated 18 August 2020), this is not required for the piling and pile removal works associated with this proposal.

There is potential for coarse and fine debris to be mobilised during piling, removal of existing structures and vessel movement. This can crush, damage and/or smother marine vegetation and habitat depending on the size of debris. Larger debris would be disposed offsite and should not cause any impacts to marine biodiversity. Mobilisation of finer debris (ie sediments) can also result in the mobilisation of contamination known to persist in study area sediments. Depending on the volume and the size of fine debris, wave, tide and current actions, finer particles may not reside in the area for long and this may only be a temporary nuisance to marine assemblages. Furthermore,

Neutral Bay and the wider harbour periodically experiences impacts from elevated turbidity, usually as a result of rainfall, tides and swell. Thus, marine assemblages in the study area are likely to be frequently exposed to these conditions and the proposal is unlikely to introduce vastly different conditions.

Water-based construction activities would result in vessel and barge movements in and around the study area. This has potential to increase the frequency of vessel wash impact on intertidal and subtidal rocky reefs and the scour of soft sediment areas. Marine vegetation and sessile fauna can be scoured from the rocky reefs and epifauna, including scattered colonies of macroalgae on hard substratum, and infauna in soft sediment habitats can be removed/relocated. As large and small vessels currently frequent the study area, the community assemblages are likely to be well-adapted to vessel wash and scour. Thus, impacts as a result of vessel and barge movements are unlikely to substantially impact marine biodiversity in the study area.

Table 4.1: Areas of terrestrial and marine vegetation and habitat to be directly impacted by the proposal

Vegetation and habitat	Area to be directly and indirectly impacted/removed (ha)
Landscaped gardens and parks	0.06 Including the removal of the following trees: <ul style="list-style-type: none"> ▪ Wildfire x3 (juvenile) ▪ Smooth-barked Apple x1 (juvenile)
Intertidal rocky reef	<0.01 (vertical area only)
Vertical submerged marine vegetation/habitat (intertidal and subtidal)	0.01 (vertical area on existing structures)
Low and medium relief subtidal rocky reef (Type 2 – Moderately sensitive KFH)	<0.01
Soft sediment (Type 3 – Minimally sensitive KFH)	0.05



Legend

- Compound Area
- Proposal Footprint
- Planted Trees
- Landscaped gardens and parks
- Low - medium relief rocky reef
- Soft sediment

1:360 Scale at A3



Vegetation and Habitat to be Impacted
FIGURE 4.1
NORTH SYDNEY



Map Produced by National Water & Environment
 Date: 2020-05-27 | Project: AWE200198
 Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Map: AWE200198_GS014_NSydney_ImpactVegHab.mxd 02
 Aerial Imagery supplied by Nearmaps (2020)

4.1.3 Coastal fauna and mobile marine fauna

Proposal construction activities are unlikely to substantially impact on mobile marine fauna occurring within the study area. Fish are highly mobile and temporary disturbance from the movement of vessels, piling and removal of structures would be minor, as similar and higher condition habitat are abundant and wide-ranging in the harbour. Other disturbances associated with these works may include noise and vibration and alterations to water quality. Tolerance to changes in noise, vibration and water quality may vary among species, but the response is generally similar to these types of activities in a busy harbour (i.e. movement away from unfavourable conditions). Marine fauna in the harbour are likely to be exposed to an ambient level of noise from existing marine activities. These species are also likely to recolonise the study area once conditions return to pre-construction levels.

Impacts on sessile and less mobile marine fauna (excluding threatened species) associated with rocky reef and soft sediments have been addressed in Section 4.1.2.

An increase in vessel and barge activity during construction is associated with an increased risk of vessel strikes with marine turtles and mammals. The proposal footprint is considered suboptimal habitat for most marine mammals and very few individuals, if any, would occur during construction. The increased risk, however, is proportional to the increase in vessel traffic for the proposal relative to overall vessel traffic. This proportional increase is considered to be very small. Given marine turtles and marine mammals regularly breach the surface to breathe, the risk of vessel strike to these species could be managed by having observers monitoring potential encroachment of individuals. Vessel strike can also be mitigated by slow boat speeds that minimise collisions or result in minor harm from which fauna may recover.

Vegetation clearing in the study area would temporarily remove foraging habitat for highly mobile, disturbance tolerant fauna. This is addressed in Section 4.1.1. Land-based construction activities would also create noise and vibration in the study area and the responses of terrestrial fauna are likely to be similar to that of mobile marine fauna (i.e. move away from unfavourable conditions and return once disturbance is removed).

With the correct controls, proposal construction is unlikely to cause mortality to coastal or mobile marine fauna in the study area.

4.1.4 Threatened, migratory and protected species

The proposal is unlikely to significantly impact threatened species and disturbances to potential habitat would largely be temporary. The details of the AoSs which assess impacts on threatened species considered potentially occurring in the study area are in Appendix D.

Clearing of landscaped vegetation of up to 0.06 hectares and four trees has potential to remove roosting and foraging habitat for the Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Greater Broad-nosed Bay and the Grey-headed Flying-fox. However, the area of removal is a very small proportion of the available habitat for these species and is not expected to reduce species' range, disrupt breeding or reduce population sizes. Much of the disturbed area would be landscaped and reinstated following construction completion.

Water-based activities have potential to impact habitat for the Southern Myotis, Black Rockcod and White's Seahorse. The foraging resource that the study area represents would be made available for these species following the completion of construction thus, proposal impacts to potential foraging habitat for these species are only temporary. The loss of potential habitat from the installation of three piles on subtidal rocky reef (508 millimetres in diameter each) and the removal impact of part of the existing structure is considered minimal for Black Rockcod and White's Seahorse. This is a very small proportion of available habitat in their distribution and the installation of new piles would provide similar, if not the same habitat for these species during operation (see

Section 4.1.2). Additional controls would be implemented to survey for Black Rockcod and White's Seahorse at the start of construction so that individuals in the area are not harmed (see Section 5).

4.1.5 Pests and diseases

Aside from the potential for the introduction and/or spread and introduction of exotic vegetation and diseases addressed in Section 4.1.1, the study area is unlikely to be susceptible to any other land-based pests and disease as a result of the proposal. Proposal activities over water have a small potential to introduce marine pests if vessels, equipment or plant are used if controls are not implemented.

4.1.6 Commercial and recreational fishing

The proposal is unlikely to substantially impact populations of marine species important to recreational fishing as discussed in Section 4.1.3. However, the proposal would remove a portion of the existing wharf frequently used by recreational fishers. The remaining structure would still form a recreational fishing area for fishers to resume their activities following construction completion.

4.1.7 Key Threatening Processes

Eight Key Threatening Processes (KTPs) have potential to be triggered by the proposal. These are discussed below.

(1) Introduction of Non-indigenous Fish and Marine Vegetation to the Coastal Waters of NSW (FM Act)

Threat abatement actions prioritised in the *Priority Action Statement – Actions for the introduction of non-indigenous fish and marine vegetation to coastal waters of NSW* (Fisheries Scientific Committee, 1994) surrounds community and stakeholder liaison and awareness, legislative development and implementation, eradication and control and research, monitoring and mapping. The proposal is unlikely to interfere with any of these threat abatement actions albeit the potential to introduce/facilitate the spread of non-indigenous fish and marine vegetation. However, vessels and equipment should be sourced from local areas (see Section 5) to avoid introducing non-indigenous fish and marine vegetation. Thus, proposal activities are unlikely to further exacerbate this KTP.

(2) Clearing of Native Vegetation (BC Act) and (3) Land Clearance (EPBC Act)

The proposal would include the clearing of native vegetation although none are remnant native vegetation but rather landscape plantings. Hence, although the proposal temporarily triggers this KTP, the native vegetation to be cleared does not constitute remnant vegetation. Furthermore, areas of clearing would be rehabilitated, landscaped and integrated back into Kesterton Park following the completion of construction.

There are currently no Threat Abatement Plans (TAPs) for these KTPs however recovery actions have been identified. These surround community and stakeholder liaison and awareness, legislative development and implementation, eradication and control and research and monitoring. The proposal would not interfere with any of these actions or further exacerbate this KTP.

(4) Invasion and Establishment of Exotic Vines and Scramblers (BC Act), (5) Invasion of Native Plant Communities by Exotic Perennial Grasses (BC Act), (6) Loss and Degradation of Native Plant and Animal Habitat by Invasion of Escaped Garden Plants, Including Aquatic Plants (EPBC Act) and (7) Novel Biota and Their Impact on Biodiversity (EPBC ACT)

These KTPs surround the risk of the spread or establishment of exotic species. This KTP is unlikely to be triggered/further exacerbated by the proposal as:

- Areas to be disturbed would be rehabilitated with native species and maintained following construction completion

- Controls would be implemented to avoid the introduction/spread of exotic species during construction.

(8) Installation and Operation of Instream Structures and Other Mechanisms That Alter Natural Flow Regimes of Rivers and Streams (FM Act)

The proposal would install 11 piles and a floating pontoon while removing a set of concrete intertidal steps and associated piles. The size of these structures are small in comparison to the extent of the estuary thus would not interfere with fish passage. Due to the size of these structures in proportion to the estuary, alterations to hydrodynamics are likely to be localised and unlikely to impact any threatened species listed under the FM Act.

The identified threat abatement actions for this KTP include advice to consent authorities, community and stakeholder engagement, research and monitoring and habitat rehabilitation and protection. The proposal is unlikely to interfere with these actions with habitat rehabilitation proposed following proposal completion. Thus, the proposal is unlikely to further exacerbate or trigger this KTP.

4.2 Operational impacts

4.2.1 Marine vegetation and habitat

The jetty, gangway and pontoon components of the proposal would sit permanently on or above the water's surface and avoid impacts to the seabed. However, these structures would shade a portion of intertidal rocky reef, subtidal rocky reef and subtidal soft sediment habitat. As a result, less than 0.01 hectares of subtidal rocky reef habitat assemblage may change and manifest in a reduction of macroalgae (Table 4.1 and Figure 4.1). This impact area is a very small proportion of subtidal rocky reef habitat in the study area and the wider harbour and is not considered ecologically significant. Shading of intertidal and soft sediment habitat (about 0.05 hectares) is not expected to substantially change community assemblages as these areas generally lack marine vegetation (Table 4.1 and Figure 4.1). The removal of part of the existing wharf structure would leave a small portion of soft sediment habitat (<0.01 hectares) exposed to sunlight. This is not expected to have any substantial impacts to soft sediment communities.

The relocation of the ferry terminal also translates to the relocation of localised ferry wash and underwater turbulence. Neutral Bay currently experiences substantial vessel traffic and ferry routes are likely to vary from time to time. Impacts from the small changes to the docking and departing ferry route at the new terminal are unlikely to be detectable in the highly variable boating environment of Neutral Bay. There is potential for soft sediment habitat to be scoured where the ferry jets would be located while docking and departing the new terminal. However, these habitats are quick to recover as discussed in Section 4.1.2. Sediment mobilisation from ferry jets may affect nearby rocky reef habitat, however, communities in the study area are likely to be well-adapted to turbidity and sedimentation from stormwater runoff and from existing vessel traffic (also see Section 4.1.2).

The structures of the new terminal are not expected to substantially alter coastal processes or hydrology of the study area or the wider harbour. The proposal would install 11 piles and a floating pontoon while removing a set of concrete intertidal steps and associated piles. The size of these structures are small in comparison to the extent of the estuary thus would not interfere with fish passage. Due to the size of these structures in proportion to the estuary, alterations to hydrodynamics are likely to be localised and unlikely to produce substantial impacts to marine biodiversity.

4.3 Cumulative impacts

North Sydney Council has divided the LGA into precincts. North Sydney Wharf is within the Milson Precinct. Projects within the Milson Precinct and the Sydney Ferries Network have been considered for the purposes of this cumulative impact assessment as per Section 6.16 of the REF.

Projects identified that could create cumulative impacts with the proposal have been detailed in Table 4.2.

Table 4.2: Past, present and future projects

Project	Construction impacts	Operational impacts
<p>TfNSW Ferry Wharf Upgrade Program Program described as per the REF.</p>	<p>Upgrade of North Sydney Wharf would require additional movements within Sydney Harbour. There would be a potential minor short term cumulative increase in vessel movements within the study area and the harbour. However, the harbour currently experiences a high level of vessel traffic and this increase is unlikely to generate substantial cumulative impacts on biodiversity. Other upgrades could potentially require the removal of coastal and marine vegetation. However, these areas are generally modified and the proportion of these areas to other similar areas in the harbour is very small, even when combined. This is relevant to the removal of vegetation (terrestrial and marine) and potential habitat for native, threatened and/or migratory species.</p>	<p>Operational impacts of all ferry upgrade locations are likely to resemble those discussed above. Most locations would require the removal of existing structures in place of new structures. This is generally a temporary disturbance to coastal and marine vegetation and habitat and ecologically acceptable for coastal and marine species in the harbour.</p>
<p>Loreto School Redevelopment (State Significant Development) Partial demolition of existing buildings; maximum building envelopes for new buildings; upgrading existing facilities; removal of 11 trees; increasing capacity of students. Located on Elamang Avenue, Kirribilli. Development application approved by Independent Planning Commission.</p>	<p>Removal of 11 trees is unlikely to create substantial impacts to coastal biodiversity when combined with the minor clearing required the North Sydney Ferry Wharf Upgrade (this proposal).</p>	<p>See construction impacts.</p>
<p>62 Willoughby Street, Kirribilli To carry out alterations and additions to an existing boat repair facility and marina including the removal of slip rails, timber jetties and mooring piles and construction of a boatshed, installation of a boat crane with the capacity for 35T vessels, installation of a floating pontoon to accommodate five</p>	<p>Removal of marine habitat at the boat repair facility would likely result in the removal of marine vegetation and habitat described in this report. However, the majority of habitat to be removed for the proposal would be replaced by the new wharf structures and the area proposed to be removed at the boat repair facility and for the proposal would still be a small proportion of similar habitat in the harbour. Furthermore, the boat repair</p>	<p>The boat repair facility would remove existing structures in place of new structures. This is generally a temporary disturbance to coastal and marine vegetation and habitat and ecologically acceptable for coastal and marine species in the harbour.</p>

Project	Construction impacts	Operational impacts
<p>vessels, concrete hardstand, vehicular crossing and ancillary works. Under assessment by the Sydney North Planning Panel.</p>	<p>facility would likely reinstate some similar subtidal habitat in place of those removed.</p>	

5 Avoid, minimise and mitigate impacts

Under the TfNSW *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (Roads and Traffic Authority (RTA), 2011) the management of biodiversity should aim to:

1. Avoid and minimise impacts first
2. Mitigate impacts where avoidance is not possible
3. Offset where residual impacts cannot be avoided.

Table 5.1 details measures to avoid, minimise or mitigate proposal impacts. These should be included in the construction environmental management plan and any associated sub-plans prior to construction.

Table 5.1: Mitigation measures

Impact	ID	Mitigation measures	Responsibility	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
All project impacts	B1	Integrate the management of flora and fauna into the construction environmental management plan (either as a standalone flora and fauna management plan or a subplan). This is to include all terrestrial and marine flora and fauna.	Contractor	Pre-construction	Effective	None
	B2	Retained vegetation in close proximity to construction activities (e.g. south-western corner) will not be damaged or removed and mitigation measures identified in the <i>Arboricultural Assessment Report: North Sydney Wharf High Street, North Sydney</i> (Earthscape Horticultural Services, 2020) will be implemented.	Contractor	Construction	Effective	None
Removal of native vegetation, threatened species habitat and habitat features	B3	Native vegetation and habitat removal will be minimised through detailed design.	TfNSW	Detailed design	Effective	0.06 ha of landscaped gardens and parks to be removed. 0.05 ha of landscaped gardens and parks to be reinstated following construction completion. 0.01 ha of landscaped gardens and parks to be permanently removed.
	B4	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Pre-construction	Effective	
	B5	Vegetation and habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction	Effective	
	B6	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011). Replacement planting (species and number) will be determined in consultation with North Sydney Council to reinstate habitat and minimise impacts to the visual characteristics of Kesterton Park.	Contractor	Detailed design / Post construction	Effective	
	B7	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the project site.	Contractor	Construction	Proven	

Impact	ID	Mitigation measures	Responsibility	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
Removal of marine vegetation and habitat	B8	Considerations during detailed design to promote colonisation of habitat-forming species could include the installation of structures which provide habitat complexity (e.g. designs available as part of the Living Seawalls Project).	TfNSW	Detailed design	Effective	Removal of subtidal rocky reef habitat below the three piles (508 millimetres in diameter each). Removal of part of the existing wharf structure. However, the installation of the new wharf structure is likely to replace this removed habitat.
	B9	Direct removal of marine vegetation and habitat limited to the footprint of the eleven piles and some minor anchoring during water-based construction activities.	Contractor	Construction	Effective	
	B10	Minimise anchoring where possible and avoid anchoring on subtidal rocky reef habitat.	Contractor	Construction	Effective	
	B11	Complete a targeted survey for Black Rockcod and White's Seahorse within 24 hours prior to the commencement of water-based construction activities. Black Rockcod individuals should be encouraged to move away from the study area and White's Seahorse should be captured and relocated to nearby similar habitat. A White's Seahorse relocation plan (including other Syngnathids as per NSW DPI Fisheries advice on 9 September 2020) should be developed in consultation with DPI Fisheries to dictate this activity.	TfNSW	Pre-construction	Effective	
	B12	A Section 37 permit under the FM Act to relocate Syngnathids collected during the targeted pre-clearance survey would be required as part of the White's Seahorse relocation. Alternatively, a provision can be added to a Part 7 Permit under Section 205 of the FM Act to include approval for Syngnathid relocation.	TfNSW	Pre-construction	Effective	
Aquatic impacts	B13	Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (NSW DPI, 2013).	Contractor	Construction	Effective	Potential localised sediment mobilisation.
	LS8	Prior to commencement of construction activities, sediment control device (such as sediment boom and curtain) will be installed around the construction footprint	Contractor	Construction	Effective	Potential localised sediment mobilisation.

Impact	ID	Mitigation measures	Responsibility	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
		<p>to contain disturbed sediment from water surface by allowing suspended sediments to settle back on the bottom of the seabed overtime. The silt boom and curtain would extend from a minimum of 100 millimetres above the water line to a minimum of 2.5 metres below the water line before starting work.</p> <p>Installation should be undertaken during high tide periods from a boat. The device should be designed to rise and fall with the tide to prevent disturbance. Inspection of the device should be undertaken on a daily basis after ebbing tides, with additional inspection be carried following storm events. Monitoring of turbidity inside and outside of the device should also be performed, using a portable turbidity meter/logger. As with installation, decommissioning should be carried out by boat during high tide periods.</p>				
	LS11	Worked with positioning barges, drilling and pile driving should occur during calm conditions to prevent excessive scouring and other impacts.	Contractor	Construction	Effective	None
	WQ1	<p>A spill management plan will be developed and communicated to all staff working on site.</p> <p>Appropriate land and aquatic spill kits are to be maintained on site and on barges. Aquatic spill kits must be specific for working within the marine environment. The spill kit must be appropriately sized for the volume of substances at the work site.</p> <p>All workers will be advised of the location of the spill kit and trained in its use.</p>	Contractor	Construction	Effective	None
	B14	Piling to stop if marine mammals are observed within 100 metres of the project area and only to recommence once they have moved beyond 100 metres of the proposal footprint or are not seen for at least 20 minutes.	Contractor	Construction	Effective	None
Changes to coastal processes	B15	The detailed design should aim to avoid/minimise any impact to coastal processes and hydrology.	TfNSW	Detailed design	Effective	Potential localised

Impact	ID	Mitigation measures	Responsibility	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
						changes to currents.
Injury and mortality of fauna	B16	Fauna will be managed in accordance with <i>Guide 9: Fauna handling</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction	Effective	None
Invasion and spread of weeds, pests and diseases	B17	Weed species will be managed in accordance with <i>Guide 6: Weed management</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction	Effective	None
	B18	Pest species will be managed within the project site.	Contractor	Construction	Effective	None
	B19	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).	Contractor	Construction	Effective	None
	B20	Water-based equipment and vessels to be sourced from local suppliers. Equipment and vessels must be cleaned and inspected prior to entering the project site.	Contractor	Construction	Effective	None
	B21	Occurrence of any marine pests must be reported to NSW DPI Fisheries.	Contractor	Construction	Effective	None
Noise, light and vibration	B22	Shading and artificial light impacts will be minimised through detailed design.	TfNSW	Detailed design	Effective	None

6 Offset strategy

The proposal is not expected to clear any remnant native vegetation (or PCTs) and would only clear up to 0.06 hectares of landscaped native/exotic vegetation. Offsets are not required for the clearing of this vegetation.

The proposal is expected to impact less than 0.01 hectares of marine vegetation on subtidal rocky reefs as well as about 0.01 hectares of vertically colonised marine vegetation on the existing wharf structures to be removed (Table 4.1). About 0.02 hectares of submerged surface area would be available for recolonisation of marine vegetation and other habitat-forming species as part of the new wharf to replace the areas removed during construction. Considerations during detailed design to promote colonisation of habitat-forming species could include the installation of structures which provide habitat complexity (e.g. designs available as part of the Living Seawalls Project).

7 Conclusion

The proposal forms part of the Ferry Wharf Upgrade Program and the TAP and is focused on the upgrade of the North Sydney Wharf. This includes a number of land and water-based activities and a new location for the new wharf and the removal of a portion of the existing wharf.

A biodiversity assessment was completed to describe the existing coastal and marine environment within the study area and to assess impacts to coastal and marine biodiversity as a result of the construction and operation of the proposal. The biodiversity assessment was informed by a review of existing information and data in the study area and the wider study locality, as well as a field survey of the study area.

The study area is located in Neutral Bay, an embayment on the northern foreshores of Sydney Harbour. The terrestrial portion of the study area includes Kesterton Park, which is likely to be on reclaimed land while the marine portion was comprised of a vertical sandstone seawall bound by a corridor of subtidal rocky reef and soft sediment habitat in the deeper areas. There was no remnant native vegetation in the study area but rather a landscape park with native and exotic plantings thus, no native PCTs or TECs occur within or next to the study area. There were no mangroves, saltmarsh or seagrass in or next to the study area however, a mosaic of macroalgae colonise the subtidal rocky reef (Type 2 KFH) and debris in the soft sediment habitats (Type 3 KFH).

The vegetation and habitat in the study area provides potential habitat for a number of urban, disturbance tolerant native species. Vegetation and habitat in the study area forms potential habitat for six terrestrial and two marine threatened fauna species:

- White's Seahorse (*Hippocampus whitei*) listed as endangered under the FM Act
- Black Rockcod (*Epinephelus daemeli*) listed as endangered under the FM Act and vulnerable under the EPBC Act
- Five microchiropteran bats (microbats):
 - Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) listed as vulnerable under the BC Act
 - Little Bent-winged Bat (*Miniopterus australis*) listed as vulnerable under the BC Act
 - Large Bent-winged Bat (*Miniopterus orianae oceanensis*) listed as vulnerable under the BC Act
 - Southern Myotis (*Myotis macropus*) listed as vulnerable under the BC Act
 - Greater Broad-nosed Bat (*Scoteanax rueppellii*) listed as vulnerable under the BC Act
- Grey-headed Flying Fox (*Pteropus poliocephalus*) listed as vulnerable under the BC Act and the EPBC Act.

The proposal would include the removal of up to 0.06 hectares of landscaped gardens and parks which includes the removal of three juvenile Wildfire and one Smooth-barked Apple plantings. The removal of habitat resources is unlikely to have a substantial impact on native fauna as there is an abundance of similar habitat across the study locality. The majority of vegetation to be cleared is associated with the establishment of the construction compound. Thus, following the decommissioning of the construction compound (i.e. completion of construction), up to 0.05 hectares of the compound site would be restored and landscaped as part of Kesterton Park.

The risks of the spread/introduction of weeds and diseases and the potential for erosion and sediment mobilisation associated with vegetation clearing and construction activities would be managed during construction in accordance with the relevant TfNSW guidelines. In doing so, these risks would be removed or minimised substantially.

With respect to water-based impacts, three piles (508 millimetres in diameter) would be drilled into low-medium relief rocky reef, close to the existing seawall to support the jetty structure and eight others (four 914 millimetres in diameter and four 457 millimetres in diameter) would be driven into

subtidal soft sediment habitat in deeper water. The area of low-medium relief rocky reef and soft sediment habitat under the footprint of the piles would be permanently lost while the anchor areas for the barge would be temporarily lost. This would include the direct removal of macroalgae and sessile marine fauna from subtidal rocky reefs and epifauna and infauna from soft sediment habitats. The rocky reef and soft sediment habitats in the study area constitutes the majority of subtidal habitat in the harbour and community assemblages are generally ubiquitous and quick to recolonise following disturbance. The new wharf structures would also shade less than 0.01 hectares and 0.05 hectares of subtidal rocky reef habitat and soft sediment habitat, respectively and some vertical intertidal rocky reef habitat. Macroalgae mosaics in the study area vary greatly within the study area. This impact area is a very small proportion of subtidal rocky reef habitat in the study area and the wider harbour and is not considered ecologically significant. Shading of intertidal and soft sediment habitat is not expected to substantially change community assemblages as these areas generally lack marine vegetation.

The removal of part of the existing wharf structure and piles would result in the removal of marine vegetation, habitat and sessile/less mobile fauna on the piles and concrete steps. These existing structures are densely colonised and the majority of these species are common in subtidal rocky reefs and would quickly colonise the piles of the new wharf and pontoon. There is potential that the materials proposed for the new piles are not suitable for colonisation in which case, the marine assemblage on the removed structures would be permanently lost. Considerations during detailed design to promote colonisation of habitat-forming species could include the installation of structures which provide habitat complexity (e.g. designs available as part of the Living Seawalls Project).

Under Section 199 of the FM Act, consultation with NSW DPI (Fisheries) is required for any dredging and reclamation works. 'Dredging' under the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI, 2013) is classified as disturbance of the seabed/streambed. In this case, this refers to removal of structures and piling. Section 205 of the FM Act states that a permit to 'harm' marine vegetation would be required. However, through consultation with NSW DPI (Fisheries) (dated 18 August 2020), this is not required for the piling and pile removal works associated with this project.

Sediment mobilisation and vessel wash and scour were also identified as likely proposal impacts. However, the study area is likely to be frequently exposed to elevated levels of sediment, associated with rainfall and sea conditions, and vessel traffic in Neutral Bay. Thus, with the appropriate controls, a slight, temporary increase in these impacts is not expected to substantially impact marine biodiversity. Impacts from the introduction/spread of marine pests would also be managed during construction.

The proposal is unlikely to significantly impact threatened species and disturbances to potential habitat would largely be temporary and constitute a very small proportion of available habitat. The proposal would not fragment or isolate threatened species populations or substantially impact any species' lifecycle. Additional controls could be implemented to survey for the Black Rockcod and White's Seahorse so that individuals in the area at the start of construction are not harmed. Species impact statements were no considered to be required for the proposal.

Considering the above, the proposal is unlikely to significantly impact coastal and marine biodiversity.

8 References

- Aquaculture, Conservation and Marine Parks Unit, Port Stephens Fisheries Institute, 2012. *Black Rockcod (Epinephelus daemeli) recovery plan*, s.l.: s.n.
- ASS Management Advisory Committee, 1998. *Acid Sulfate Soils Assessment Guidelines*, s.l.: ASS Management Advisory Committee.
- Atlas of Living Australia, 2020. *Micronomus norfolkensis*. [Online]
Available at: https://bie.ala.org.au/species/ALA_Mormopterus_norfolkensis
[Accessed 2020].
- Aurecon Australasia Pty Ltd, 2019. *North Sydney wharf interchange: Concept design report*, s.l.: Roads and Maritime Services.
- Australian Museum, 2020. *Seahorses and pipefishes*. [Online]
Available at: <https://australianmuseum.net.au/seahorses-and-pipefishes>
[Accessed 2020].
- Birch, G., 2006. *A short geological and environmental history of the Sydney estuary, Australia*, s.l.: Sydney University Press.
- BoM, 2020a. *Climate Data Online*. [Online]
Available at: <http://www.bom.gov.au/climate/data/index.shtml?bookmark=136>
[Accessed 2020].
- BoM, 2020b. *Groundwater Dependent Ecosystem Atlas*. [Online]
Available at: <http://www.bom.gov.au/water/groundwater/gde/map.shtml>
[Accessed 2020].
- Browne, M. et al., 2013. Microplastics Moves Pollutants and Additives to Worms, Reducing Functions Linked to Health and Biodiversity. *Current Biology*, Volume 23, pp. 2388-2392.
- Cardno, 2018. *Western Harbour Tunnel and Warringah Freeway Upgrade Technical Working Paper: Marine Water Quality*, s.l.: s.n.
- Cardno, 2020. *Preliminary Site Investigation - North Sydney Ferry Wharf*, s.l.: s.n.
- Chapman, G. A. & Murphy, C. L., 1989. *Soil Landscapes of the Sydney 1:100, 000 Sheet*, Sydney: Soil Conservation Service of NSW.
- Coffey Geotechnics Pty Ltd, 2016. *Sydney Harbour Ferry Wharves Upgrade Program - Package 2: Stage 2 Contamination Assessment - North Sydney South Ferry Wharf*, s.l.: Hansen Yuncken.
- Connell, S. & Gillanders, B., 2007. *Marine Ecology*. Melbourne, Victoria: Oxford University Press.
- Creese, R. G., Glasby, T. M., West, G. & Callen, C., 2009. *Mapping the habitats of NSW estuaries*, s.l.: NSW DPI.
- Das, P., Marchesiello, P. & Middleton, J., 2000. Numerical Modelling Of Tide-Induced Residual Circulation In Sydney Harbour. *Marine and Freshwater Research*, Volume 51, pp. 97-112.
- Department of the Environment (DoE), 2013. *Significant impact guidelines 1.1 – Matters of National Environmental Significance*, s.l.: s.n.
- Department of the Environment and Energy, 2017. *Draft Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus*, s.l.: Commonwealth of Australia.
- Dwyer, P. D. & Hamilton-Smith, E., 1965. Breeding caves and maternity colonies of the bent-winged bat in south-eastern Australia. *Helictite*, Volume 4, pp. 3-21.
- Eby, P., 1996. *Interactions between the Grey-headed Flying-fox Pteropus poliocephalus (Chiroptera: Pteropodidae) and its diet plants-seasonal movements and seed dispersal*, Armidale, NSW: University of New England.
- ENSure, 2015. *Oran Park Green and Golden Bell Frog (Litoria aurea) Survey*, St. Leonards, NSW: ENSure.
- Eyre, B. & Ferguson, A., 2005. Benthic metabolism and nitrogen cycling in a subtropical east Australian estuary (Brunswick): temporal variability and controlling factors. *Limnology and Oceanography*, Volume 50, pp. 81-96.
- Fisheries Scientific Committee, 1994. *Introduction of Non-indigenous Fish and Marine vegetation to Coastal Waters Key Threatening Process - Recommendation*, s.l.: s.n.
- Fisheries Scientific Committee, 2019. *White's seahorse: Hippocampus whitei - Final Determination*. s.l.:s.n.

- Gadd, G. & Griffiths, A., 1977. Microorganisms and heavy metal toxicity. *Microbial Ecology*, Volume 4, pp. 303-317.
- Griffiths, S., 2002. *Structure and dynamics of rockpool fish assemblages in Southeastern Australia*, s.l.: University of Wollongong.
- Harasti, D., Glasby, T. M. & Martin-Smith, K. M., 2010. Striking a balance between retaining populations of protected seahorses and maintaining swimming nets. *Aquatic Conservation: Marine and Freshwater Ecosystems*, Volume 20, pp. 159-166.
- Harasti, D., Martin-Smith, K. & Gladstone, W., 2014. Ontogenetic and sex-based differences in habitat preferences and site fidelity of the White's seahorse *Hippocampus whitei*. *Journal of Fish Biology*, Volume 85, pp. 1413-1328.
- Harasti, D., Martin-Smith, K. M. & Gladstone, W., 2012. Population dynamics and life history of a geographically restricted seahorse, *Hippocampus whitei*. *Journal of Fish Biology*, Volume 81, pp. 1297-1314.
- Heemstra, P. C. & Randall, J. E., 1993. *FAO species catalogue. Vol. 16. Groupers of the world (Family Serranidae, Subfamily Epinephelinae). An annotated and illustrated catalogue of the grouper, rockcod, hind, coral grouper and lyretail species known to date.* s.l.:FAO Fisheries Synopsis.
- Henry, G. W., 1984. *Commercial and recreational fishing in Sydney estuary*, s.l.: NSW Department of Agriculture.
- Ivesa, L., Chapman, M. G., Underwood, A. J. & Murphy, R. J., 2010. Differential patterns of distribution of limpets on intertidal seawalla: experimental investigation of the roles of recruitment, survival and competition. *Marine Ecology Progress Series*, Volume 407, pp. 55-69.
- Johnston, E. et al., 2015. Sydney Harbour: what we do and do not know about a highly diverse estuary. *Marine and Freshwater Research*, Volume 66, pp. 1073-1087.
- Kingsford, R. T. et al., 2004. Classifying landform at broad spatial scales: the distribution and conservation of wetlands in New South Wales, Australia. *Marine and Freshwater Research*, Volume 55, pp. 17-31.
- Kuiter, R. H., 2009. *Seahorses and their relatives*. s.l.:Seafood: Aquatic Photographics.
- Martin, D. et al., 2016. Functional, phylogenetic and host-geographic signatures of *Labyrinthula* spp: provide for putative species delimitation and a global-scale view of seagrass wasting disease. *Estuaries Coasts*, Volume 39, pp. 1403-1421.
- McKone, C. & Tanner, K., 2009. Role of salinity in the susceptibility of eelgrass *Zostera marina* to the wasting disease pathogen *Labyrinthula zosterae*. *Marine Ecology Progress Series*, Volume 377, pp. 123-130.
- McLoughlin, L., 2000. Shaping Sydney Harbour; sedimentation, dredging and reclamation 1788-1990s. *Australian Geographer*, Volume 31, pp. 183-208.
- Mitchell, P., 2002. *Descriptions of NSW (Mitchell) Landscapes*, s.l.: s.n.
- Montoya, D., 2015. *Pollution in Sydney Harbour: sewage. toxic chemicals and microplastics*, s.l.: NSW Parliamentary Research Service.
- NSW Department of Industry and Investment, 2009. *Black Cod (Epinephelus daemeli) Draft Recovery Plan*, s.l.: Fisheries Conservation and Aquaculture Branch.
- NSW DPI, 2008b. *Threatened Species Assessment Guidelines: The Assessment of Significance*, s.l.: s.n.
- NSW DPI, 2013. *Policy and Guidelines for Fish Conservation and Management*, Wollongbar, NSW: NSW DPI.
- NSW DPI, 2016b. *Caulerpa taxifolia*. [Online]
Available at: <http://www.dpi.nsw.gov.au/fishing/pests-diseases/marine-pests/found-in-nsw/caulerpa-taxifolia>
[Accessed 2016].
- NSW DPI, 2016. *Fish communities and threatened species distributions of NSW*, s.l.: NSW DPI.
- NSW DPI, 2018a. *Pests & disease*. [Online]
Available at: <https://www.dpi.nsw.gov.au/fishing/pests-diseases>
[Accessed 2018].

- NSW DPI, 2020a. *Key Fish Habitat maps*. [Online]
Available at: <https://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps>
[Accessed 2020].
- NSW DPI, 2020b. *White's Seahorse (Hippocampus whitei)*. [Online]
Available at: <https://www.dpi.nsw.gov.au/fishing/threatened-species/what-current/endangered-species2/whites-seahorse>
[Accessed 2020].
- NSW DPIE, 2017a. *Southern Myotis - profile*. [Online]
Available at:
<https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10549>
[Accessed 2020].
- NSW DPIE, 2017b. *Greater Broad-nosed Bat - profile*. [Online]
Available at:
<https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10748>
[Accessed 2020].
- NSW DPIE, 2020. *Little Bent-winged Bat - profile*. [Online]
Available at:
<https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10533>
[Accessed 2020].
- NSW National Parks and Wildlife Service, 2003. *The Bioregions of New South Wales: they biodiversity, conservation and history*, s.l.: s.n.
- NSW OEH, 2016. *NSW Guide to Surveying Threatened Plants*, s.l.: s.n.
- NSW OEH, 2016. *The Native Vegetation of the Sydney Metropolitan Area – Version 3.1 VIS_ID 4489*. s.l.: NSW OEH.
- OzCoasts, 2015. *The benthic environments of Sydney Harbour, New South Wales*. [Online]
Available at: http://www.ozcoasts.gov.au/geom_geol/case_studies/sydney_final_report.jsp
[Accessed 2018].
- Raghukumar, S., 2002. Ecology of the marine protists, the Labyrinthulomycetes (Thraustichytrids and Labyrinthulids). *European Journal of Protistology*, Volume 38, pp. 127-145.
- Roads and Traffic Authority (RTA), 2011. *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects*, s.l.: Roads and Maritime.
- Roy, P. et al., 2001. Structure and Function of South-east Australian Estuaries. *Estuarine, Coastal and Shelf Science*, Volume 53, pp. 351-384.
- Sydney Institute of Marine Science, 2014. *Sydney Harbour. A systemic review of the science 2014*, s.l.: Sydney Institute of Marine Science.
- Sydney Institute of Marine Science, 2018. *Underwater research in Sydney Harbour*. [Online]
Available at: <http://sims.org.au/research/long-term-projects/sydney-harbour-research-program/about-sydney-harbour/>
[Accessed 2018].
- Trevathan-Tackett, S. et al., 2018. Pathogenic Labyrinthula associated with Australian seagrasses: Considerations for seagrass wasting disease in the southern hemisphere. *Microbiological Research*, Volume 206, pp. 74-81.
- WillyWeather, 2020. *Sydney Tide Times*. [Online]
Available at: <http://tides.willyweather.com.au/nsw/sydney.html>
[Accessed 2020].

Appendix A – Species recorded

Recorded flora

Family	Scientific name	Common name	Native/exotic	Priority weed
Aizoaceae	<i>Carpobrotus glaucesens</i>	Pigface	Native	-
Balsaminaceae	<i>Impatiens</i> sp.	-	Exotic	-
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak	Native	-
Cyperaceae	<i>Carex</i> sp.	-	Native	-
Dilleniaceae	<i>Hibbertia scandens</i>	Climbing Guinea Flower	Native	-
Lythraceae	<i>Lagerstroemia indica</i>	Crepe Myrtle	Exotic	-
Myrtaceae	<i>Angophora costata</i>	Smooth-barked Apple	Native	-
	<i>Eucalyptus botryoides</i>	Bangalay	Native	-
	<i>Corymbia maculata</i>	Spotted Gum	Native	-
	<i>Corymbia ficifolia</i>	Wildfire	Native to Western Australia	-
Phyllanthaceae	<i>Glochidion ferdinandi</i>	Cheese Tree	Native	-
Poaceae	<i>Stenotaphrum secundatum</i>	Sir Walter Buffalo	Exotic	-
Proteaceae	<i>Banksia integrifolia</i>	Coast Banksia	Native	-
Rhamnaceae	<i>Phyllica</i> sp.	-	Exotic	-

Recorded fauna

Family	Scientific name	Common name	Native/exotic
Acanthuridae	<i>Prionurus</i> spp.	Sawtails	Native
Diodontidae	<i>Dicotylichthys punctulatus</i>	Threebar Porcupinefish	Native
Girellidae	<i>Girella tricuspidata</i>	Luderick	Native
Labridae	<i>Ophthalmolepis lineolate</i>	Southern Maori Wrasse	Native
Laridae	<i>Chroicocephalus novaehollandiae</i>	Silver Gull	Native
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	Native
Monacanthidae	<i>Scobinichthys granulatus</i>	Rough Leatherjacket	Native
Mullidae	<i>Upeneichthys lineata</i>	Bluestriped Goatfish	Native
Muricidae	<i>Morula marginalba</i>	Mulberry Whelk	Native
Neritidae	<i>Nerita atramentosa</i>	Black Nerites	Native
Ostreidae	<i>Saccostrea glomerata</i>	Sydney Rock Oyster	Native
Plesiopidae	<i>Trachinops taeniatus</i>	Eastern Hulafish	Native
Sparidae	<i>Acanthopagrus australis</i>	Yellowfin Bream	Native

Appendix B – Habitat assessment table

Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (ie. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (5 kilometre) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (5 kilometre). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the study area.

Threatened species habitat assessment table

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
Amphibians						
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 metres from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size.	(PMST)	None. No suitable habitat within the study area.
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). Ephemeral and permanent freshwater wetlands, ponds, dams with an open aspect and fringed by Typha spp. and other aquatics, free from predatory fish.	(PMST)	None. No suitable habitat within the study area.
<i>Mixophyes balbus</i>	Stuttering Frog	E	V	Occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	(PMST)	None. No suitable habitat within the study area.
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	-	It has restricted distribution from Pokolbin to Nowra and west to Mt Victoria. Occurs in open forests and wet drainage lines below sandstone ridges that often have shale lenses or cappings in the Hawkesbury and Narrabeen Sandstones.	44 (BioNet)	None. No suitable habitat within the Study area.
Flora						

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Acacia bynoeana</i>	Bynoe's Tiny Wattle	E	V	Found in central eastern NSW, from the Hunter District south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood (<i>Corymbia gummifera</i>), Scribbly Gum (<i>Eucalyptus haemastoma</i>), Drooping Red Gum (<i>E. parramattensis</i>), Old Man Banksia (<i>Banksia serrata</i>) and Small-leaved Apple (<i>Angophora bakeri</i>).	(PMST)	None. No suitable habitat within the study area.
<i>Acacia pubescens</i>	Downy Wattle	V	V	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravelly soils, often with ironstone.	(PMST)	None. No suitable habitat within the study area.
<i>Acacia terminalis</i> <i>subsp. terminalis</i>	Sunshine Wattle	E	E	Very limited distribution between Botany Bay to the northern foreshore of Port Jackson. Recent collections have only been made from the Quarantine Station, Clifton Gardens, Dover Heights, Parsely Bay, Nielson Park, Cooper Park, Chifley and Watsons Bays. Coastal scrub and dry sclerophyll woodland on sandy soils. Habitat is generally sparse and scattered. Most areas of habitat or potential habitat are small and isolated.	62 (BioNet) (PMST)	None. No suitable habitat within the study area.
<i>Allocasuarina glareicola</i>	-	E	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. Found in open woodland with <i>Eucalyptus parramattensis</i> , <i>Eucalyptus fibrosa</i> , <i>Angophora bakeri</i> , <i>Eucalyptus sclerophylla</i> and <i>Melaleuca decora</i> . Common associated understorey species include <i>Melaleuca nodosa</i> , <i>Hakea dactyloides</i> , <i>Hakea sericea</i> , <i>Dillwynia tenuifolia</i> , <i>Micromyrtus minutiflora</i> , <i>Acacia elongata</i> , <i>Acacia brownei</i> , <i>Themeda australis</i> and <i>Xanthorrhoea minor</i> .	(PMST)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Allocasuarina portuensis</i>	Nielsen Park She-oak	E	E	The original known habitat of the Nielsen Park She-oak is at Nielsen Park, in Woollahra local government area. There are no plants left at the original site where it was discovered. However, propagation material has been planted successfully at a number of locations at Nielsen Park and other locations in the local area, e.g. Gap Bluff, Hermit Point and Vacluse House. The original habitat is tall closed woodland. Canopy species include: <i>Ficus rubiginosa</i> , <i>Angophora costata</i> , <i>Elaeocarpus reticulatus</i> and <i>Glochidion ferdinandi</i> with a shrub layer of <i>Pittosporum revolutum</i> , <i>Kunzea ambigua</i> and <i>Monotoca elliptica</i> . The original habitat occurs above a sandstone shelf approximately 20 metres above the harbour. The shallow sandy soils are highly siliceous, coarsely textured and devoid of a soil profile. The plantings have occurred on similar soils.	39 (BioNet) (PMST)	None. No suitable habitat within the study area.
<i>Asterolasia elegans</i>	-	E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve. Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (<i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i>), Smooth-barked Apple (<i>Angophora costata</i>), Sydney Peppermint (<i>Eucalyptus piperita</i>), Forest Oak (<i>Allocasuarina torulosa</i>) and Christmas Bush (<i>Ceratopetalum gummiferum</i>).	(PMST)	None. No suitable habitat within the study area.
<i>Caladenia tessellata</i>	Thick-lipped Spider-orchid	E	V	Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	(PMST)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (<i>C. subulata</i>) and the Tartan Tongue Orchid (<i>C. erecta</i>).	(PMST)	None. No suitable habitat within the study area.
<i>Doryanthes palmeri</i>	Giant Spear Lily	V	-	Hardy, low maintenance monocot endemic to north east New South Wales and south east Queensland. It is listed as vulnerable due to the fact that it occurs in so few regions of Australia.	1 (BioNet)	None. No suitable habitat within the study area.
<i>Darwinia biflora</i>	-	V	V	Occurs at 129 sites in the northern and north-western suburbs of Sydney, in the Ryde, Baulkham Hills, Hornsby and Ku-Ring-Gai local government areas. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury sandstone. Associated overstorey species include <i>Eucalyptus haemastoma</i> , <i>Corymbia gummifera</i> and/or <i>E. squamosa</i> . The vegetation structure is usually woodland, open forest or scrub-heath.	(PMST)	None. No suitable habitat within the study area.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	-	V	-	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	5 (BioNet)	None. No suitable habitat within the study area.
<i>Eucalyptus camfieldii</i>	Camfields Stringybark	V	V	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted species of Narrow-leaved Stringybark (<i>Eucalyptus oblonga</i>), Brown Stringybark (<i>E. capitellata</i>) and Scribbly Gum (<i>E. haemastoma</i>).	(PMST)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally conservation reserves. Planted as urban trees, windbreaks and corridors. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or meta-sedimentary rock.	4 (Bionet)	None. No suitable habitat within the study area.
<i>Genoplesium baueri</i>	Yellow Gnat-orchid	E	E	Recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. The species has been recorded at locations now likely to be within the several conservation reserves including Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Found in sparse sclerophyll forest and moss gardens over sandstone	(PMST)	None. No suitable habitat within the study area.
<i>Hygrocybe reesiaae</i>	-	V		<i>Hygrocybe reesiaae</i> is a mushroom of the waxcap genus <i>Hygrocybe</i> . It is pink or lilac in colour, and generally grows in moist, shady conditions. A rare species, it is only found near Sydney and Tasmania.	1 (Bionet)	None. No suitable habitat within the study area.
<i>Melaleuca biconvexa</i>	Biconvexa Paperbark	V	V	Found only in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	(PMST)	None. No suitable habitat within the study area.
<i>Persicaria elatior</i>	Tall Knotweed	V	V	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	(PMST)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Persoonia hirsuta</i>	Hairy Geebung	E	E	The Hairy Geebung has been recorded in the Sydney coastal area, the Blue Mountains area and the Southern Highlands. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	(PMST)	None. No suitable habitat within the study area.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	-	V	V	Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	(PMST)	None. No suitable habitat within the study area.
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	Broad distribution in western Sydney, occurring on the Cumberland Plain (Narellan, Marayong, Prospect Reservoir areas). Another smaller population is recorded in districts (Landsdowne to Shellharbour to northern Kiama) Illawarra. It grows on well-structured clay soils. On the inland Cumberland Plain sites it is associated with Grey Box and Ironbark. In the coastal Illawarra it occurs commonly in Coastal Banksia open woodland with a more well developed shrub and grass understorey.	(PMST)	None. No suitable habitat within the study area.
<i>Prostanthera junonis</i>	Somersby Mintbush	E	E	Has a north-south range of approximately 19 kilometres on the Somersby Plateau in the Gosford and Wyong local government areas. The species is restricted to the Somersby Plateau. It occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub. It occurs in both disturbed and undisturbed sites.	(PMST)	None. No suitable habitat within the study area.
<i>Rhodamnia rubescens</i>	Scrub Turpentine	CE	-	Shrub or small tree to 25 metres high occurring in coastal districts north from Batemans Bay in New South Wales approximately 280 kilometres south of Sydney, to areas inland of Bundaberg in Queensland. Populations typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 metres asl with rainfall of 1,000-1,600 mm. Commonly occurs in all rainforest subforms except cool temperate rainforest.	1 (Bionet)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V	V	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	25 (Bionet) (PMST)	None. No suitable habitat within the study area.
<i>Thesium australe</i>	Austral Toadflax	V	V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>).	(PMST)	None. No suitable habitat within the study area.
Invertebrates						
<i>Synemon plana</i>	Golden Sun Moth	E	CE	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. The species' historical distribution extended from Bathurst (central NSW) through the NSW Southern Tablelands, through to central and western Victoria, to Bordertown in eastern South Australia. Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by Wallaby Grasses (<i>Austrodanthonia</i> spp.). Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly Spear-grasses (<i>Austrostipa</i> spp.) or Kangaroo Grass (<i>Themeda australis</i>).	(PMST)	None. No suitable habitat within the study area.
Birds						

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	Temperate woodlands and open forests of the inland slopes of south-east Australia. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature Eucalypts and Sheoaks.	(PMST)	Low. No records in the study locality. Presence of associated overstorey species considered to be in suboptimal environment.
<i>Ardenna carneipes</i>	Flesh-footed Shearwater	V	M, Ma	Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia. Nest on LHI on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach. Eggs are laid at the end of a burrow 1-2 metres in length.	(PMST)	Low. Has potential to fly through and forage in the study area however, available habitat is suboptimal and widespread.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western Australia. Occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats.	1 (BioNet) (PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	Occurs in open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	2 (BioNet)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Calidris canutus</i>	Red Knot	-	E, Mi, Ma	Common in all the main suitable habitats around the coast of Australia. Mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Calidris ferruginea</i>	Curlew Sandpiper	E	CE, Mi, Ma	The breeding range of the Curlew Sandpiper is mainly restricted to the Arctic of northern Siberia, including Yamal Peninsula east to Kolyuchiskaya Gulf, Chokotka Peninsula, and also New Siberian Island. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Calidris tenuirostris</i>	Great Knot	V	CE, Mi, Ma	In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	1 (BioNet)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Calyptorhynchus lathamii</i>	Glossy Black Cockatoo	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, <i>Allocasuarina diminuta</i> and <i>A. gymnathera</i> . Belah (<i>Casuarina cristata</i>) is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah.	2 (BioNet)	None. No suitable habitat within the study area.
<i>Charadrius leschenaultii</i>	Greater Sand Plover	V	V, Mi, Ma	In Australia the species is commonly recorded in parties of 10-20 on the west coast, with the far northwest being the stronghold of the population. The species is apparently rare on the east coast, usually found singly while it is common on the west coast. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores; begin foraging activity on wet ground at low tide, usually away from the edge of the water; individuals may forage and roost with other waders.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Charadrius mongolus</i>	Lesser Sand Plover	V	E, Mi, Ma	In Australia the species is found around the entire coast but is most common in the Gulf of Carpentaria, and along the east coast of Queensland and northern NSW. Individuals are rarely recorded south of the Shoalhaven estuary, and there are few inland records. Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms. Highly gregarious, frequently seen in flocks exceeding 100 individuals; also often seen foraging and roosting with other wader species. Roosts during high tide on sandy beaches, spits and rocky shores; forage individually or in scattered flocks on wet ground at low tide, usually away from the water's edge.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	1 (BioNet)	None. No suitable habitat within the study area.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground Nature Reserve, Budderoo Nature Reserve, Woronora Plateau, Jervis Bay National Park, Booderee National Park and Beecroft Peninsula and Southern - Nadgee Nature Reserve and Croajingalong National Park in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	(PMST)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in apples (<i>Angophora</i> spp.), paperbarks (<i>Melaleuca</i> spp.) and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country (e.g. paddocks, roadside remnants) and urban trees also help sustain viable populations of the species.	6 (BioNet)	Low. Potential foraging habitat present in the study area albeit highly disturbed and widely available.
<i>Grantiella picta</i>	Painted Honeyeater	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	(PMST)	None. No suitable habitat within the study area.
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V	-	Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels.	2 (BioNet)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	Ma	Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea).	34 (BioNet) (PMST)	Low. May fly through and forage in study area however, study area habitat is widely distributed.
<i>Hirundapus caudacutus</i>	White-throated Needletail		V, Mi, Ma	Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 metres up to more than 1000 metres above the ground. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps.	(PMST)	Low. May fly through and forage in study area however, study area habitat is widely distributed and suboptimal.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Ixobrychus flavicollis</i>	Black Bittern	V	-	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.	2 (BioNet)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Lathamus discolor</i>	Swift Parrot	E	CE, Ma	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>C. gummifera</i>), Red Ironbark (<i>E. sideroxylon</i>), and White Box (<i>E. albens</i>).	4 (BioNet) (PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by <i>Eucalyptus longifolia</i> , <i>Corymbia maculata</i> , <i>E. elata</i> , or <i>E. smithii</i> . Individuals appear to occupy large hunting ranges of more than 100 km ² . They require large living trees for breeding, particularly near water with surrounding woodland/forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	1 (BioNet)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Limosa lapponica baueri</i>	Bar-tailed Godwit	-	V	<p>The Bar-tailed Godwit is a migratory wader which undertakes the largest non-stop flight of any bird. The trans-Pacific route from its breeding grounds in the Arctic to its non-breeding grounds in the southern hemisphere covers over 11,000 kilometre. Birds arrive in New South Wales between August and October and then leave between February and April, with a small number of individuals overwintering. The subspecies is most frequently recorded along major coastal river estuaries and sheltered embayments, particularly the Tweed, Richmond, Clarence, Macleay, Hastings, Hunter and Shoalhaven river estuaries, Port Stephens and Botany Bay. It is a rare visitor to wetlands away from the coast with scattered records as far west as along the Darling River and the Riverina.</p> <p>It is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms. It often occurs around beds of seagrass, and sometimes in nearby saltmarsh or the outer margins of mangrove areas. It forages at low to mid tide in shallow water or along the water's edge on sandy substrates on intertidal flats, banks and beaches or on soft mud substrates.</p>	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Limosa lapponica menzbieri</i>	Northern Siberian Bar-tailed Godwit	-	CE	<p>The Bar-tailed Godwit (both subspecies combined) has been recorded in the coastal areas of all Australian states. Occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats</p>	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Limosa limosa</i>	Black-tailed Godwit	V	Mi, Ma	<p>A migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently found at Kooragang Island (Hunter River estuary). Occurs in sheltered bays, estuaries and lagoons with large intertidal mudflats and sand flats. Also found at inland mudflats, swamps.</p>	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Macronectes halli</i>	Northern Giant Petrel	V	V, Mi, Ma	The Northern Giant-Petrel has a circumpolar pelagic distribution, usually between 40-64°S in open oceans. Their range extends into subtropical waters (to 28°S) in winter and early spring, and they are a common visitor in NSW waters, predominantly along the south-east coast during winter and autumn. Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements. Hence most birds recorded in NSW coastal waters are immature birds. Northern Giant-Petrels seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Ninox connivens</i>	Barking Owl	V	-	Found throughout continental Australia except for the central arid regions. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas.	3 (BioNet)	None. No suitable habitat within the study area.
<i>Ninox strenua</i>	Powerful Owl	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine (<i>Syncarpia glomulifera</i>), Black Sheoak (<i>Allocasuarina littoralis</i>), Blackwood (<i>Acacia melanoxylon</i>), Rough-barked Apple (<i>Angophora floribunda</i>), Cherry Ballart (<i>Exocarpus cupressiformis</i>) and a number of Eucalypt species.	212 (BioNet)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Numenius madagascariensis</i>	Eastern Curlew	-	CE, Mi, Ma	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Onychoprion fuscata</i>	Sooty Tern	V	Ma	The Sooty Tern is found over tropical and sub-tropical seas and on associated islands and cays around Northern Australia. In NSW only known to breed at Lord Howe Island. Occasionally seen along coastal NSW, especially after cyclones. Large flocks can be seen soaring, skimming and dipping but seldom plunging in off shore waters. Breeds in large colonies in sand or coral scrapes on offshore islands and cays including Lord Howe and Norfolk Islands.	1 (BioNet)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Pachyptila turtur subantarctica</i>	Fairy Prion (Southern)	-	V	The southern subspecies (subantarctica) of the Fairy Prion was first recorded on Macquarie Island in 1956, with breeding confirmed in 1978. Breeding has also been recorded on two offshore rock stacks at Macquarie Island, one near Langdon Point, the other near Davis Point. A second sub-population was found on Bishop and Clerk Islands in 1993. The species as a whole has been recorded breeding on subantarctic and cool temperate islands. The southern subspecies of the Fairy Prion is a marine bird, found mostly in temperate and subantarctic seas. The species' oceanic distribution is poorly known. The Fairy Prion sometimes forages over continental shelves and the continental slope, but it can come close inshore in rough weather. It may also feed in deep coastal waters. Off Wollongong, NSW, 79% of Fairy Prions were seen in waters over the continental slope while 21% were counted over neritic water (water more than 200 metres deep). Data from the south-eastern Australian Seabird Atlas confirm this pattern, with 83% (of 24 505 individuals) seen over the continental slope, 9% over continental shelf and only 8% over open ocean. The southern Fairy Prion is found flying over the ocean where sea surface temperatures are 8.6° to 20.2 °C.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Pandion cristatus</i>	Eastern Osprey	V	Mi, Ma	Total range of this species is from Esperance in Western Australia to NSW and into Victoria and Tasmania. In some states (Victoria and Tasmania and southern NSW) the species is a rare vagrant. The only single historical breeding record in NSW is from the St. Georges Basin. Occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. Mostly found in coastal areas but occasionally travel inland along major rivers.	1 (BioNet) (PMST)	Low. May fly through and forage in study area however, study area habitat is widely distributed.
<i>Pterodroma leucoptera leucoptera</i>	Gould's Petrel	V	E, Ma	Breeds on both Cabbage Tree Island, 1.4 kilometres offshore from Port Stephens and on nearby Boondelbah island. The range and feeding areas of non-breeding petrels are unknown. The first arrival of Gould's petrel on cabbage tree Island occurs from mid to late September. Principal nesting habitat is located within two gullies which are characterised by steeply, sloping rock scree with a canopy of Cabbage Tree Palms. They nest predominantly in natural rock crevices among the rock scree and also in hollow fallen palm trunks, under mats of fallen palm fronds and in cavities among the buttresses of fig trees. Seizes prey (squid and fish) from the sea surface.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Pterodroma neglecta neglecta</i>	Kermadec Petrel	V	V, Ma	Ranges over subtropical and tropical waters of the South Pacific. Balls Pyramid (near Lord Howe Island) and Phillip Island (near Norfolk Island) are the only known breeding sites in Australian waters. Breeds on islands across the South Pacific. In Australia it breeds on Ball's Pyramid and Phillip Island (near Norfolk Island). Nests in a crevice amongst rocks. Feeds on squid, fish, crustaceans by skimming and diving into the sea surface.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Ptilinopus superbus</i>	Superb Fruit-dove	V	Ma	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	4 (BioNet)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Rostratula australis</i>	Australian Painted Snipe	E	E, Ma	Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Sternula albifrons</i>	Little Tern	E	Mi, Ma	Migrates from eastern Asia, this species is found along the north, east and south-east Australian coasts. In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire coast from Tasmania to northern Queensland. This species is almost exclusively coastal, preferring sheltered environments.	1 (BioNet) (PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Sternula nereis</i>	Australian Fairy Tern	-	V	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there. The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. The bird roosts on beaches at night. Predates small bait-sized fish via shallow dives in shallow water.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Thalassarche bulleri</i>	Buller's Albatross	-	V, Ma, Mi	Buller's Albatross breed in New Zealand (Snares, Solander and Chatham Islands), but are regular visitors to Australian waters. They are frequently seen off the coast from Coffs Harbour, south to Tasmania and west to Eyre Peninsula. In Australia, Buller's Albatross are seen over inshore, offshore and pelagic waters. They appear to congregate over currents where water temperature exceeds 16 °C. Feeds mostly on squid, fish, krill and tunicates via surface seizing.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Thalassarche bulleri platei</i>	Northern Buller's Albatross	-	V, M, Ma	The Pacific Albatross is a non-breeding visitor to Australian waters. Foraging birds are mostly limited to the Pacific Ocean and the Tasman Sea, although birds do reach the east coast of the Australian mainland. Occurrence within the Australian Fishing Zone is likely, however, the threat from longline injury is considered low. The Pacific Albatross is a marine, pelagic species. It occurs in subtropical and subantarctic waters of the South Pacific Ocean. Habitat preferences are poorly known. In New Zealand, the species has been observed in association with fishing boats close inshore and over waters of 180–360 metres depth although it is not so strongly associated with fishing grounds as are other albatrosses.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Thalassarche cauta cauta</i>	Shy Albatross	V	V, Ma, Mi	This species is circumpolar in distribution, occurring widely in the southern oceans. Islands off Australia and New Zealand provide breeding habitat. In Australian waters, the Shy Albatross occurs along the east coast from Stradbroke Island in Queensland along the entire south coast of the continent to Carnarvon in Western Australia. Although uncommon north of Sydney, the species is commonly recorded off southeast NSW, particularly between July and November, and has been recorded in Ben Boyd National Park. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. Occasionally the species occurs in continental shelf waters, in bays and harbours. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Thalassarche melanophris</i>	Black-browed Albatross	V	V, Ma, Mi	The Black-browed Albatross has a circumpolar range over the southern oceans, and are seen off the southern Australian coast mainly during winter. This species migrates to waters off the continental shelf from approximately May to November and is regularly recorded off the NSW coast during this period. The species has also been recorded in Botany Bay National Park. Inhabits antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Can tolerate water temperatures between 0 °C and 24 °C. Spends most of its time at sea, breeding on small isolated islands.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Thalassarche salvini</i>	Salvin's Albatross	-	V, Ma, Mi	Salvin's Albatross breeds on Bounty, Snares and Chatham Islands, south of New Zealand, as well as on Crozet Island in the Indian Ocean. The species forages over most of the southern Pacific Ocean, where it is particularly common in the Humboldt Current, off South America. There are small numbers in the Indian Ocean and sometimes in the South Atlantic Ocean. During the non-breeding season, the species occurs over continental shelves around continents. It occurs both inshore and offshore and enters harbours and bays. Salvin's Albatross is scarce in pelagic waters. Feeds primarily in shelf waters and takes prey from surface or just below, it has been seen diving up to 2 m.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Thinornis rubricollis rubricollis</i>	Hooded Plover	CE	V, Ma	The Hooded Plover is endemic to southern Australia and is nowadays found mainly along the coast from south of Jervis Bay, NSW, south through Victoria and Tasmania to the western side of the Eyre Peninsula (South Australia). In south-eastern Australia Hooded Plovers prefer sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beachcast seaweed, and backed by sparsely vegetated sand-dunes for shelter and nesting. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs. They regularly use near-coastal saline and freshwater lakes and lagoons, often with saltmarsh.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Tyto tenebricosa</i>	Sooty Owl	V	-	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist Eucalypt forests.	1 (BioNet)	None. No suitable habitat within the study area.
Fish and Syngnathids						
<i>Hippocampus whitei</i>	White's Seahorse	E (FM Act)	Ma (nominated for endangered listing)	Endemic temperate Australian species found only between Forster and Wollongong, NSW. White's seahorse inhabits shallow inshore areas in estuaries, harbours and bays, where it lives on rocky reefs, sponges, seagrass beds, and under piers and jetties to 25 m.	(DPI) (PMST)	High. Sedentary populations known in the harbour in similar habitats.
<i>Epinephelus daemeli</i>	Black Rockcod	E (FM Act)	V	In Australia, the distribution of black cod ranges from southern Queensland through NSW to northern Victoria. However, records from Queensland and Victoria are rare, and the NSW coastline forms the species' main range, both in Australia and internationally. Adults are usually found in caves, gutters and beneath bommies on rocky reefs from nearshore areas to at least 50 metres depth. Small juveniles are often recorded in coastal rock pools while larger juveniles are found around rocky shores in estuaries. The use of estuaries may be an important part of the ecology of juvenile black cod in NSW waters. The black cod is territorial and often have a high site fidelity.	(DPI) (PMST)	High. Known to occur in the harbour and suitable resident habitat occurs in the study area.
<i>Prototroctes maraena</i>	Eastern Grayling	E (FM Act)	V	The Australian grayling occurs in rivers and streams on the eastern and southern flanks of the Great Dividing Range but is diadromous. During the freshwater phase of the life cycle, this species inhabits lower altitude reaches of both large rivers and smaller streams spawning in the tidal freshwater reaches of rivers, presumably among a gravel streambed. Very little is known of the Australian grayling's specific habitat requirements during the estuarine or marine phase of the life cycle.	(DPI) (PMST)	Low. May occur in the study area during the marine phase of life-cycle albeit at the end of its range and habitat is widespread.
Mammals						

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Arctocephalus forsteri</i>	New Zealand Fur Seal	V	Ma	Occurs in Australia and New Zealand. Reports of non-breeding animals along southern NSW coast particularly on Montague Island, but also at other isolated locations to north of Sydney. Prefers rocky parts of islands with jumbled terrain and boulders.	4 (BioNet)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Arctocephalus pusillus</i>	Australian Fur Seal	V	Ma	Reported to breed at Seal Rocks, near Port Stephens and Montague Island in southern NSW. Haul outs are observed at isolated places along the NSW coast. Prefers rocky parts of islands with flat, open terrain. They occupy flatter areas than do New Zealand fur-seals where they occur together. The Australian fur-seal prefers to utilise oceanic waters of the continental shelf for foraging and generally does not dive deeper than 150 m.	3 (BioNet)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Cercartetus nanus</i>	Eastern Pygmy Possum	V	-	Found in a broad range of habitats from rainforest through to wet and dry sclerophyll forest and woodland to heath, but in most areas woodlands and heath appear to be preferred.	1 (BioNet)	None. No suitable habitat within the study area.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Forages over a broad range of open forest and woodland habitats, this species is a cave roosting bat which favours sandstone escarpment habitats for roosting, in the form of shallow overhangs, crevices and caves.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Dasyurus maculatus maculatus</i>	Spotted-tail Quoll	V	E	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	(PMST)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Eubalaena australis</i>	Southern Right Whale	E	E, Mi	This species occurs in temperate and subpolar waters of the Southern Hemisphere, with a circumpolar distribution between about 20° S and 55° S with some records further south to 63° S. The Southern Right Whale migrates between summer feeding grounds in Antarctica and winter breeding grounds around the coasts of southern Australia, New Zealand, South Africa and South America. This species feed in the open oceans in summer and move inshore in winter for calving and mating with calving females usually remaining very close to the coast. The Southern Right Whale is not believed to feed in Australian waters at all. The Southern Right Whale is constrained in their ability to colonise unused areas of potentially suitable habitat due to a high degree of site fidelity (individuals returning to the same breeding site each year).	2 (BioNet) (PMST)	Low. Usually associated with open water, but may swim through the study area albeit boat traffic renders the study area suboptimal.
<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern/south eastern)	E	E	This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.	(PMST)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Megaptera novaeangliae</i>	Humpback Whale	V	V, Mi	Occurs in oceanic and coastal waters worldwide. The population of Australia's east coast migrates from summer, cold-water feeding grounds in Subantarctic waters to warm-water winter breeding grounds in the central Great Barrier Reef. They are regularly observed in NSW waters in June and July, on the northward migration and October and November, on the southward migration. As with the western Australian population, the eastern Australian population also tend to migrate further offshore during their northward migration. Three major aggregation areas have been previously identified for the eastern Australian population in Queensland around the southern end of the Great Barrier Reef, Hervey Bay and in the Gold Coast region. The southern end of the Great Barrier Reef is a suspected calving area. The breeding area for the eastern population of the humpback whale is presumed to be off the coast between central and northern Queensland. Some feeding has been observed in Australia's coastal waters but this is thought to primarily be opportunistic and forms only a small portion of their nutritional requirements. Feeding has been observed close to shore off Eden, NSW, from late September until late November. Feeding behaviour has also been reported off Fraser Island, Queensland. Feeding may also occur in northern waters of the Great Barrier Reef, as well as Victoria, as sightings of humpback whales have been reported in these areas in summer months.	6 (BioNet) (PMST)	Low. Usually associated with open water, but may swim through the study area albeit boat traffic renders the study area suboptimal.
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	-	Found along the east coast from south Queensland to southern NSW. Occurs in dry sclerophyll forest, woodland swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in manmade structures. Usually solitary but have been recorded to roost communally.	10 (BioNet)	Moderate. Potential roosting habitat is present in the study area albeit widespread.
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	-	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	3 (BioNet)	Moderate. Potential roosting habitat is present in the study area albeit widespread.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	Occurs on east and north west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other manmade structures.	67 (BioNet)	Moderate. Potential roosting habitat is present in the study area albeit widespread.
<i>Myotis macropus</i>	Southern Myotis	V	-	Generally, roost in groups close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching insects and small fish.	37 (BioNet)	Moderate. Potential roosting habitat is present in the study area albeit widespread.
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	1 (BioNet)	None. No suitable habitat within the study area.
<i>Petauroides volans</i>	Greater Glider	-	V	The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 metres above sea level. An isolated inland subpopulation occurs in the Gregory Range west of Townsville, and another in the Einasleigh Uplands. The broad extent of occurrence is unlikely to have changed appreciably since European settlement. However, the area of occupancy has decreased substantially mostly due to land clearing. This area is probably continuing to decline due to further clearing, fragmentation impacts, fire and some forestry activities. An arboreal, nocturnal marsupial largely restricted to Eucalypt forests and woodlands with a diet of eucalypt leaves and occasionally flowers. Found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows although, distribution may be patchy, even in suitable habitat. Favours forests with a diversity of Eucalypt species due to seasonal variation its preferred tree species. Shelters in tree hollows during the day. Home ranges are typically 1-4 ha.	(PMST)	None. No suitable habitat within the study area.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	Range extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	(PMST)	None. No suitable habitat within the study area.
<i>Phascolarctos cinereus</i>	Koala (combined populations Qld, NSW and the ACT)	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 Eucalypt species and 30 non-Eucalypt species, but in any one area will select preferred browse species.	3 (BioNet) PMST	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	Distribution is fragmented across all eastern states of Australia, where it inhabits open heath lands, open woodlands with heath understorey and vegetated sand dunes.	(PMST)	None. No suitable habitat within the study area.
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox	V	V	Generally, found within 200 kilometres of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 kilometres of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	1,067 (BioNet) (PMST)	High. Potential foraging habitat is present in the study area albeit widespread.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	1 (BioNet)	Moderate. Potential foraging habitat is present in the study area albeit widespread.
Reptiles						

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Caretta caretta</i>	Loggerhead Turtle	E	E, Mi, Ma	The Loggerhead Turtle has a worldwide distribution in coastal tropical and subtropical waters. In Australia, Loggerheads occur in coral reefs, bays and estuaries in tropical and warm temperate waters off the coast of Queensland, Northern Territory, Western Australia and New South Wales.	3 (BioNet) (PMST)	Low. May swim through the study area albeit widespread.
<i>Chelonia mydas</i>	Green Turtle	V	V, Mi, Ma	Green Turtles occur in seaweed-rich coral reefs and coastal seagrass pastures in tropical and subtropical areas of Australia. Usually ocean-dwelling but also occurs in coastal waters on the north or central coast with some straying south of the central coast. Green Turtles spend their first five to ten years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with driftlines and rafts of Sargassum (a floating marine plant that is also carried by currents). Once Green Turtles reach 30 to 40 cm curved carapace length, they settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds. The shallow foraging habitat of adults contains seagrass beds or algae mats on which Green Turtles mainly feed. In Australia there are seven separate genetic management units for the green turtle, and three of these occur in Queensland. The entire Great Barrier Reef area is an important feeding area for turtles which nest locally, as well as for those which nest in other regions and countries.	(PMST)	Low. May swim through the study area albeit widespread.
<i>Dermochelys coriacea</i>	Leatherback Turtle	E	E, Mi, Ma	Throughout the world's tropical and temperate seas and in all coastal waters of Australia. Most sightings are in temperate waters. Occurs in inshore and offshore marine waters. Rarely breeds in Australia, with the nearest regular nesting sites being the Solomon Islands and Malayan Archipelago. Occasional breeding records from NSW coast, including between Ballina and Lennox Head in northern NSW.	1 (BioNet) (PMST)	Low. May swim through the study area albeit widespread.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	-	V, Mi, Ma	Major nesting of Hawksbill Turtles in Australia occurs at Varanus Island and Rosemary Island in Western Australia, and in the northern Great Barrier Reef and Torres Strait, Queensland. hawksbill turtles spend their first five to ten years drifting on ocean currents. Hawksbill Turtles spend their first five to ten years drifting on ocean currents. During this pelagic phase, they are often found in association with rafts of <i>Sargassum</i> sp. (floating marine algae that is also carried by currents). Once Hawksbill Turtles reach 30 to 40 cm curved carapace length, they settle and forage in tropical tidal and sub-tidal coral and rocky reef habitat. They primarily feed on sponges and algae. They have also been found, though less frequently, within seagrass habitats of coastal waters, as well as the deeper habitats of trawl fisheries. Hawksbill Turtles have been seen in temperate regions as far south as northern NSW.	(PMST)	Low. May swim through the study area albeit widespread.
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 metres of escarpments in summer.	(PMST)	None. No suitable habitat within the study area.
<i>Natator depressus</i>	Flatback Turtle	-	V, Mi, Ma	The Flatback Turtle is only found in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya and is one of only two species of sea turtle without a global distribution. Post-hatchling and juvenile Flatback Turtles do not have the wide dispersal phase in the oceanic environment like other sea turtles. Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into Papua New Guinea and Irian Jaya although the extent of their range is not fully known. Hatchling to subadult Flatback Turtles lack a pelagic life stage and reside in the Australian continental shelf. Flatback Turtles require sandy beaches to nest. Sand temperatures between 25 °C and 33 °C are needed for successful incubation. Beaches free from light pollution are required to prevent disorientation, disturbance, and to allow nesting females to come ashore.	(PMST)	Low. May swim through the study area albeit widespread.

Elasmobranchs

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Carcharias taurus</i>	Grey Nurse Shark (east coast population)	CE (FM Act)	CE	Grey Nurse Sharks are usually found in inshore coastal waters usually less than 40 metres in depth. This species congregates at a number of rocky reef sites with gravel or sand filled gutters, overhangs or caves known as 'aggregate sites' and key aggregate sites refer to those areas occupied by a larger number of grey nurse sharks. Individuals spend most of their time within or in close proximity to aggregate sites but may undertake excursions of varying lengths of time away from site. In NSW, aggregations of grey nurse sharks (east coast population as listed under the EPBC Act) can be found at reefs off the following locations: Byron Bay, Brooms Head, Solitary Islands, South West Rocks, Laurieton, Forster, Seal Rocks, Port Stephens, Sydney, Bateman's Bay, Narooma and Montague Island. Relatively little is known about the migratory habits of Grey Nurse Sharks in Australian waters but tagged sharks have been recorded moving over 800 kilometres between sites in relatively short periods of time.	(DPI) (PMST)	Low. May swim through the study area albeit widespread. No aggregate sites known in the harbour.
<i>Carcharodon carcharias</i>	Great White Shark	V (FM Act)	V, Mi	In Australia, White Sharks have been recorded from central Queensland around the south coast to north-west Western Australia, but may occur further north on both coasts. White Sharks are widely, but not evenly, distributed in Australian waters. This species can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas. The majority of recorded White Shark movements occur between the coast and 100 metres in depth but have been recorded to dive to depth of over 1,200 m. Individuals may travel long distances in a relatively short time, but can remain in the same areas for weeks to months. In NSW, the Stockton Beach/Hawks Nest area are identified as primary residency areas for juvenile White Sharks.	(PMST)	Low. May swim through the study area albeit widespread.

Scientific Name	Common Name	BC Act/FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Rhincodon typus</i>	Whale Shark	-	V, Mi	In Australia, the Whale Shark is known from NSW, Queensland, Northern Territory, Western Australia and occasionally Victoria and South Australia, but it is most commonly seen in waters off northern Western Australia, Northern Territory and Queensland. The Whale Shark is an oceanic and coastal, tropical to warm-temperate pelagic shark. It is often seen far offshore, but also comes close inshore and sometimes enters lagoons of coral atolls. The Whale Shark is generally encountered close to or at the surface, as single individuals or occasionally in schools or aggregations of up to hundreds of sharks. This species is generally found in areas where the surface temperature is 21–25 °C, preferably with cold water of 17 °C or less upwelling into it, and salinity of 34 to 34.5 parts per thousand.	(PMST)	Low. May swim through the study area albeit widespread.

* Distribution and habitat requirement information adapted from:

- Australian Government DAWE <https://www.environment.gov.au/biodiversity/threatened/species>.
- NSW DPIE-EES <http://www.environment.nsw.gov.au/threatenedSpeciesApp/> and
- NSW DPI (Fisheries) listed threatened species, populations and ecological communities <https://www.dpi.nsw.gov.au/fishing/species-protection/what-current>.

+ Data source includes

- The NSW DPI (Fisheries) Threatened species lists <https://www.dpi.nsw.gov.au/fishing/species-protection/what-current>.
- Number of records from the NSW DPIE-EES Wildlife Atlas record data (Accessed April 2020) <http://www.bionet.nsw.gov.au/> and
- Australian Government DAWE PMST <http://www.environment.gov.au/epbc/protected-matters-search-tool>.

Key:

EP = endangered population

CE = critically endangered

E = endangered

V = vulnerable

Mi = migratory (EPBC Act only)

Ma = marine (EPBC Act only)

Migratory species habitat assessment table

Scientific Name	Common Name	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
Birds					
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi, Ma	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Anous stolidus</i>	Common Noddy	Mi, Ma	Mainly occurs in ocean off the Queensland coast. Breeds on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoal or cays or coral or sand. This species feeds main on fish but are known to take squid, molluscs and aquatic insects in offshore areas.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Apus pacificus</i>	Fork-tailed Swift	Mi, Ma	Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 metres to at least 300 metres above ground and probably much higher.	(PMST)	Low. Almost exclusively aerial so unlikely to land in the study area but may fly through.
<i>Ardenna grisea</i>	Sooty Shearwater	Mi, Ma	In Australia, the Sooty Shearwater breeds on islands off New South Wales (NSW) and Tasmania. The Sooty Shearwater forages in pelagic (open ocean) sub-tropical, sub-Antarctic and Antarctic waters. The Sooty Shearwater breeds mainly on subtropical and sub-Antarctic islands, as well as on the mainland of New Zealand. The Sooty Shearwater forages in pelagic (open ocean) sub-tropical, sub-Antarctic and Antarctic waters. The species migrates and forages in the North Pacific and Atlantic Oceans during the non-breeding season. Sooty Shearwaters may forage inshore occasionally, especially during rough weather.	(PMST)	Low. Some foraging habitat present in the study area however, is widely distributed and not preferred.
<i>Arenaria interpres</i>	Ruddy Turnstone	Mi, Ma	Coastline and only occasionally inland. They are mainly found on exposed rocks or reefs, often with shallow pools, and on beaches.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi, Ma	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Scientific Name	Common Name	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mi, Ma	In NSW, the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Calidris ruficollis</i>	Red-necked Stint	Mi, Ma	It is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. The Red-necked Stint breeds in Siberia and sporadically in north and west Alaska, probably from Taymyr region to Anadyr Territory and Koryakland. The Red-necked Stint mostly forages on bare wet mud on intertidal mudflats or sandflats, or in very shallow water; mostly in areas with a film of surface water and mostly close to edge of water. Roosts on sheltered beaches, spits, banks or islets, of sand, mud, coral or shingle, sometimes in saltmarsh or other vegetation.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Calonectris leucomelas</i>	Streaked Shearwater	Mi, Ma	Found in the western Pacific, breeding on the coast and on offshore islands of Japan, Russia, and on islands off the coasts of China, North Korea and South Korea. This marine species can be found over both pelagic and inshore waters.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Charadrius bicinctus</i>	Double-banded Plover	Mi, Ma	The Double-banded Plover can be found in both coastal and inland areas. The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Cuculus optatus</i>	Oriental Cuckoo	Mi	Occurs from the coastal region of the Northern Territory to the south of NSW coast. This species is very secretive inhabiting forests, occurring in coniferous, deciduous and mixed forest.	(PMST)	None. No suitable habitat within the study area.
<i>Fregata ariel</i>	Lesser Frigate Bird	M, Ma	Breeding populations are found in the tropical waters of Indian and Pacific Oceans, except in the east Pacific, and the South Atlantic on remote tropical and sub-tropical islands. Mainly feeds on fish but can snatch bird eggs and chicks as well as scavenge.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.

Scientific Name	Common Name	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Fregata minor</i>	Great Frigate Bird	Mi, Ma	Breeding populations found on small, remote tropical and sub-tropical islands of the Indian and Pacific Oceans and the South Atlantic. Kleptoparasitic behaviour leads to stealing fish and squid from other bird species as well as snatching small chicks.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Gallinago hardwickii</i>	Latham's Snipe	Mi, Ma	Recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. Occurs in permanent and ephemeral wetlands up to 2000 metres above sea-level.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Limosa lapponica</i>	Bar-tailed Godwit	Mi, Ma	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Monarcha melanopsis</i>	Black-faced Monarch	Mi, Ma	Widespread in eastern Australia. Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	(PMST)	None. No suitable habitat within the study area.
<i>Monarcha trivirgatus</i>	Spectacled Monarch	Mi, Ma	Occurs along the entire east coast of Australia. Breeds in dense scrub in gullies of coastal ranges.	(PMST)	None. No suitable habitat within the study area.
<i>Motacilla flava</i>	Yellow Wagtail	Mi, Ma	Breeds in northern latitudes and travels south before the onset of winter. Occurs in a variety of damp or wet habitats with low vegetation. Outside of the breeding season, it is also found in cultivated areas.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mi, Ma	Widespread in eastern Australia and vagrant to New Zealand. Inhabit heavily vegetated gullies in Eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	(PMST)	None. No suitable habitat within the study area.
<i>Numenius phaeopus</i>	Whimbrel	Mi, Ma	The Whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Scientific Name	Common Name	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Philomachus pugnax</i>	Ruff	Mi, Ma	The Ruff is a rare but regular non-breeding visitor to Australia, being recorded in all States and Territories. In NSW the species has been recorded at Kurnell, Tomki, Casino, Ballina, Kooragang Island, Broadwater Lagoon and Little Cattai Creek. The Ruff is found on generally fresh, brackish or saline wetlands with exposed mudflats at the edges.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Pluvialis fulva</i>	Pacific Golden Plover	Mi, Ma	Most Pacific Golden Plovers occur along the east coast, and are especially widespread along the Queensland and NSW coastlines. In non-breeding grounds in Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as <i>Sarcocornia</i> , or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Rhipidura rufifrons</i>	Rufous Fantail	Mi, Ma	Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by Eucalypts such as Tallow-wood (<i>Eucalyptus microcorys</i>), Mountain Grey Gum (<i>E. cypellocarpa</i>), Narrow-leaved Peppermint (<i>E. radiata</i>), Mountain Ash (<i>E. regnans</i>), Alpine Ash (<i>E. delegatensis</i>), Blackbutt (<i>E. pilularis</i>) or Red Mahogany (<i>E. resinifera</i>); usually with a dense shrubby understorey often including ferns.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Tringa brevipes</i>	Grey-tailed Tattler	Mi, Ma	In NSW the Grey-tailed Tattler is distributed along most of the coast from the Queensland border, south to Tilba Lake. The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Tringa nebularia</i>	Common Greenshank	Mi, Ma	The Common Greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Mi, Ma	Fresh or brackish (slightly salty) wetlands such as rivers, water meadows, sewage farms, drains, lagoons and swamps.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Mammals and Elasmobranchs

Scientific Name	Common Name	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Balaenoptera edeni</i>	Bryde's Whale	Mi	Bryde's whales occur in temperate to tropical waters, both oceanic and inshore, bounded by latitudes 40° N and 40° S, or the 20 °C isotherm. Bryde's whales have been recorded from all Australian states except the Northern Territory, including one sighting each in Victoria and NSW and 11 reported strandings in South Australia, NSW, Victoria and Queensland. Bryde's whales are found year-round primarily in temperatures exceeding 16.3 °C. The coastal form of Bryde's whale appears to be limited to the 200 metres depth isobar, moving along the coast in response to availability of suitable prey. The offshore form is found in deeper water (500 metres to 1000 m). Dive times are relatively short, averaging 1.27 minutes but potentially lasting 9 minutes. This suggests that Bryde's whales use the upper layers of the ocean, and can therefore be considered pelagic.	(PMST)	Low. Usually associated with open water, but may swim through the study area albeit boat traffic renders the study area suboptimal.
<i>Caperea marginata</i>	Pygmy Right Whale	Mi	Records of pygmy right whales in Australian waters are distributed between 32° S and 47° S, but are not uniformly spread around the coast. The northern distribution of pygmy right whales may be limited on the west and east coasts of Australia by the warm, south-flowing Leeuwin and East Australian currents. Few or no records are available for NSW, eastern Victoria, and the northern part of the Great Australian Bight, while Western Australia has fewer records than comparative eastern Australian states. Concentrations of stranded animals have occurred at the entrance of the gulfs in South Australia and around Tasmania, but live sightings have predominated in the former region. The numerous strandings in Tasmania may be due to the proximity of the Subtropical Convergence, an apparently important feeding zone for pygmy right whales. Pygmy right whales have primarily been recorded in areas associated with upwellings and with high zooplankton abundance, particularly copepods and small euphausiids which constitute their main prey. There is some evidence to indicate that the area south of 41° S is important for weaned pygmy right whales, possibly because of the higher prey abundance in these waters.	(PMST)	Low. Usually associated with open water, but may swim through the study area albeit boat traffic renders the study area suboptimal.
<i>Lagenorhynchus obscurus</i>	Dusky Dolphin	Mi	In Australia, dusky dolphins are known from only 13 reports since 1828, with two sightings in the early 1980s. They occur across southern Australia from Western Australia to Tasmania, with unconfirmed sightings south of continental Australia but confirmed sightings near Kangaroo Island, South Australia, and off Tasmania, and a recent stranding in the latter State. Given the lack of understanding of the species' distribution in Australian waters, no key localities have yet been identified. Dusky dolphins occur mostly in temperate and subantarctic waters. They are considered to primarily inhabit inshore waters but may also be pelagic at times.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.

Scientific Name	Common Name	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Lamna nasus</i>	Porbeagle	Mi	The Porbeagle is wide-ranging and inhabits temperate, subarctic and subantarctic waters of the North Atlantic and Southern Hemisphere. The Porbeagle primarily inhabits oceanic waters and areas around the edge of the continental shelf. They occasionally move into coastal waters, but these movements are temporary. The Porbeagle utilises a broad vertical range of the water column and is known to dive to depths exceeding 1300 m. The Porbeagle is thought to be reasonably flexible in the types of habitat used for foraging.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Manta alfredi</i>	Reef Manta Ray	Mi	Distributed in the Indo-West Pacific: Red Sea, South Africa, Thailand to Western Australia; north to Japan (Yaeyama Island), to Solitary Island, Australia as far east as French Polynesia and the Hawaiian Islands. Reported in the Atlantic (Canary and Cape Verde islands) but this species may be restricted more or less to the Indian and Western Pacific only. Adults are commonly sighted inshore, within a few kilometers of land; found around coral and rocky reefs as well as along productive coastlines with consistent upwelling, tropical island groups, atolls and bays.	(PMST)	None. No suitable habitat within the study area.
<i>Manta birostris</i>	Giant Manta Ray	Mi	The Giant Manta Ray occurs in tropical, sub-tropical and temperate waters of the Atlantic, Pacific and Indian Oceans. Commonly sighted along productive coastlines with regular upwelling, oceanic island groups and particularly offshore pinnacles and seamounts. Widespread, although relatively uncommon in Australian waters; also Cocos (Keeling) Islands and Christmas Island in the eastern Indian Ocean. Elsewhere the species is circumglobal, usually offshore, often around oceanic islands, sometimes coastal, and most common in tropical waters. Giant Manta Rays aggregate around Ningaloo Reef during autumn and winter.	(PMST)	None. No suitable habitat within the study area.
<i>Sousa chinensis</i>	Indo-Pacific Humpback Dolphin	Mi	In Australia, Indo-Pacific Humpback Dolphins are known to occur along the northern coastline, extending to Exmouth Gulf on the west coast (25° S), and the Queensland/NSW border region on the east coast (34° S). Within their geographical range, Australian Humpback Dolphins are found primarily in coastal waters however, this species is known to inhabit shallow coastal, estuarine, and occasionally riverine habitats, in tropical and subtropical regions.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.

Scientific Name	Common Name	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
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* Distribution and habitat requirement information adapted from:

- Australian Government DAWE <https://www.environment.gov.au/biodiversity/threatened/species>.
- NSW DPIE-EES <http://www.environment.nsw.gov.au/threatenedSpeciesApp/>. and
- NSW DPI (Fisheries) listed threatened species, populations and ecological communities <https://www.dpi.nsw.gov.au/fishing/species-protection/what-current>.

+ Data source includes

- Number of records from the NSW DPIE-EES Wildlife Atlas record data (Accessed April 2020) <http://www.bionet.nsw.gov.au/>. and
- Australian Government DAWE PMST <http://www.environment.gov.au/epbc/protected-matters-search-tool>.

Key:

Mi = migratory (EPBC Act only)

Ma = marine (EPBC Act only)

Protected species habitat assessment table

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
Birds						
<i>Ardea alba</i>	Great Egret	-	Ma	The Eastern Great Egret is a widespread species of southern and eastern Asia and Australasia. Eastern Great Egrets are widespread in Australia. They occur in all states/territories of mainland Australia and in Tasmania. They have also been recorded as vagrants on Lord Howe, Norfolk and Macquarie Islands. The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Ardea ibis</i>	Cattle Egret	-	Ma	The Cattle Egret was originally native to Africa, south-west Europe, and Asia. Originally the bird's Asian distribution was from Pakistan, south to Sri Lanka, north to the Himalayas and east to Korea, Japan, and the Philippines. Two major distributions have been located; from north-east Western Australia to the Top End of the Northern Territory and around south-east Australia. The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Charadrius ruficapillus</i>	Red-capped Plover	-	Ma	The Red-capped Plover is widespread throughout Australia. Found in wetlands, especially in arid areas, and prefers saline and brackish waters.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Himantopus</i>	Pied Stilt	-	Ma	The Black-winged Stilt has a wide range, including Australia, Central and South America, Africa, southern and south-eastern Asia and parts of North America and Eurasia Prefer freshwater and saltwater marshes, mudflats, and the shallow edges of lakes and rivers.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.
<i>Merops ornatus</i>	Rainbow Bee-eater	-	Ma	The Rainbow Bee-eater is widely distributed throughout Australia and eastern Indonesia. The Rainbow Bee-eater is distributed across much of mainland Australia, and occurs on several near-shore islands. The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation.	(PMST)	Low. Some foraging habitat present in the study area however, is suboptimal and widely distributed.
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet	-	Ma	The Red-necked Avocet is found throughout mainland Australia, but breeds mainly in the south-western interior. Out of breeding season, it visits most of the rest of Australia, but is only an accidental visitor to Tasmania or the Cape York Peninsula. The Red-necked Avocet is found in large shallow freshwater or saltwater wetlands and estuarine mudflats.	(PMST)	Low. Prefers specific habitat not in the study area however, it may fly through.

Fish and Syngnathids

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Acentronura tentaculata</i>	Shortpouch Pygmy Pipehorse	P	Ma	This species is found on tropical inshore reefs. It also occurs in temperate waters associated with shallow sandflats in protected and somewhat silty coastal areas among sparse low plant growth and in algae on rocks. This species inhabits waters of 7-40 metres in depth. Pipefishes feed on small living crustaceans.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Anampses elegans</i>	Elegant Wrasse	P	-	Elegant Wrasse are a widespread but uncommon species found on coral reef and rocky reef habitats at depths from 2 to 35 m. The distribution of elegant wrasse extends from southern Queensland to Montague Island on the NSW south coast, particularly around inshore islands. The species is also found at Lord Howe Island, especially in the shallow lagoon habitat, and at nearby Elizabeth and Middleton Reefs, and they have also been recorded from Norfolk Island, the Kermadec Islands, New Zealand and Easter Island. Elegant wrasse are a subtropical, warm-temperate species that are active during the day.	(DPI)	High. Potential habitat is present in the study area.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Epinephelus coioides</i>	Estuary Cod	P	-	<p>Occurs in tropical and warm temperate marine waters of the Indo-Pacific including the Persian Gulf, India, the Philippines, Singapore, Hong Kong, Taiwan, Fiji and around numerous other islands. In Australia they are most common in Queensland, the Northern Territory and Western Australia; however, they are known to occur as far southwards as the Sydney area.</p> <p>Estuary cod inhabit turbid coastal reefs and are often found in brackish water over mud and rubble. They are frequently misidentified as Greasy Grouper (<i>Epinephelus tauvina</i>) or Malabar Grouper (<i>Epinephelus malabaricus</i>), which look similar and have overlapping distributions. Estuary cod also have a variety of common names including estuary rock cod, orange-spotted grouper, orange-spotted cod, green grouper, greasy cod, spotted river cod and brown-spotted grouper.</p>	(DPI)	High. Potential habitat is present in the study area.
<i>Epinephelus lanceolatus</i>	Queensland Groper	P	Ma	<p>This species has a wide distribution throughout the tropical waters of the Indo-West Pacific. In Australia they occur along all tropical and warm temperate coasts but are rarely found in cooler waters to the south. Queensland Groper occupy a variety of habitats throughout their growth stages including estuaries and coral reefs. This species is usually solitary and inhabit caves and around wrecks and structures. They are ambush predators that swallow prey whole.</p>	(DPI)	Moderate. Potential habitat is present in the study area albeit towards the end of the species range.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Festucalex cinctus</i>	Girdled Pipefish	P	Ma	Endemic to tropical and temperate waters of the Northern Territory, Queensland and New South Wales. Usually inhabits sheltered coastal bays and estuaries, on patches of rubble, sand or in areas of sparse seagrass, algal and sponge growth. Most specimens were dredged or trawled in depths of 8-31 metres but divers collected some specimens over rubble bottoms in depths of 12 m. In Sydney Harbour it is most common in depths of 10-20 m.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Filicampus tigris</i>	Tiger Pipefish	P	Ma	The tiger pipefish is relatively common in subtropical waters of Australia's east and west coasts. A relic population also occurs in the warmer waters of Spencer Gulf, South Australia. Inhabits areas near channels in inshore sheltered bays and estuaries with sandy or muddy bottoms, or along seagrass bed edges at 2-30 m. Feeds on aggregations of mysid shrimps in sheltered bays adjacent to tidal channels.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Heraldia nocturna</i>	Upside-down Pipefish	P	Ma	Endemic to temperate waters of southern and south-eastern Australia, from about Hastings, New South Wales, southwards to Victoria, to Port Davey on the west coast of Tasmania, westwards through South Australia to Geographe Bay, Western Australia. Upside-down Pipefish inhabit sheltered inshore rocky reefs in harbours, bays and coves where they are found under ledges, in holes, crevices and small caves at 2-30 m.	(DPI) (PMST)	High. Potential habitat is present in the study area.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Hippichthys penicillus</i>	Beady Pipefish	P	Ma	Widespread in the tropical Indo-west-central Pacific, from the Red Sea and East Africa across the Indian Ocean to north-eastern Australia, north to Taiwan, Japan, Micronesia and east to Samoa and Tonga. This species usually inhabits brackish waters in mangrove estuaries, tidal creeks and sometimes in freshwater reaches in the lower parts of rivers and streams.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Hippocampus abdominalis</i>	Big-belly Seahorse	P	Ma	Known from temperate waters of New Zealand and southern Australia, where it occurs from about South West Rocks, New South Wales, southwards to the northern Great Australian Bight, South Australia, and south to the Derwent Estuary, Tasmania. Big-belly Seahorses live in a range of habitats from low rocky reefs in shallow estuaries, to deep tidal channels and deeper coastal reefs to 100 m. They cling to seagrasses, sponges, macroalgae such as kelp holdfasts and other structures on reefs.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Histiogamphelus briggsii</i>	Crested Pipefish	P	Ma	Endemic to temperate waters of south-eastern Australia, from New South Wales, south to Victoria and Tasmania, and westwards to Gulf St Vincent. Crested pipefish inhabit inshore sandy areas, singly or in small aggregations, often amongst detached seaweed or along the margins of Posidonia seagrass beds and in open sandy areas at 3–20 m; most common in Bass Strait.	(DPI) (PMST)	High. Potential habitat is present in the study area.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Lissocampus runa</i>	Javelin Pipefish	P	Ma	Endemic to temperate waters of southern and eastern Australia; known from southern Qld, southwards to Tasmania, and across to about Rottnest Island, south-western Australia. Usually inhabits tidepools and sheltered bays, usually in seagrass and algal beds, and rocky and shelly rubble substratum to about 20 m.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Maroubra perserrata</i>	Sawtooth Pipefish	P	Ma	Endemic to temperate southern Australian waters from southern Queensland to Rottnest Island, Western Australia. The sawtooth pipefish inhabits coastal rocky reefs at 3-25 m, sheltering beneath ledges and in caves during day.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Notiocampus ruber</i>	Red Pipefish	P	Ma	Endemic to temperate waters of southern and south-eastern Australia from Sydney Harbour, New South Wales, south and west to Flinders Island in Bass Strait, Tasmania, Victoria, South Australia and the Recherche Archipelago, Western Australia; usually inhabits rocky reefs, often in crevices, in association with sponges and encrusting and filamentous red algae at 5–20 m.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Paraplesiops bleekeri</i>	Eastern Blue Devil	P	-	Eastern Blue Devil are a shy, secretive fish found in caves, crevices and under ledges on inshore reefs and estuaries. Eastern blue devil fish are distributed from southern Queensland to Montague Island on the NSW south coast. They can be found in waters between 3-30 metres and are generally solitary occupying caves, crevices or under ledges.	(DPI)	High. Potential habitat is present in the study area.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Pelamis platurus</i>	Yellow-bellied Seasnake	-	Ma	The Yellow-bellied Seasnake is the most widely distributed of all sea snake species. In the beginning of the 21st century, the species was found to range from the east coast of Africa through the Indian and Pacific Oceans to the west coast of the Americas. It was found in most Australian waters with the exception of the colder southern coastline. The greatest density of populations was thought to exist south of the tropics where it was most commonly found on beaches after storms. Populations were also found in tropical seas and the Gulf of Carpentaria. The population living near the central coast of NSW was thought to be permanent and breeding, though no new studies have confirmed this. Most Australian specimens have been washed ashore by a combination of ebbing tides and onshore winds. The Yellow-bellied Seasnake is usually found within a few kilometres of the coast and prefers shallow inshore waters found to be between 11.7–36 °C. Nevertheless, the species is the most pelagic of all known sea snakes, occurring in the open waters well away from coasts and reefs.	(PMST)	Low. Prefers specific habitat not in the study area however, it may get washed into the harbour.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Phyllopteryx taeniolatus</i>	Weedy Seadragon	P	Ma	<p>Endemic to temperate coastal waters of southern Australia, from about Newcastle (New South Wales) south to Actaeon Island (Tasmania) and across southern Australia to about Geraldton (Western Australia).</p> <p>Common seadragons inhabit shallow estuaries to deeper offshore reefs, living seagrass beds and on rocky reefs covered in macroalgae, especially kelp beds, in depths of 1-50 m. Individuals usually remain within a broad home range.</p>	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Solegnathus spinosissimus</i>	Spiny Pipefish	P	Ma	<p>Known from temperate waters of Australia and New Zealand. In Australian waters, spiny pipehorses have been recorded from off Caloundra, southern Queensland, to southern Tasmania, throughout Bass Strait to south of Cape Otway, Victoria. In the southern part of their range, Spiny Pipehorses inhabit relatively shallow waters. Specimens have been collected from muddy, silty, shelly and rubble substrates, and rocky reefs, and may be washed ashore after storms. Spiny Pipehorses use their prehensile tails to cling to macroalgae and sessile invertebrates on the substrate.</p>	(DPI) (PMST)	High. Potential habitat is present in the study area.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Solenostomus cyanopterus</i>	Robust Ghost Pipefish	P	Ma	Widespread in the tropical Indo-west Pacific, from East Africa and the Red Sea, eastwards to Fiji and southern Japan, and south to Australia. Known in Australian waters from the Shark Bay region, Western Australia, around the tropical north and southwards to at least Sydney Harbour, New South Wales. Robust Ghost Pipefish live in protected coastal and lagoon reefs, deeper coastal reefs and deep, clear estuaries with seagrass or macro-algae in 15-25 m.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Solenostomus paradoxus</i>	Ornate Ghost Pipefish	P	Ma	Widespread in tropical and warm-temperate regions of the Indo-west Pacific, from East Africa, eastwards to Fiji and Tonga, north to southern Japan, south to Australia and New Caledonia. Ornate ghost pipefish inhabit protected coastal, lagoon and outer reef areas with drop-offs or rock faces, in depths of 3-35 m. They often associate with Crinoids (featherstars), Gorgonians and black corals. Although usually solitary, they may be seen in pairs, or even in small groups.	(DPI) (PMST)	Low. Prefers specific habitat not characterised by study area.
<i>Stigmatopora argus</i>	Spotted Pipefish	P	Ma	Found from the Hawkesbury River, NSW to Shark Bay, WA in temperate waters. Usually among vegetation in bays and estuaries, but sometimes offshore among floating Sargassum.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Stigmatopora nigra</i>	Widebody Pipefish	P	Ma	Known from temperate waters of southern Australia and New Zealand. The Widebody Pipefish occurs from about Fraser Island in southern Queensland to north of Perth (Western Australia), and around Tasmania. It is common in sheltered seagrass and algal beds from intertidal depths to 35 m.	(DPI) (PMST)	High. Potential habitat is present in the study area.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Syngnathoides biaculeatus</i>	Double-end Pipefish	P	Ma	In Australian waters, known from Geraldton to Shark Bay, and north to Ashmore and Cartier Reefs, Western Australia, and from the Timor Sea, the Northern Territory, eastwards to Queensland and south to Batemans Bay (NSW). Inhabits shallow, protected waters of bays, lagoons and estuaries including mangrove areas, in association with seagrass beds and macroalgae in depths at 0-10 m. Juveniles sometimes found clinging to floating algae and plant debris including Sargassum sp. rafts.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Trachyrhamphus bicoarctatus</i>	Bentstick Pipefish	P	Ma	Widespread in the tropical Indo-west Pacific. Bentstick Pipefish are known in Australian waters from the central coast of Western Australia, northwards throughout the waters of the Northern Territory and Queensland to central New South Wales. They live in sheltered coastal lagoon and reef areas on sandy and rubble habitats amongst seagrasses and macroalgae at 1-30 m.	(DPI) (PMST)	High. Potential habitat is present in the study area.
<i>Urocampus carinirostris</i>	Hairy Pipefish	P	Ma	In Australia, known from the Shoalwater Bay region (Queensland) to northern Tasmania, Victoria, and to the Ceduna region of South Australia, and in south-western Australia where it reaches the Perth region. Rare in South Australia. Inhabits the lower reaches of rivers, sheltered estuaries and shallow reefs in seagrass and algal beds a 0-6 m. One of the most common estuarine pipefishes in eastern Australia, occurring year-round in seagrass beds in Western Port (Victoria), and abundant in seagrass beds in Moreton Bay (Queensland).	(DPI) (PMST)	High. Potential habitat is present in the study area.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat requirements*	Number of records (source)+	Likelihood of occurrence
<i>Vanacampus margaritifer</i>	Mother-of-Pearl Pipefish	P	Ma	Endemic to sub-tropical and temperate Australia, from North Stradbroke island, Queensland, southwards to Jurien Bay, Western Australia, absent from Tasmania. Inhabits shallow estuarine and coastal waters in seagrass beds, macroalgae (<i>Ecklonia</i> spp. and other brown algae), rocky reef, boulder, rubble, sandy and muddy habitats between 2-15 m.	(DPI) (PMST)	High. Potential habitat is present in the study area.

* Distribution and habitat requirement information adapted from:

- Australian Government DAWE <https://www.environment.gov.au/biodiversity/threatened/species>.
- NSW DPIE-EES <http://www.environment.nsw.gov.au/threatenedSpeciesApp/> and
- NSW DPI (Fisheries) listed threatened species, populations and ecological communities <https://www.dpi.nsw.gov.au/fishing/species-protection/what-current>.

+ Data source includes

- Number of records from the NSW DPIE-EES Wildlife Atlas record data (Accessed April 2020) <http://www.bionet.nsw.gov.au/> and
- Australian Government DAWE PMST <http://www.environment.gov.au/epbc/protected-matters-search-tool>.

Key:

P = protected (FM Act only)

Ma = marine (EPBC Act only)

Appendix C – Aquatic habitat complexity examples



Plate E1: Example of high relief subtidal rocky reef in the Sydney Harbour area



Plate E2: Example of medium relief subtidal rocky reef in the Sydney Harbour area



Plate E3: Example of low relief subtidal rocky reef in the Sydney Harbour area

Appendix D – Assessments of Significance

Preamble

The Assessments of Significance (AoSs) have been completed by Jake Ludlow (BSc) and Dilys Zhang (BSc Hons.), ecologists for Cardno, for marine and coastal threatened species listed under the BC Act, FM Act and the EPBC Act that was identified as having a moderate to high potential to occur within the study area due to the presence of nearby records and/or the presence of suitable habitat. These species were identified in Section 3.11 and include:

- White's Seahorse (*Hippocampus whitei*) listed as endangered under the FM Act
- Black Rockcod (*Epinephelus daemeli*) listed as endangered under the FM Act and vulnerable under the EPBC Act
- Five microchiropteran bats (microbats):
 - Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) listed as vulnerable under the BC Act
 - Little Bent-winged Bat (*Miniopterus australis*) listed as vulnerable under the BC Act
 - Large Bent-winged Bat (*Miniopterus orianae oceanensis*) listed as vulnerable under the BC Act
 - Southern Myotis (*Myotis macropus*) listed as vulnerable under the BC Act
 - Greater Broad-nosed Bat (*Scoteanax rueppellii*) listed as vulnerable under the BC Act
- Grey-headed Flying Fox (*Pteropus poliocephalus*) listed as vulnerable under the BC Act and the EPBC Act.

No threatened ecological communities (TECs) occur within or next to the study area thus, no AoSs are required for this project.

Under the BC Act a 5-part test of significance is applied to determine whether an activity is likely to have a significant impact on listed threatened species, ecological communities, or their habitats, or will be carried out in a declared area of outstanding biodiversity value. The test of significance is set out in section 7.3 of the BC Act.

Part 7A of the FM Act lists threatened species, populations and ecological communities and key threatening processes (KTPs) for species, populations and ecological communities in NSW waters. Section 220ZZ of the FM Act outlines significant impact considerations to threatened species, populations and ecological communities listed under the FM Act. Under the FM Act, a '7-part test' is carried out to assess the likelihood of significant impact upon threat-listed species, populations or ecological communities listed under the FM Act. The document *Threatened Species Assessment Guidelines: The Assessment of Significance* (NSW DPI, 2008b) outlines a set of guidelines to help proponents of a development or activity with interpreting and applying the factors of assessment in the 7-part test. The guidance provided by the NSW DPI (2008b) has been used here in preparing the 7-part test.

For the species listing under the EPBC Act, a significance assessment has been completed in accordance with the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoE, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (DoE, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening. It is sufficient if a significant impact on the environment is a real or not remote chance or possibility (DoE, 2013).

Species listed under the BC Act/FM Act and the EPBC Act have been assessed using the corresponding assessment guidelines separately. Species with similar life stage/habitat requirements (i.e. tree-roosting and cave-roosting microbats) have been assessed together.

Assessment of significance (BC Act)

Tree-roosting microbats (Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*))

The factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are outlined below:

1. In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Eastern Coastal Free-tailed Bats are known to roost and breed in dry Eucalypt Forest, wet sclerophyll forest and riparian habitat (Atlas of Living Australia, 2020). Greater Broad-nosed Bats can occupy a range of habitat but are most frequently found in tall wet forests (NSW DPIE, 2017b). The Eastern Coastal Free-tailed Bat also has been found to breed in mangrove forests while the breeding ecology of the Greater Broad-nosed Bat remains more obscure. Both species are have preference to roost in tree hollows but would also inhabit man-made structures including under wharf/bridges and in rooves, which occur within the study area. They may roost in colonies but can also be solitary. There are no known maternity sites in or next to the study area.

The proposed works would require the removal of up to four landscape trees, some lawn areas and the intertidal concrete steps of the existing wharf structure. The existing wharf structure to be impacted is unlikely to be occupied by these species as these areas are inundated during high tide twice a day. The removal of four trees have potential to remove roosting habitat for local populations. However, the three Wildfire and one Smooth-barked Apple to be removed are juveniles and unlikely to form any habitat value for these species and removal of these trees is unlikely to remove any suitable roosting/breeding habitat for these species. The temporary removal of the lawn areas would remove some foraging habitat. The temporary removal of the lawn areas is unlikely to affect foraging for these species as they are purely aerial. Furthermore, their nocturnal foraging times are unlikely to coincide with land-based construction during the day. Thus, the project is unlikely to adversely affect the life cycle of these species such that a viable local population of these species is likely to be placed at risk of extinction.

2. In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
 - a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
 - b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

3. In relation to the habitat of a threatened species or ecological community:
 - a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
 - b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
 - c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The project would remove about 0.06 hectares of potential foraging and roosting habitat for these two species. The existing wharf structures to be removed by the project is not considered suitable habitat for these species (see (1)). The vegetation in the study area forms part of a fragmented landscape of urban, landscaped/modified vegetation. The removal of this area of vegetation is not predicted to further fragment or isolate habitat for these species. Furthermore, landscaped habitat is likely to be restored following construction completion rendering this disturbance to be temporary

in most areas. As discussed in (1), the habitat to be removed is not considered optimal for the roosting or breeding of these two species. The project is also not going to substantially affect the foraging habitat for these species during construction (see (1)). Thus, the project is unlikely to modify, fragment or isolate habitat important to the long-term survival of these species in the locality.

4. Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no Areas of Outstanding Biodiversity Value (AOBVs) listed for these two species. This question is not applicable, as no AOBVs have been listed for these species.

5. Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Of the KTPs listed under the BC Act, *Clearing of native vegetation* has the greatest potential to impact potential foraging habitat and suboptimal roosting habitat for these microbat species but is considered to impose only minimal impact on the total extent of potential habitat in the locality. Furthermore, the native vegetation to be cleared are landscaped vegetation and no remnant native vegetation would be impacted by the project (also see Section 4.1.7).

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* are likely to occur as a result of the project if weed controls are not implemented during and after the construction. However, weed invasion is likely to be limited to groundcover grass and herbaceous weeds and these weeds are unlikely to greatly impact on these two microbat species (also see Section 4.1.7).

Conclusion

While there is potential foraging and suboptimal roosting habitat for the Eastern Coastal Free-tailed Bat and the Greater Broad-nosed Bat throughout the study area, this habitat is widespread and not optimal for these two species. The project would remove potential roosting habitat for these species however, the trees to be removed did not exhibit features optimal for microbat roosts and are considered suboptimal habitat. The project would also remove up to 0.06 hectares of potential foraging habitat for these species. However, this was not considered to substantially impact these species due to their nocturnal foraging preference and being purely aerial during that time. Furthermore, the project would landscape and reinstate the majority of these areas following construction completion. Based on this, the project is unlikely to significantly impact these two species and a species impact statement (SIS) is not required.

Cave-roosting microbats (Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Little Bent-winged Bat (*Miniopterus australis*), Southern Myotis (*Myotis macropus*))

The factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are outlined below:

1. In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Little and Large Bent-winged Bats have known maternity sites in caves across south-eastern Australian spanning from the NSW/Queensland border to South Australia (Dwyer & Hamilton-Smith, 1965). These sites are not in the Sydney region and in most cases, have specific temperature and humidity characteristics. There are no known breeding locations for the Southern Myotis but roosting habitat include under bridges/wharves and in rooves.

The study area does not occur within or next to any known maternity sites for these species thus, the project is unlikely to interfere for breeding. The project would not remove any potential roosting habitat as the man-made structures with potential to form roosting habitat for these three species would remain intact. The intertidal steps of the existing wharf structure to be removed does not constitute suitable roosting habitat as they would be inundated at least twice a day. The temporary removal of the lawn areas would remove some foraging habitat. The temporary removal of the lawn areas is unlikely to affect foraging for these species as they are purely aerial. Furthermore, their nocturnal foraging times are unlikely to coincide with land-based construction during the day.

The project would create some disturbance over the water during water-based construction activities which would render this foraging habitat unavailable for the Southern Myotis during construction. However, the project would not substantially modify this foraging resource to permanently preclude it from the species foraging territory and upon completion of construction, this area would be once again available as foraging territory for the Southern Myotis. Furthermore, the proportion of potential habitat to be impacted by the project is very small compared to what is available in the wider locality. Thus, the project is unlikely to adversely affect the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.

2. In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
 - a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
 - b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

3. In relation to the habitat of a threatened species or ecological community:
 - a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
 - b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
 - c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The project would remove about 0.06 hectares of potential foraging habitat for these species. The vegetation in the study area forms part of a fragmented landscape of urban, landscaped/modified vegetation. The removal of this area of vegetation is not predicted to further fragment or isolate habitat for these species. Furthermore, landscaped habitat is likely to be restored following construction completion rendering this disturbance to be temporary in most areas. As discussed in (1), water-based activities may render potential foraging habitat for the Southern Myotis

unavailable during construction. However, this is not expected to be a surmountable impact to the species foraging range. Thus, project is also not going to substantially affect the foraging habitat for these species during construction and is unlikely to modify, fragment or isolate habitat important to the long-term survival of these species in the locality.

4. Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no AOBVs listed for these three species. This question is not applicable, as no AOBVs have been listed for these species.

5. Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A KTP is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Of the KTPs listed under the BC Act, *Clearing of native vegetation* has the greatest potential to impact potential foraging habitat and suboptimal roosting habitat for these microbat species but is considered to impose only minimal impact on the total extent of potential habitat in the locality. Furthermore, the native vegetation to be cleared are landscaped vegetation and no remnant native vegetation would be impacted by the project (also see Section 4.1.7).

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* are likely to occur as a result of the project if weed controls are not implemented during and after the construction. However, weed invasion is likely to be limited to groundcover grass and herbaceous weeds and these weeds are unlikely to greatly impact on these three microbat species (also see Section 4.1.7).

Conclusion

While there is potential foraging habitat for these three species throughout the study area, this habitat is widespread and not optimal. The project would remove up to 0.06 hectares of potential foraging habitat for these species and render the estuarine area not suitable for foraging for the Southern Myotis during construction. However, this was not considered to substantially impact these species due to their nocturnal foraging preference (in relation to land-based works) and being purely aerial during that time. Furthermore, the project would landscape and reinstate the majority of these areas following construction completion and estuarine habitat would be available as a foraging resource upon completion of water-based construction activities. Based on this, the project is unlikely to significantly impact these three species and a SIS is not required.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

The factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are outlined below:

1. In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Grey-headed Flying-fox (*Pteropus poliocephalus*) occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 kilometre of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.

There are no roost camps located within the study area. As such, the impacts of the project to the Grey-headed Flying-fox will be limited to loss of potential feeding habitat caused by clearing during the construction phase. The project would remove four trees which could provide potential foraging habitat while in bloom. Foraging habitat mainly comprises nectar resources from native trees and shrubs as well as fruit resources. The impact to potential foraging habitat would represent a very small percentage of the total extent of foraging vegetation present in the locality. The project is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species.

Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area, the project is not expected to significantly affect the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

2. In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
 - a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
 - b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

3. In relation to the habitat of a threatened species or ecological community:
 - a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
 - b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
 - c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The potential habitat of the Grey-headed Flying-fox within the study area is limited to foraging habitat. The extent of habitat for the Grey-headed Flying-fox will be reduced by about four trees. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered.

Importantly, the project will not result in fragmentation of habitat for the Grey-headed Flying-fox. This species is highly mobile and will freely fly long distances (up to 50 kilometre) over open areas including urbanised city centres to move between roost camps and foraging sites. The project will not affect the movement of the Grey-headed Flying-fox between habitat patches. The project will not impact on the most important habitats for Grey-headed Flying-fox within the locality, which are

roosting camps outside of the study area. Considering this, the project is unlikely to modify, fragment or isolate habitat important to the long-term survival of this species in the locality.

4. Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no AOBVs listed for this species. This question is not applicable, as no AOBVs have been listed for this species.

5. Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A KTP is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Of the KTPs listed under the BC Act, *Clearing of native vegetation* has the greatest potential to impact potential foraging habitat for the Grey-headed Flying-fox but is considered to impose only minimal impact on the total extent of potential habitat in the locality. Furthermore, the native vegetation to be cleared are landscaped vegetation and no remnant native vegetation would be impacted by the project (also see Section 4.1.7).

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* are likely to occur as a result of the project if weed controls are not implemented during and after the construction. However, weed invasion is likely to be limited to groundcover grass and herbaceous weeds and these weeds are unlikely to greatly impact on this species (also see Section 4.1.7).

Conclusion

The Grey-headed Flying-fox will experience a small reduction in the extent of suitable foraging habitat as a result of the project. No roosting camps or other important habitat will be impacted. The project is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. Thus, the project is unlikely to significantly impact the Grey-headed Flying-fox and a SIS is not required.

7-part test (FM Act)

White's Seahorse (*Hippocampus whitei*) – endangered (FM Act)

The following questions test whether a proposed development or activity is likely to significantly affect White's Seahorse:

1. In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

White's Seahorse has limited geographical distribution in Australia and is endemic to nine estuaries, coastal lakes and embayments from Wallis Lake in the north to Lake Illawarra in the south, along approximately 300 kilometre of the NSW coast (Harasti, et al., 2014). White's seahorse is known to occur at depths of between one and 15 metres and can be found in a wide range of habitat types (both natural and artificial). Natural habitat for White's Seahorse in estuaries includes marine vegetation (ie seagrass, macroalgae on rocky reef and mangroves) as well as sponges and corals (Australian Museum, 2020; Harasti, et al., 2014; Kuitert, 2009). In Sydney, they are often found associated with artificial structures, particularly protective swimming net enclosures and jetty pylons. Their use of artificial habitats appears to be most common in areas where natural habitat (such as seagrass, sponges and soft corals) has been lost (Fisheries Scientific Committee, 2019). The species is found to prefer habitats with dense epibiotic growth and avoids areas devoid of growth, possibly in relation to the greater availability of shelter and prey in these areas (Harasti, et al., 2010). Densities in artificial habitats such as swimming nets can be as much as one per square metre, but estimates in natural habitat have been around an order of magnitude less (Harasti, et al., 2012).

Data collected on breeding pairs found that White's Seahorse displays life-long monogamy, with three pairs observed remaining bonded over three consecutive breeding years (Harasti, et al., 2012). The breeding season for White's Seahorse extends between October to April (Australian Museum, 2020).

The study area is considered to provide suitable habitat for White's Seahorse in low to medium relief rocky reef (about 0.10 hectares) and existing wharf piles, tidal steps and pontoon (vertical area of about 0.01 ha). The loss of individuals from the removal of suitable habitat could affect the viability of local populations due to their monogamous breeding behaviour and site fidelity although the proportion of suitable habitat to be impacted is small relative to that available in the harbour. The precise number of White's Seahorse with potential to be impacted by the project, although likely to be small, is uncertain. Targeted surveys could be completed prior to the commencement of water-based construction activities to capture and relocate individuals in the study area. With this measure, the project is unlikely to adversely affect the life cycle of the White's Seahorse such that a viable local population of the species is likely to be placed at risk of extinction.

2. In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

3. In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
 - a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
 - b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

4. In relation to the habitat of a threatened species, population or ecological community:
 - a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
 - b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
 - c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the threatened species, population or ecological community in the locality

As indicated in (1), White's Seahorse are found in subtidal rocky reef and artificial structures which are both present in the study area. However, the optimal habitat and known populations are found elsewhere in the harbour (eg Clifton Gardens). It is also likely that the frequent exposure to ferry and other vessel wash may render habitat in the study area suboptimal. The proposal would permanently remove low to medium relief subtidal rocky reef under the pile footprint (508 millimetre diameter x2) and the piles and concrete structures associated with part of the existing wharf which forms suitable habitat for the species. The project would also shade <0.01 hectares of subtidal rocky reef which may lead to a change in assemblages in this small area. These are small proportions of potential habitat for the species in the study area and the wider harbour. Furthermore, the 11 piles and pontoon to be installed would form potential habitat for the species once habitat-forming species have colonised. Thus, although the project will remove habitat important for the long-term survival of the species, replacement habitat would be reinstated and habitat removal would not fragment or isolate potential habitat for the species in the harbour.

5. Whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly)

Critical habitat refers to those areas listed in the Register of Critical Habitat kept by NSW DPI (Fisheries). This question is not applicable, as no critical habitat has been listed for White's Seahorse.

6. Whether the proposed development or activity is consistent with a recovery plan or threat abatement plan

There is no recovery plan or threat abatement plan (TAP) for this species. It was, however, in the opinion of the Fisheries Scientific Committee that White's Seahorse is eligible to be listed nationally as endangered under the Common Assessment Method (Fisheries Scientific Committee, 2019). Since then, White's Seahorse has also been nominated for endangered-listing under the EPBC Act. Invitation to comment on the proposed listing came to a close 15 April 2020 and DAWE are currently reviewing the proposition.

In the interim, the Scientific Committee has recommended management actions for White's Seahorse, including:

- collate and synthesise data collected to quantify the significance of high and moderate risk threat interactions with *H. whitei* (medium priority)
- reduce the impact of public and private boat moorings that impact on *H. whitei* habitats (high priority)
- councils to maintain best practice management of protective swimming nets by using the suggested NSW DPI seahorse friendly cleaning methods (high Priority)
- consider information on *H. whitei* distribution, abundance and habitat preferences during development and review of Marine Park Zoning Plans (medium priority)
- negotiate with relevant authorities to encourage the identification, assessment and modification of natural resource management plans and policies to minimise impacts on *H. whitei* habitats (medium priority)
- continue to monitor the distribution and abundance of *H. whitei* at important sites (Port Stephens and Sydney Harbour) to inform population status and to assist in determining the effectiveness of recovery actions (high priority)
- develop and trial artificial habitats to promote recovery of *H. whitei* populations (high priority).

- implement research using eDNA to investigate the occurrence of *H. whitei* in estuaries and embayments across its range (high priority)
- implement genetics research to investigate population structure of *H. whitei* across its entire range (NSW and Qld) (medium priority)
- encourage the reporting of sightings of seahorses along the east coast of Australia to iSeahorse and iNaturalist (medium priority)

The project would not interfere with any of the above recommendations. Targeted surveys during pre-construction to capture and relocate the species could be completed in consultation with NSW DPI to align with some of the above management recommendations.

7. Whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

The KTP of *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* (FM Act) is of relevance given instream structures would be placed in or adjacent to White's Seahorse habitat. This KTP is discussed in Section 4.1.7. However, these structures are unlikely to substantially alter nearshore natural tidal flow and therefore would not be exacerbated by the project to impact White's Seahorse.

Conclusion

White's Seahorse are known to occur in the harbour and the study area provides suitable habitat for the species in subtidal rocky reefs and existing subtidal jetty structures. The project would include control measures to capture and relocate individuals prior to water-based construction activities, which would avoid any mortality to individuals in the study area. The project would also replace suitable habitat proposed to be removed such that there would not be a substantial loss, fragmentation or isolation of White's Seahorse habitat. Thus, the project is unlikely to have a significant impact on White's Seahorse with the implementation of construction measures and a small proportion of White's Seahorse habitat to be impacted in relation to that available in the harbour determines a SIS is not required.

Black Rockcod (*Epinephelus daemeli*) – endangered (FM Act)

The following questions test whether a proposed development or activity is likely to significantly affect Black Rockcod:

1. In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Black Rockcod, also known as Black Cod or Saddled Rockcod, occurs from southern Queensland to Kangaroo Island in South Australia and are found offshore at Lord Howe Island, Norfolk Island, Kermadec Islands and the North Island of New Zealand (Heemstra & Randall, 1993). New South Wales is the centre of the species distributional range in Australia. They are protogynous hermaphrodites (ie change sex from female to male) and at the time of spawning, males establish a harem within their territory. Black Rockcod are opportunistic carnivores, eating mainly other fish and crustaceans.

Black Rockcod are mostly found in caves and gutters in coastal areas. Dispersal of eggs is thought to be pelagic and juveniles can recruit to rockpools (Griffiths, 2002). Adults are highly territorial, usually adopting a cave as core territory. Black Rockcod have been observed by divers or caught by anglers in estuaries, including Sydney Harbour. Although the locations of these occurrences have generally been at the mouths of estuaries and involved juvenile fish, there is anecdotal evidence that Black Rockcod have been caught in embayments of the harbour. Although the species may have been prevalent in estuaries in the past (NSW Department of Industry and Investment, 2009), it is unlikely that viable populations of Black Rockcod currently occur in the estuary. The few individuals that occur are more likely to be part of one or many populations in nearby coastal areas. Since any Black Rockcod in the harbour are likely to form a very small proportion of a viable population of the species, and with the appropriate project controls to complete targeted surveys for individuals prior to water-based construction activities, project impacts would be negligible and would not affect the viability of local populations such that the species is placed at risk of extinction.

2. In the case of an endangered population, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

3. In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
 - a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
 - b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

4. In relation to the habitat of a threatened species, population or ecological community:
 - a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
 - b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
 - c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the threatened species, population or ecological community in the locality

As indicated in (1), Black Rockcod are mostly found in caves and gutters in coastal areas. Dispersal of eggs is thought to be pelagic and juveniles can recruit to rockpools (Griffiths, 2002). Adults are highly territorial, usually adopting areas of high relief rocky reef, such as a cave, for core territory. Although very few, if any, Black Rockcod may occur in suitable habitat within the study area now, more individuals probably occurred there in the past when the species was more prevalent, as there are past reports of many large individuals being caught in estuaries (NSW Department of Industry and Investment, 2009). In the future, if populations of Black Rockcod were to recover, the medium relief rocky reef areas in the study area may again become more commonly occupied.

Generally, the study area is occupied by low to medium relief rocky reef along the seawall. The project would permanently remove a very small area of this reef from the installation of three piles (508 millimetre in diameter) and generate some temporary disturbance from vessel/barge traffic, piling noise and vibration and anchoring during construction. The area of habitat removal is not considered to be substantial to fragment or isolate Black Rockcod habitat and the disturbance in the study area is temporary and the species is likely to move away and return once construction is complete. Shading of a small portion of subtidal rocky reef habitat could trigger changes to community assemblages in this area. However, the removal of the existing structure is likely to encourage macroalgae to recolonise a similar area to the shaded area, inherently improving habitat condition. Thus, although the project would remove Black Rockcod habitat, it would not fragment or isolate habitat important to the long-term survival of the species.

5. Whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly)

Critical habitat refers only to those areas listed in the Register of Critical Habitat kept by NSW DPI (Fisheries). This question is not applicable, as no critical habitat has been listed for Black Rockcod.

6. Whether the proposed development or activity is consistent with a recovery plan or threat abatement plan

A draft recovery plan for the Black Rockcod was placed on public exhibition in November 2009 (NSW Department of Industry and Investment, 2009). The specific objectives of the recovery plan are to:

- mitigate medium and high risk threats to Black Rockcod
- initiate and support scientific research to increase knowledge of the distribution, abundance, reproductive biology, life history, ecology, migratory patterns and genetics of Black Rockcod
- monitor fishery management strategies where necessary to reduce potential for interaction with Black Rockcod (either directly or indirectly)
- establish an on-going monitoring program to document the status of Black Rockcod populations and their habitats and to evaluate the effectiveness of recovery actions
- provide enhanced compliance and protection for important Black Rockcod habitats
- educate the community about the identification of Black Rockcod, increase awareness of the status of and threats to Black Rockcod populations, and enhance community support for recovery actions
- improve understanding of the threats to the survival of Black Rockcod and contribute to management actions to ameliorate identified threats.

The key objectives of the recovery plan are to mitigate medium and high risk threats to Black Rockcod. Included among these risks are the loss or degradation of estuarine and intertidal nursery habitats. As the project would impact a very small proportion of Black Rockcod habitat in the estuary, it is not considered a substantial loss or degradation of estuarine habitat. Thus, the project is not considered to interfere with any recovery objectives for the Black Rockcod.

7. Whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

The KTP of *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* (FM Act) is of relevance given instream structures would be placed in or adjacent to Black Rockcod habitat. This KTP is discussed in Section 4.1.7. However, these structures are unlikely to substantially alter nearshore natural tidal flow and therefore would not be exacerbated by the project to impact Black Rockcod.

Conclusion

Black Rockcod are known to occur in estuaries, particularly on medium to high relief rocky reefs. The project would remove a very small amount of potential habitat for the species from the installation of three piles and cause some temporary disturbance during construction. However, high condition habitat occurs in many areas in the harbour and due to the temporary nature of the vessel/barge and anchoring disturbance, the project is unlikely to significantly impact Black Rockcod and a SIS is not required.

Significant impact assessment (EPBC Act)

Black Rockcod (*Epinephelus daemeli*) – vulnerable (EPBC Act)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- a. lead to a long-term decrease in the size of an important population of a species

Black Rockcod, also known as Black Cod or Saddled Rockcod, occur from southern Queensland to Kangaroo Island in South Australia and are found offshore at Lord Howe Island, Norfolk Island, Kermadec Islands and the North Island of New Zealand (Heemstra & Randall, 1993). New South Wales is the centre of the species distributional range in Australia. They are protogynous hermaphrodites (ie change sex from female to male) and at the time of spawning, males establish a harem within their territory. Black Rockcod are opportunistic carnivores, eating mainly other fish and crustaceans.

Black Rockcod are mostly found in caves and gutters in coastal areas. Dispersal of eggs is thought to be pelagic and juveniles can recruit to rockpools (Griffiths, 2002). Adults are highly territorial, usually adopting a cave as a core territory. Black Rockcod have been observed by divers or caught by anglers in estuaries, including Sydney Harbour. Although the locations of these occurrences have generally been at the mouths of estuaries and involved juvenile fish, there is anecdotal evidence that Black Rockcod have been caught in embayments of the harbour. Although the species may have been prevalent in estuaries in the past (NSW Department of Industry and Investment, 2009), it is unlikely that viable populations of Black Rockcod currently occur in the estuary but rather a few individuals that occur would form part of one or many important populations in nearby coastal areas. Any Black Rockcod in the harbour are likely to form a very small proportion of an important population of the species, and appropriate project controls to complete targeted surveys for individuals prior to water-based construction activities so that individuals could be encouraged away from the project area would be implemented. Thus, the project impacts would unlikely impact the species such that an important population of the species would experience a long-term decrease in size.

- b. reduce the area of occupancy of an important population

As indicated in (a), Black Rockcod are mostly found in caves and gutters in coastal areas thus, the small number of individuals in the harbour are likely to form part of an important population in nearby coastal areas. There is low to medium relief rocky reef habitat in the study area which can form habitat for the species although the availability of gutters and caves may be limited compared to high relief reef habitat in other elsewhere in the harbour. The project would permanently remove a very small area of rocky reef habitat under the three piles to support the jetty (508 millimetre diameter). The study area would also experience some disturbance from vessel/barge movement and anchoring during construction. These impacts are unlikely to permanently reduce the area of occupancy of an important population as the study area would become available for Black Rockcod upon completion of construction and the small area of habitat below the three piles is unlikely to be important to the survival of individuals in the harbour.

- c. fragment an existing important population into two or more populations

As indicated in (a), the small number of individuals in the harbour are likely to form part of an important population in nearby coastal areas. The occupancy of these individuals in the harbour are likely to mostly surround medium to high relief rocky reef areas, as refuges, and open water as transiting areas. The project would not install any structures or remove substantial areas of habitat to fragment important populations of Black Rockcod as connectivity in the study area and the wider harbour would be maintained.

- d. adversely affect habitat critical to the survival of a species

See (b).

- e. disrupt the breeding cycle of an important population

Black Rockcod are protogynous hermaphrodites (ie change sex from female to male) and at the time of spawning males establish a harem within their territory. Dispersal of eggs is thought to be pelagic and juveniles can recruit to rockpools (Griffiths, 2002). As indicated in (a), Black Rockcod individuals in the harbour are likely to form part of an important population in nearby coastal areas, the habitat in the harbour is only a small proportion of habitat occupied by the species in its breeding cycle. Since any Black Rockcod in the harbour are likely to form a very small proportion of a viable population of the species, and with the appropriate project controls to complete targeted surveys for individuals prior to water-based construction activities to encourage any individuals in the study areas to vacate, project impacts would be negligible and would not disrupt the breeding cycle of an important population.

- f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

See (b) and (c).

- g. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Use of equipment and movement of vessels and barges have potential to act as vectors for introduced species. However, there are no known invasive species that could be introduced that could directly cause Black Rockcod to decline. Invasive species that would alter Black Rockcod habitat could be introduced via the aforementioned vectors however, project controls would be in place to avoid introductions. Thus, the project is unlikely to introduce or spread invasive species that are harmful to Black Rockcod.

- h. introduce disease that may cause the species to decline

As per (g).

- i. interfere substantially with the recovery of the species

State and Commonwealth recovery plans have been developed for the Black Rockcod. The specific objectives of the Commonwealth recovery plan are to:

- mitigate moderate and high risk threats to Black Rockcod
- initiate and support scientific research to increase knowledge of the distribution, abundance, reproductive biology, life history, ecology, migratory patterns and genetics of Black Rockcod
- monitor fishery management strategies where necessary to reduce potential for interaction with Black Rockcod (either directly or indirectly)
- establish an on-going monitoring program to document the status of Black Rockcod populations and their habitats and to evaluate the effectiveness of recovery actions
- provide enhanced compliance and protection for important Black Rockcod habitats
- educate the community about the identification of and 'best practice' catch and release methods for Black Rockcod, increase awareness of the status of and threats to Black Rockcod populations, and enhance community support for recovery actions
- improve understanding of the threats to the survival of Black Rockcod and contribute to management actions to ameliorate identified threats.

The key objectives of the recovery plan are to mitigate medium and high risk threats to Black Rockcod. Included among these risks are that juvenile Black Rockcod are impacted by the loss or degradation of estuarine and intertidal nursery habitats. As the project would impact a very small proportion of Black Rockcod habitat in the estuary, it is not considered a substantial loss or

degradation of estuarine habitat. Thus, the project is not considered to interfere with any recovery objectives for the Black Rockcod.

Conclusion

Black Rockcod are known to occur in estuaries, particularly on medium to high relief rocky reefs. The project would remove a very small amount of potential habitat for the species from the installation of three piles and cause some temporary disturbance during construction. However, high condition habitat occurs in many areas in the harbour and the study area only forms a very small proportion of available habitat for important populations of Black Rockcod. Thus, the project is unlikely to significantly impact Black Rockcod and a referral is not required.

Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable (EPBC Act)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- a. lead to a long-term decrease in the size of an important population of a species

There have been no roosting camps currently identified in the study area thus, the project would not directly affect any known breeding site of the Grey-headed Flying-fox. Therefore, the impacts of the project would be confined to loss of foraging habitat caused by direct clearing during the construction phase.

The project would directly remove four trees which form potential foraging habitat. Foraging habitat mainly comprises nectar resources from native trees as well as fruits of some exotic trees. This area of habitat may be defined as a portion of the potential area of occupancy for feeding lifecycle attributes of important populations. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 kilometre radius of the study area. Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of populations in the region, the project is not expected to lead to a long-term decrease in the size of an important population of the Grey-headed Flying-fox.

- b. reduce the area of occupancy of an important population

See (a). The project will reduce the area of foraging habitat available to the species however, the area occupied by this species will remain the same and disturbed areas would be landscaped and reinstated following construction completion.

- c. fragment an existing important population into two or more populations

There is currently a high degree of habitat fragmentation across the wide locality. Highly mobile species, such as Grey-headed Flying-foxes, are expected to be less impacted by fragmentation and this species is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom. Thus, the project would not fragment an important population of the Grey-headed Flying-fox.

- d. adversely affect habitat critical to the survival of a species

Habitat critical to the survival of a species refers to areas that are necessary for activities such as:

- foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species including the maintenance of other species essential to the survival of the species, such as pollinators
- to maintain genetic diversity and long-term evolutionary development
- for the reintroduction of populations or recovery of the species.

The proposed area of habitat loss represents a very small proportion of potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of the study area and known roosting camps in the region. This species typically exhibits very large home ranges and Grey-headed Flying-foxes are known to travel distances of at least 50 kilometres from roost sites to access seasonal foraging resources (Eby, 1996). No evidence of a Grey-headed Flying-fox camp has been identified in or next to the study area.

The draft recovery plan for the Grey-headed Flying-fox (Department of the Environment and Energy, 2017) identifies trees of the Myrtaceae family as important foraging habitat for this species. The project would require the removal of five of these trees however, the affected area of foraging habitat represent a small proportion of the total extent of important foraging vegetation types present within a 50 kilometre radius of the study area. Given the relative widespread nature of

similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations, the project is not expected to adversely affect habitat critical to the survival of the species.

- e. disrupt the breeding cycle of an important population

As stated above there would be a minor impact on foraging habitat identified as important during the breeding cycle of the species. The project would not directly affect a known roosting camp/breeding site.

- f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As stated above, no evidence of a roosting camp has been identified in or next to the study area and there would be a relatively minor impact on critical foraging habitat. Thus, the project is not expected to lead to a decline in populations of this species.

- g. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The potential for weed invasion was considered possible with a project of this nature and appropriate controls would be implemented during construction and operation to reduce this threat.

- h. introduce disease that may cause the species to decline, or

There are no known disease issues affecting this species in relation to the project. The project would be unlikely to increase feral animal abundance or the potential for significant disease vectors to affect local populations.

- i. interfere substantially with the recovery of the species.

The Draft Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*) (Department of the Environment and Energy, 2017) outlines the following actions:

1. identify, protect and enhance native foraging habitat critical to the survival of Grey-headed Flying-foxes.
2. identify, protect and enhance roosting habitat of Grey-headed Flying-foxes camps.
3. determine population trends in Grey-headed Flying-foxes so as to monitor species' national distribution and conservation status.
4. build community capacity to coexist with flying-foxes and minimise the impacts on urban settlements from existing camps without resorting to dispersal.
5. increase public awareness and understanding of Grey-headed Flying-foxes and the recovery program, and involve the community in the recovery program where appropriate.
6. improve the management of Grey-headed Flying-fox camps in sensitive areas.
7. significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture.
8. support research activities that will improve the conservation status and management of Grey-headed Flying-foxes.
9. assess and reduce the impact on Grey-headed Flying-foxes of electrocution on power lines, and entanglement in netting and on barbed-wire.

The recovery actions listed above are largely not applicable to the project as they focus on priority conservation lands that are outside of the study area, community awareness and research and development. In addressing action 1, given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations, the project is not expected to interfere substantially with this recovery action by removing a very small proportion of a foraging resource. Furthermore, vegetation

prevalent with exotic species would be replaced with native species local to the Sydney region during landscaping.

Conclusion

The Grey-headed Flying-fox will suffer a small reduction in extent of suitable foraging habitat from the project. No roosting/breeding camps or other important habitat will be impacted. The project is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The project will not interfere with the recovery of the Grey-headed Flying-fox and will not contribute to the key threats to this species. Thus, the project is unlikely to significantly impact the Grey-headed Flying-fox and a referral is not required.

Appendix E

Noise and vibration impact assessment

Noise and Vibration Impact Assessment

North Sydney Wharf Upgrade

AWE200198



Prepared for
Transport for NSW

13 October 2020

Document Information

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Executive Summary

This noise and vibration impact assessment was conducted on behalf of Transport for NSW (TfNSW), for inclusion in the Review of Environmental Factors prepared for the proposed North Sydney Wharf upgrade. North Sydney wharf is a commuter wharf located about one kilometre from the centre of North Sydney. Currently, the wharf interchange does not provide equitable access to ferry services.

The water based features of the proposal would include:

- > Installation of a new seven-metre long by three-metre wide concrete jetty, supported by three new piles, including minor modifications to the top of the seawall
- > Installation of a new 12-metre by 27-metre pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with pivot piles (to assist vessel berthing) provided at either end of the pontoon
- > Installation of a new 18-metre uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- > Installation of two protection piles on the northern side of the gangway
- > Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- > Safety and security features on the pontoon including an emergency help point, lighting, CCTV, ladders to the water and a life buoy and tactile indicators where required.

The land based features of the proposal would include:

- > One accessible parking space at the cul-de-sac end of High Street
- > One kiss-and-ride space or zone at the cul-de-sac end of High Street
- > Three new bicycle parking hoops
- > Footpath regrading to produce a *Disability Standards for Accessible Public Transport 2002* (DSAPT) compliant grade
- > Installation of a new accessible ramp between the existing footpath and the new gangway
- > One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- > Installation of new wayfinding signage, information boards, and opal card readers
- > Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter
- > Removal and replacement of up to four trees to construct the accessible pathway.

This assessment has been carried out to determine the predicted noise impacts associated with the construction of the proposed North Sydney Wharf upgrades.

Noise modelling has been carried out to determine whether the proposed construction works associated with the proposal are likely to impact nearby noise sensitive receivers.

This assessment considers the following impacts on nearby noise sensitive receivers:

- > Noise impacts from construction of the project in accordance with NSW EPA (formerly the Department of Environment & Climate Change (DECC)) and Roads & Maritime guidelines for the control of construction noise impacts
- > Construction vibration from the project in accordance with NSW EPA (formerly the Department of Environment & Conservation (DEC)) and Roads & Maritime guidelines for assessing vibration.

Construction noise and vibration guidelines

This assessment considers the following policies and guidelines:

- > NSW Interim Construction Noise Guideline (DECC 2009) (ICNG)
- > NSW Assessing Vibration – A Technical Guideline (DEC 2006) (AVATG)
- > Roads and Maritime Construction Noise and Vibration Guideline (RMS 2016) (CNVG).

Assessment conclusions

The assessment identified the following conclusions:

- > In accordance with the noise management levels stipulated in Section 5.1, dwellings exposed to levels of construction noise above 75 dB(A) are considered highly noise affected, with dwellings exposed to levels above the daytime RBL +10 dB(A) considered noise affected
- > Construction noise levels are predicted to exceed the NSW ICNG noise management levels (NML) for “standard” hours at all noise catchment areas (NCA) for standard construction hours for all construction stages
- > Construction noise levels are predicted to significantly exceed management levels for “non-standard” hours of operation for Stage 3a, 3b and 3c at the nearby residential receivers in both NCAs, particularly for receivers located on High Street. This is due to the proximity of receivers to the construction works
- > Predicted levels are expected to be highly intrusive at a significant number of receivers in NCA 2 for Stage 3a, 3b and 3c for works during out of hours period 1 (OOH1) and OOH period 2. Construction noise is likely to have a higher impact on and cause sleep disturbance at sensitive receivers located on High Street due to their proximity to the proposed work site
- > Highly intrusive noise levels were not predicted for NCA1 for any of the construction stages
- > It should be noted that this assessment has endeavoured to carry out “worst case” noise modelling, and noise levels are predicted based all modelled sources operating simultaneously. Should the work sites or plant and equipment be amended, the predicted noise levels will change accordingly
- > The predicted exceedances are generally a result of works being located in close proximity to the adjacent receivers. This modelling has been carried out to provide a worst case scenario and it may be possible to reduce the number of plant operating simultaneously, particularly at night, once detailed construction schedules are known
- > Provision of temporary noise barriers is not likely to be practical for this site given the elevated nature of the surrounding receivers. However, provision of anti-gawk screens with no gaps around the work site may provide some screening to the closest ground level receivers, and should be investigated further as part of the project construction noise and vibration management plan (CNVMP) assessment
- > Best practice mitigation measures are recommended in Section 8 of this report
- > An indicative assessment only of expected L_{Amax} impact has been carried out for this assessment as it is difficult to predict L_{Amax} for construction noise sources. It is generally expected that sleep disturbance criteria are likely to be exceeded unless the proposed number and type of plant are reduced for out of hours works
- > A detailed CNVMP should be prepared for the project prior to construction commencement to incorporate the recommendations detailed in Section 8 and updated to reflect the proposed staging and plant to be adopted for the project
- > The minimum working distances indicated in Table 7-1 for cosmetic damage must be complied with at all times, unless otherwise approved by TfNSW or under the environmental license as relevant, as stipulated in the NSW CNVG.

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Technical Terms

Term	Definition
Adverse Weather	Weather effects that enhance noise (that is, wind and rain) that occur at a site for a significant period of time (that is, wind exceeding 5 m/s and rain exceeding 0.5 mm per hour during any measurement period.)
A-weighted Level	As per dB(A) defined below.
Ambient Sound	Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far.
AV:ATG	New South Wales Office of Environment and Heritage Assessing Vibration: A Technical Guide (DEC 2006)
Background Sound Level	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted external ambient noise sources.
CoRTN	Calculation of Road Traffic Noise, HMSO 1988
dB(A)	Unit of acoustic measurement electronically weighted to approximate the sensitivity of human hearing to sound frequency.
DEC	NSW Department of Environment and Conservation, now known as the NSW Office of Environment and Heritage
DECC	NSW Department of Environment and Climate Change, now known as the NSW Office of Environment and Heritage
DECCW	NSW Department of Environment and Climate Change and Water, now known as the NSW Office of Environment and Heritage
Decibel, dB	Unit of acoustic measurement. Measurements of power, pressure and intensity may be expressed in dB relative to standard reference levels.
ECRTN	New South Wales superseded Office of Environment and Heritage Environmental Criteria for Road Traffic Noise (EPA 1999).
ENMM	The New South Wales Department of Roads and Maritime Safety Environmental Noise Management Manual (RTA 2001).
EPA	New South Wales Environmental Protection Authority
ICNG	New South Wales Office of Environment and Heritage Interim Construction Noise Guideline (DECCW 1999).
INP	New South Wales Office of Environment and Heritage Industrial Noise Policy (EPA 2000).
L90, L10 etc.	A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, i.e. L90 is the level which is exceeded for 90 percent of an observation period. L90 is commonly referred to as a basis for measuring the background sound level.
L _A g, T	The A-weighted background sound level measured over a time interval T.
L _A eq, T	Equivalent continuous A-weighted sound pressure level. This is the value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.
NSW	New South Wales
RBL	Rating Background Level
RNP	New South Wales Office of Environment and Heritage Road Noise Policy (DECCW 2011).
RTA	NSW Roads and Traffic Authority, now known as the NSW Department of Transport, Roads and Maritime Services
Roads and Maritime, RMS	NSW Roads and Maritime Services, now known as TfNSW

Term	Definition
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound Pressure Level, Lp, dB, of a sound	A measurement obtained directly obtained using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 microPascals.
Sound Power Level, Lw, dB of a source	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power level is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt.
TfNSW	NSW Transport for NSW

1 Introduction

This noise and vibration impact assessment was conducted on behalf of Transport for NSW (TfNSW), for inclusion in the Review of Environmental Factors prepared for the proposed North Sydney Wharf upgrade.

The North Sydney Wharf is located beside Kesterton Park on the northern side of Sydney Harbour within the North Sydney local government area. The existing wharf consists of the ferry jetty, associated shade structure and existing footpaths.

The assessment has been carried out to determine the predicted noise and vibration impacts associated with the construction of the proposed North Sydney Wharf upgrade.

Noise modelling has been carried out to identify any potential noise impacts on nearby noise sensitive receivers as a result of proposed construction works associated with the proposal.

This assessment considers the following policies and guidelines:

- > NSW Interim Construction Noise Guideline (DECC 2009) (ICNG)
- > Roads and Maritime Construction Noise and Vibration Guideline (RMS 2016) (CNVG)
- > NSW Assessing Vibration – A Technical Guideline (DEC 2006) (AV:ATG).

In undertaking the assessment, unattended noise monitoring was conducted to measure the existing ambient noise levels at various noise sensitive locations near the proposed North Sydney Wharf upgrade construction work site, north and south of the proposed site.

3D noise modelling software (SoundPLAN 8.2) was used to create a noise model of the existing scenario. The 3D model was then used to predict construction noise levels associated with the proposed works impacting on nearby noise sensitive receivers by adopting the appropriate construction staging scenarios.

1.1 Assessment Objectives

The assessment objectives are to determine the predicted levels of construction noise and vibration impact on sensitive receivers located near to the proposal, and to determine the levels of mitigation that are likely to be required, if applicable, to enable compliance with the current NSW legislation.

2 Proposal Description

2.1 Proposal Description

The water based features of the proposal would include:

- > Installation of a new 3.3-metre long by 3.3-metre wide concrete jetty, supported by three new piles, including minor modifications to the top of the seawall
- > Installation of a new 12-metre by 27-metre pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with pivot piles (to assist vessel berthing) provided at either end of the pontoon
- > Installation of a new 18-metre uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- > Installation of two protection piles on the northern side of the gangway
- > Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- > Safety and security features on the pontoon including an emergency help point, lighting, CCTV, ladders to the water and a life buoy and tactile indicators where required.

The land based features of the proposal would include:

- > One accessible parking space at the cul-de-sac end of High Street
- > One kiss-and-ride space or zone at the cul-de-sac end of High Street
- > Three new bicycle parking hoops
- > Footpath regrading to produce a *Disability Standards for Accessible Public Transport 2002* (DSAPT) compliant grade
- > Installation of a new accessible ramp between the existing footpath and the new gangway
- > One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- > Installation of new wayfinding signage, information boards, and opal card readers
- > Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter
- > Removal and replacement of up to four trees to construct the accessible pathway.

Figure 2-1 shows the key features of the proposal including the water-based and land-based components.

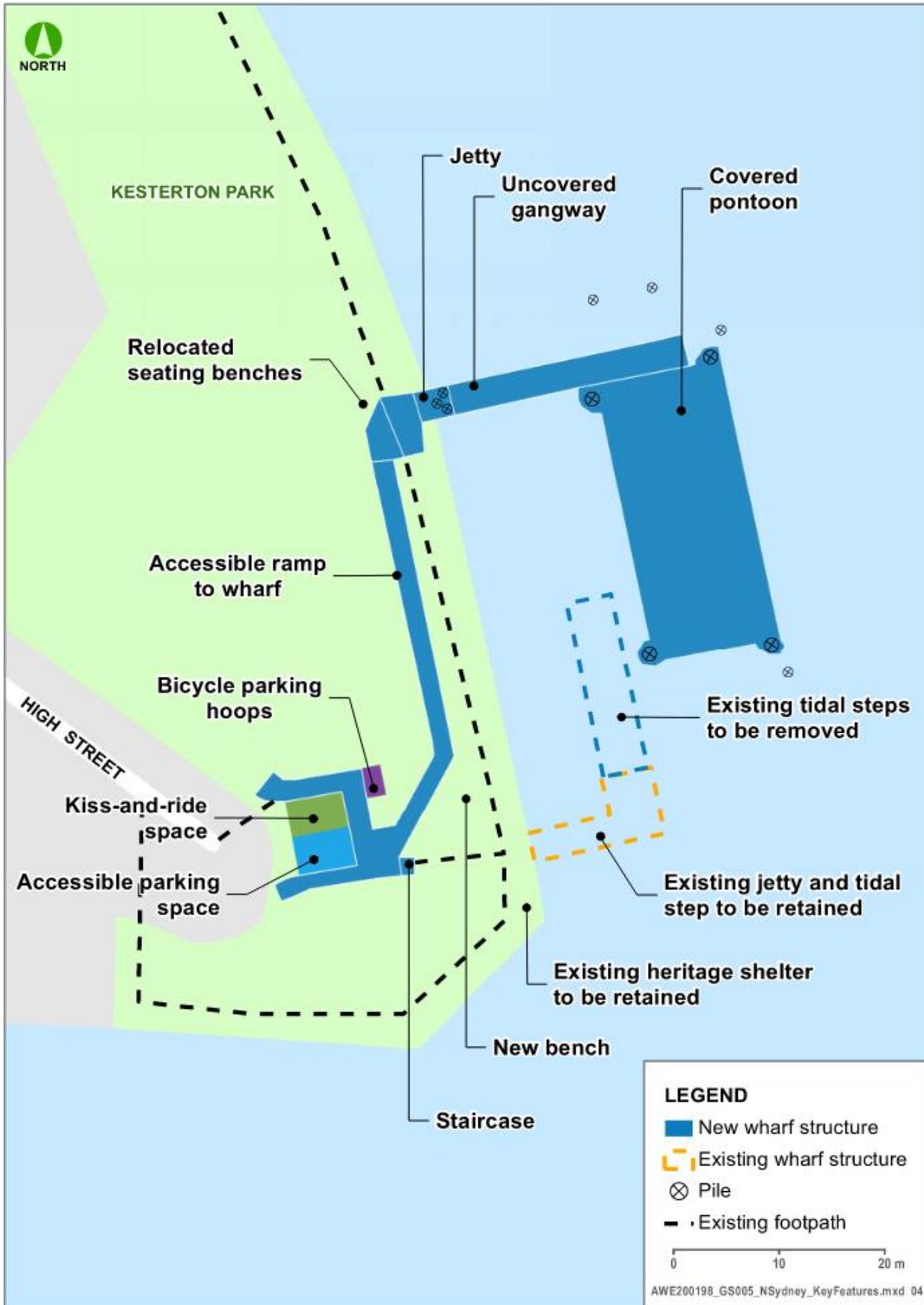


Figure 2-1 Key features of the proposal

2.2 Existing Site Description

The North Sydney Wharf is located on the northern side of Sydney Harbour approximately 580 metres east of the southbound lane of the Sydney Harbour Bridge. The existing wharf is surrounded by a range of noise sensitive receivers, mostly residential. Non-residential receivers include recreational areas such as Kesterton Park, Milsons Park and Sub Base Platypus and educational facilities such as Loreto Kirribilli School.

The assessment area for the southern section of the proposal, is shown in Figure 2-2 and includes the land uses listed in Table 2-1.

Table 2-1 Existing land uses southern section

Label	Description	Land Use
1	Kurraba Reserve	Passive Recreation
2	Residential North/East	Residential
3	Residential West	Residential
4	Sub Base Platypus	Defence Facility
5	Kesterton Park, including the locally listed heritage shelter and seawall (within the curtilage of Kesterton Park)	Passive Recreation
6	Milson Park	Passive Recreation
7	Residential South/West	Residential
8	Our Lady of The Sea Catholic Church	Place of Worship
9	Residential SSW	Residential
10	Loreto Kirribilli School	School
11	Residential South	Residential
12	Theatre	Theatre
13	Wrixton Park	Passive Recreation
14	Yacht Squadron	Community Facility

The above locations are shown in Figure 2-2.



Figure 2-2 Site location and surrounding land uses

2.3 The Proposal

The proposed upgrade to the existing High Street, North Sydney Wharf is a TfNSW initiative to provide a modern and integrated upgrade to transport infrastructure in NSW.

The proposal generally comprises the construction stages, onsite activities and timing listed in Table 2-2.

Table 2-2 Construction stages

Construction Stage	Proposed Activities
Stage 1 - Site establishment (up to 1 month)	<p>Land-side works</p> <ul style="list-style-type: none"> Establishment of a temporary site compound (erect site offices, amenities and plant/material storage areas etc.) on the land. The site compound would be located in Kesterton Park Site entry and exit points, and haul roads would be established for the construction work site Traffic control measures (including for vehicles, watercraft, pedestrians and cyclists) would be established in accordance with the traffic management plan. Appropriate wayfinding signage would be installed advising of alternative transport options where necessary Environmental controls would be established in accordance with the CEMP. <p>Water-side works</p> <ul style="list-style-type: none"> Establishment of a construction work area using floating booms to delineate this area. This would make allowance for the outward reach of the construction barge’s four anchorage points, over which marine vessels may not cross for safety reasons. The anticipated size of the barges is up to about 20 metres by 30 metres Environmental controls would be established in accordance with the construction environmental management plan.

Construction Stage	Proposed Activities
	<p>Demolition and removal of existing wharf structure</p> <ul style="list-style-type: none"> ▪ The existing wharf would be closed when safe navigable access to the wharf cannot be maintained ▪ Three of the four tidal steps would be demolished ▪ The six piles and three fender piles associated with the three tidal steps would be removed. Removal would be via vibration while pulling with a crane barge. If piles cannot be removed using this methodology, then a water blaster would be used to clear to rock to allow the piles to be then to be cut and capped.
<p>Stage 2 - Construction of land side works (1 to 2 months)</p>	<ul style="list-style-type: none"> ▪ Land side works would involve the installation of retaining walls, ramps, earthworks, a new accessible parking space, kiss-and-ride space, footpaths and landscaping ▪ Clear and grub the site and demolish existing pavements ▪ Install new storm water system including new drainage along the western side of the new accessible walkway and replacement of the existing kerb and gutter at the High Street cul-de-sac with new dish drain ▪ Construct new jetty (approximately 3.3 metres by 3.3 metres) including modifications to the top of the seawall ▪ Construct a new retaining wall along the eastern side of the new accessible ramp. The grassed area of Kesterton Park on the western side of the retaining wall and accessible ramp would be regraded to suit the new ramp and sub-soil drainage. There would be a height difference between the accessible ramp and the existing footpath. The retaining wall would be approximately 0.25 metres wide and would vary in height between 0.45 and 1.47 metres. The retaining wall materials would be consistent with the existing urban design and landscape character (e.g. local stone) ▪ Retaining walls would also be constructed along the northern side of the bicycle hoop and kiss and ride space, and along the southern side of accessible parking space ▪ Build up earthworks levels and construct new ramps ▪ Construct new parking area ▪ Construct new pavement and kerbs ▪ Finishing works (architectural, landscaping, street furniture, etc.).
<p>Stage 3 - Installation of steel piles within the waterway (up to 1 month)</p>	<ul style="list-style-type: none"> ▪ Steel locator piles for the pontoon, foundation piles for the jetty and protection piles would be installed into bedrock. These piles would be transported by barge to the site from the off-site facility ▪ The installation of the piles for the jetty would likely be undertaken by a barge mounted piling rig. The piles would be installed near to the wall but without impacting the existing seawall. The jetty would be an independent structure to the seawall. ▪ Guide piles required for the pontoon would be installed via a barge mounted piling rig ▪ Typically pile foundation systems would be piled into bedrock as follows: <ul style="list-style-type: none"> ○ teeth welded to the bottom of piles ○ positioning steel pile with crane mounted driving unit ○ driving the steel pile casings into position ○ cutting the steel pile casings to length and backfilling with concrete.
<p>Stage 4 - Installation of the pontoon and gangway (up to 1 month)</p>	<ul style="list-style-type: none"> ▪ The existing wharf would be closed when navigable access to the wharf cannot be maintained ▪ Lifting and placement of components for the new wharf would be carried out using a barge-mounted crane ▪ The new pontoon structure would be constructed at an off-site facility and floated to site. The pontoon would be secured to the locator piles and packing plates used to trim the plan position ▪ The new gangway would be fabricated at an off-site facility and floated to site by barge. The gangway would be lifted into position by the crane ▪ Finishing works completed (architectural, services, handrails, etc.).
<p>Stage 5 Installation of new or improved</p>	<ul style="list-style-type: none"> ▪ Provision for new Opal readers ▪ Installation of new microwave aerial and removal of the existing aerial ▪ Installation of bicycle parking hoops adjacent to the wharf

Construction Stage	Proposed Activities
facilities & Site Clean up (up to 1 month)	<ul style="list-style-type: none"> ▪ Installation of wayfinding signage ▪ Landscaping of the construction areas.
Stage 6 – Site Clean Up (up to 1 month)	<ul style="list-style-type: none"> ▪ The site would be cleaned up and restored to its previous state ▪ Sedimentation controls and temporary structures would be removed.

3 Existing Noise Environment

The existing acoustic environment is generally dominated by road traffic noise on local roads, noise from boats on the harbour and distant traffic due to the wharfs proximity to the Sydney Harbour Bridge.

3.1 Unattended Noise Monitoring Methodology

Unattended noise monitors were installed at the following two locations to measure ambient (i.e. background) noise levels for a period of seven days to determine the ambient background noise levels. Noise monitors were configured to measure 15-minute statistics, between the 30 April and 7 May 2020.

The unattended noise monitors were configured to measure noise levels as follows:

- > 'A' weighting
- > 'Fast' response
- > 15 minute statistical intervals
- > Measurement descriptors $L_{A_{Max}}$, $L_{A_{eq}}$, L_{A1} , L_{A10} , L_{A90} .

The loggers were deployed at the following locations (Figure 3-1):

- > **Logger 1** was approximately 23 metres from 135 Kurraba Road and approximately 411 metres from the North Sydney Wharf site
- > **Logger 2** was located approximately 25 metres from 146 High Street and approximately 86 metres from the North Sydney Wharf site.

Unattended noise monitoring was carried out using the equipment listed in Table 3-1.

Table 3-1 Noise monitoring equipment

Location	Logger Type	Serial Number
1	ARL EL-316	16-302-490
2	ARL EL-316	16-302-485

3.1.2 Potentially Altered Noise Environment

It should be noted that the background noise monitoring was conducted during COVID 19 and may represent non-typical background noise levels on this basis. Therefore, background noise levels may need to be re-determined (with short term monitoring) prior to construction to ensure that they are similar to those measured, and used as a basis for the noise management levels in this report.



Figure 3-1 Noise monitoring locations

3.2 Equipment Calibration

Calibration of the sound monitoring equipment was conducted before and after the measurement period, with a variance of less than $\pm 0.3\text{dB}$ recorded.

3.3 Metrological Monitoring Conditions

A summary of the environmental conditions noted during the measurement period were as follows (source weather station located on site):

3.3.1 Monitoring period – 30 April to 7 May 2020

- Conditions: Mostly Fine with some showers on 30 April and 5 May.
- Wind: 1 - 8 m/s predominantly from a west south west (WSW) direction
- Humidity: 30 – 89 per cent
- Temperature: 10 – 25°C

Detailed weather information recorded at the site during the monitoring period is detailed in Appendix B. Data was excluded for rain periods during the monitoring period.

Slightly elevated winds occurred intermittently on two of the monitoring days only. It should be noted that Bureau of Meteorology wind speed was recorded at 7 metres above the ground and that the ground level wind speed is significantly less. Adjustments have been made for this in Appendix B. As shown in Appendix B, adjusted wind speed of more than 5 m/s was observed on occasions. However, these exceedances occurred for a short period of time and did not affect the monitored noise levels on-site. As such, no data was removed from the monitoring results.

3.4 Measurement parameters

As environmental noise varies with time, the use of statistical descriptors is necessary to understand and describe these variations. For road traffic noise these descriptors are further classified for day time (7am - 10pm) and night time (10pm - 7am).

For environmental noise, the assessment period for day time is further split into day (7am – 6pm) and evening (6pm – 10pm). A-weighted statistical levels are used to describe ambient noise levels. The common descriptors used to describe environmental noise are described as follows:

L_{Amax} : the A-weighted maximum noise level measured during the measurement period

L_{A1} : the A-weighted noise level exceeded for 1 per cent (%) of the measurement period

L_{A10} : the noise A-weighted level exceeded for 10 per cent (%) of the measurement period, generally referred to as the average maximum sound pressure level

L_{A90} : the A-weighted noise level exceeded for 90 per cent (%) of the measurement period, generally referred to as the background noise level (refer AS 1055.1 – 1997)

L_{Aeq} : the equivalent continuous noise level over the measurement period, generally referred to as the energetical average sound pressure level over the measurement period.

3.5 Measured noise levels

Measured noise levels at each logger location were observed to be affected by the following:

Table 3-2 Observed existing noise environment

Logger	Location	Observed Noise Environment
1	Kurraba Road	The primary source of noise was from local traffic along Kurraba Road and general noise from nearby waterway vessels.
2	High Street	The primary source of noise was from local traffic along High Street and general noise from nearby waterway vessels. Distant traffic from the Sydney Harbour Bridge was also audible while on site.

3.5.2 Rating background noise level

The Rating Background Level (RBL) for each site was determined in accordance with the Noise Policy for Industry (EPA, 2017) (NSW NPI). The RBL is defined by the NSW NPI as follows:

“Rating background level (RBL)—the overall single figure background level representing each assessment period (day / evening / night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level). The rating background level is the level used for assessment purposes. Where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A).”

The weather affected data (due to wind or rain) was excluded from the analysis in accordance with the NPI requirements. The RBL applicable to each site is detailed below in Table 3-3.

The measured RBLs from Table 3-3 have been used to formulate the noise objectives for construction noise impacts as detailed in Section 5.1.

Table 3-3 Rating background noise level

Logger	Measurement Location	Measured Rating Background Noise Level, dB(A)		
		07:00-18:00	18:00-22:00	22:00-07:00
1	Kurraba Road	45	42	38
2	High Street	45	40	34

The measured RBLs from Table 3-3 have been used to formulate the noise objectives for construction noise impacts as detailed in Section 5.1. Typical measured noise levels, averaged from measured data, are shown below in Figure 3-2 for Logger 1 and Figure 3-3 for Logger 2. Full noise charts are displayed in Appendix A.

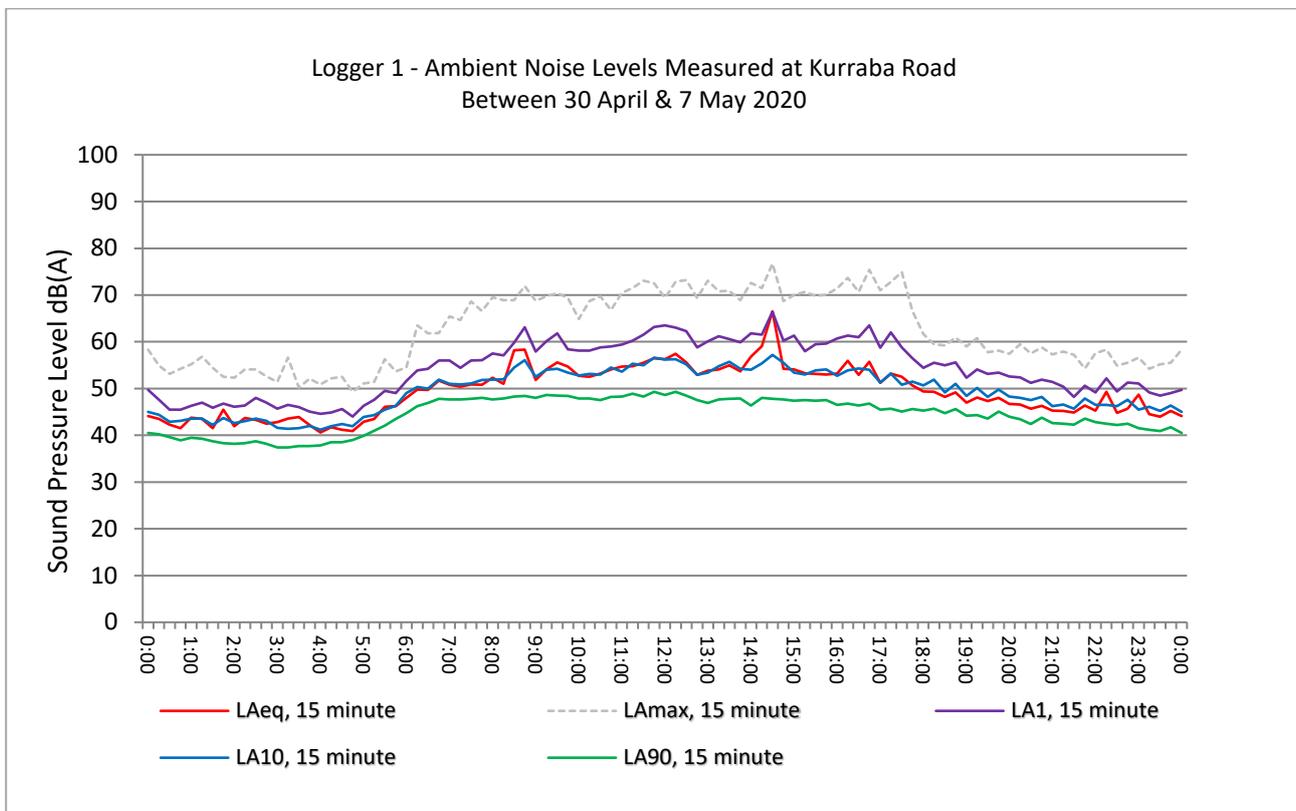


Figure 3-2 Averaged measured noise levels – logger 1

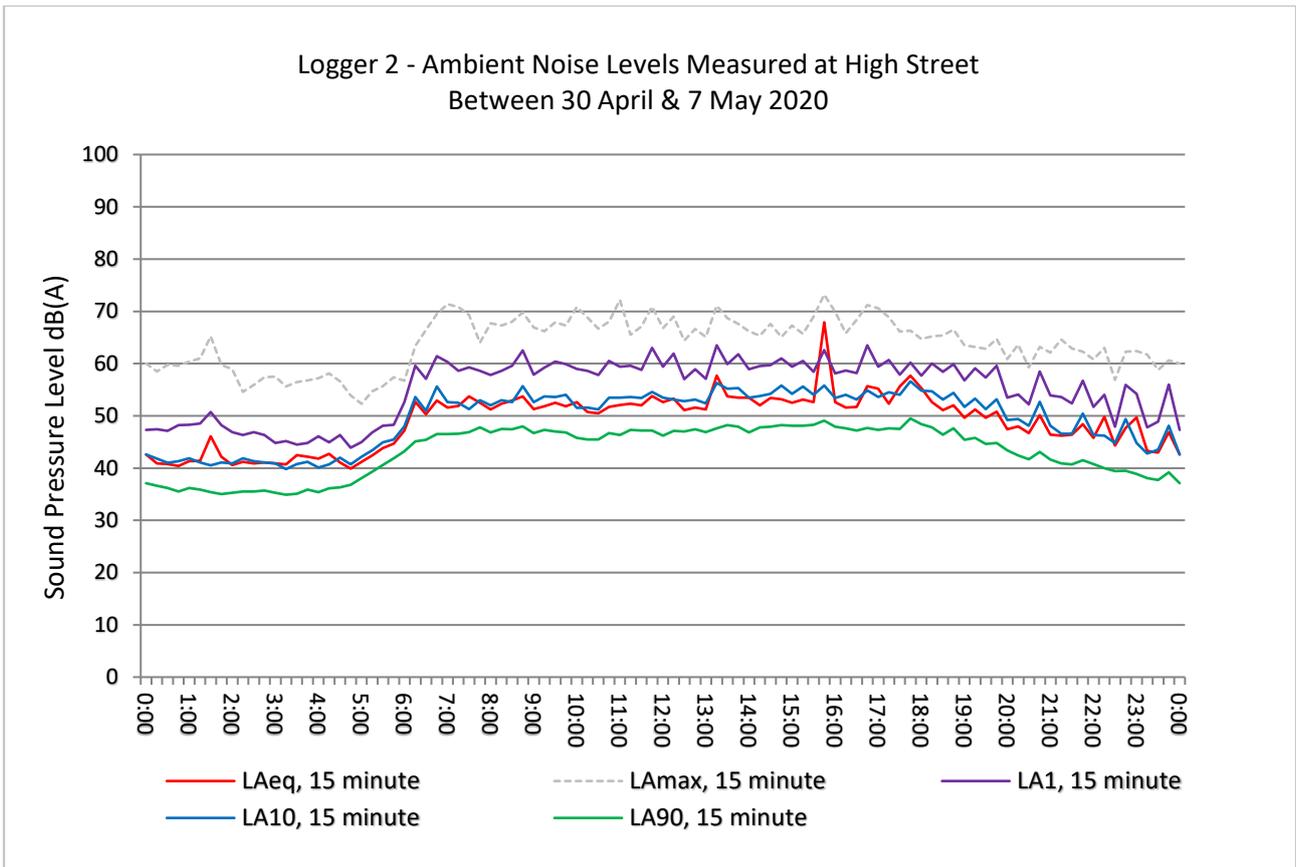


Figure 3-3 Averaged measured noise levels – logger 2

4 Statutory Noise and Vibration Criteria

4.1 Noise Criteria

4.1.1 Roads and Maritime Construction Noise and Vibration Guideline

The Roads and Maritime Construction Noise and Vibration Guideline (Roads and Maritime 2016) (CNVG) provides a framework for the assessment of noise during the construction phase of the project. The CNVG references the following documents to provide the criteria for the assessment of construction noise and vibration impacts:

- > EPA Interim Construction Noise Guideline
- > EPA Assessing Vibration – Technical Guideline
- > EPA Road Noise Policy (RNP).

The CNVG provides recommended minimum separation distances between vibration intensive plant and sensitive receivers for minimising the risk of cosmetic damage. The CNVG further states that the minimum working distance for cosmetic damage must be complied with at all times, unless otherwise approved by Transport for NSW or under the environmental licence as relevant. The minimum working distances are summarised below in Section 7.1.2

4.1.2 Interim Construction Noise Guideline

4.1.2.1 Airborne Construction Noise

NSW Office of Environment & Heritage (OEH) provides guidance for assessing construction noise impacts in the Interim Construction Noise Guideline (DECC, 2009) (NSW ICNG).

The level of noise impact and the requirement for mitigation measures is generally determined by the timing and duration of the noise emissions and the perceived impact of the noise above existing background noise levels.

It is important to note that the guideline distinguishes between qualitative and quantitative noise assessments based on the type and duration of construction activities. For example, a qualitative assessment is warranted for road maintenance type works of short duration, whereas a quantitative assessment is preferred for major infrastructure works.

Section 4 of the guideline outlines the quantitative assessment method, which establishes noise management levels and assessment requirements for proposed construction activities over three weeks duration.

The noise management level for potentially affected residential properties, as taken from Section 4.2 of the ICNG, is detailed in Table 4-1.

Table 4-1 Noise at residences using quantitative assessment (Source: DECC, 2009)

Time of day	Management level $L_{Aeq} (15 \text{ min})^*$	How to apply
Recommended standard hours: Monday to Friday: 7am to 6pm Saturday 8am to 1pm: No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq} (15 \text{ min})$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

Time of day	Management level L_{Aeq} (15 min)*	How to apply
	Highly noise affected 75 dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:</p> <p>Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences)</p> <p>If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</p>
Outside recommended standard hours	Noise affected RBL + 5 dB	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.</p> <p>For guidance on negotiating agreements see section 7.2.2.</p>

Notes:

(1) For Residential receivers - Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30 metre from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

(2) Other sensitive use receivers - Internal noise levels are to be assessed at the centre of the occupied room. External noise levels are to be assessed at the most affected point within 50 m of the area boundary

A strong justification would typically be required for works outside the recommended standard hours (see Table 4-1). The proponent should apply all feasible and reasonable work practices to meet the noise affected level. The definition of feasible and reasonable work practices is outlined in Section 1.4 of the NSW ICNG, with the following excerpts providing a brief description:

“A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.”

“Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.”

A number of factors may be considered in selecting reasonable measures, including the level of impact, the number of people affected, and the order of treatments applied to previous, similar projects. Where all feasible and reasonable practices have been applied and noise remains more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community on suitable mitigation measures. For guidance on negotiating agreements see section 7.2.2 of the NSW ICNG.

4.1.2.2 Sleep Disturbance

Section 4.3 of the NSW ICNG defines the assessment of sleep disturbance as follows:

“Where construction works are planned to extend over more than two consecutive nights, and a quantitative assessment method is used, the analysis should cover the maximum noise level, and the extent and the number of times that the maximum noise level exceeds the RBL. Some guidance indicating the potential for sleep disturbance is in the now superseded NSW Environmental Criteria for Road Traffic Noise (EPA 1999).”

The NSW Environmental Criteria for Road Traffic Noise (EPA, 1999) (NSW ECRTN) discusses a number of methodologies with respects to sleep disturbance. In general, the methodologies address sleep disturbance due to continuous noise (expressed in terms of a $L_{Aeq, \tau}$) and the affect multiple short duration noise events (expressed as a L_{Amax}).

In addition to the night time noise criteria specified in Table 4-1 (which addresses the continuous noise component generated by construction activities), the application of a noise criteria addressing the maximum noise level from construction activities is appropriate when works are planned to extend over more than two consecutive nights. The NSW ECRTN draws the following conclusions with respects to noise limits for sleep disturbance:

“Considering all of the foregoing information the following conclusions can be drawn:

- > Maximum internal noise levels below 50–55 dB(A) are unlikely to cause awakening reactions
- > One or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.

The NSW EPA confirm that a sleep disturbance criterion of $L_{A1, 1min} \leq L_{A90, 15min} + 15dB(A)$, is used for initial assessment for the purpose of this Review of environmental Factors (REF). It should only be used as a first step guide and where the criteria is not met, more detailed analysis is required to be incorporated into the detailed design and Construction Noise and Vibration Management Plan. The Application Notes of the NSW Industrial Noise Policy (2010) note the detailed analysis should include:

- > the extent to which the maximum noise level exceeds the background level
- > the number of times this happens during the night-time period
- > the time of day (normally between 10 pm and 7 am).

4.2 Vibration Criteria

4.2.1 Assessing Vibration: A Technical Guideline (Human Comfort)

Vibration from activities associated with the project could potentially impact on the amenity of the occupants of dwellings or buildings located close to the site. Generally, vibration impact can be summarised into two categories:

- > Effect on human comfort
- > Structural or cosmetic damage to buildings.

Human comfort vibration criteria is addressed in the NSW ICNG and refers to Section 2.5 of the document Assessing Vibration: A Technical Guideline (NSW AV:ATG) issued by DEC (2006).

The NSW AV:ATG outlines vibration limits in relation to human comfort. Criteria in this guideline are based on the British Standard BS6472-1992 Evaluation of human exposure to vibration in buildings (1-80Hz).

Vibration sources are defined as continuous, impulsive or intermittent. Table 4-2 provides a definition and examples of each type of vibration.

Table 4-2 Types of vibration

Type of Vibration	Definition	Examples
Continuous	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time).	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.

Type of Vibration	Definition	Examples
	that the duration is short, typically less than 2 seconds.	
Intermittent	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude.	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

The criteria are to be applied to a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states: 'Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).' When applying the criteria, it is important to note that vibration may enter the body along different orthogonal axes, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). The three axes are referenced to the human body. Thus, vibration measured in the horizontal plane should be compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y and z- axis criteria if the concern is for people in the lateral position. Preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced below in Section 5 of this report.

4.2.2 German Standard DIN 4150 (Building Damage)

In relation to structural damage, there is currently no Australian Standard that provides criteria for the assessment of structural damage to buildings. However, the German Standard DIN 4150-3 : 1999-02 - 'Structural vibration - Effects of vibration on structures', provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration. This standard also presents recommended maximum limits over a range of frequencies measured in any direction at the foundation or in the plane of the uppermost floor.

These criteria are summarised below in Section 5.

4.2.3 Summary of Minimum Working Distances for Vibration Intensive Plant

The following table provides a summary of the minimum working distance for different types of sensitive receivers referenced from the standards described above.

Table 4-3 Recommended minimum working distances for vibration intensive plant from sensitive receivers

Plant Item	Rating / Description	Minimum Working Distance		
		Cosmetic Damage (BS 7385)	Cosmetic damage (DIN 4150) Heritage and other sensitive structures	Human Response (OH&E Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	14 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	16 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	33 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	41 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	54 m	100 m
	> 300 kN (> 18 tonnes)	25 m	68 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	5 m	7 m

Plant Item	Rating / Description	Minimum Working Distance		
		Cosmetic Damage (BS 7385)	Cosmetic damage (DIN 4150) Heritage and other sensitive structures	Human Response (OH&E Vibration Guideline)
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	19 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	60 m	73 m
Vibratory Pile Driver	Sheet Piles	2 m to 20 m	50 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	40 m	4 m
Jackhammer	Hand Held	1 m (nominal)	2 m	2 m

The minimum working distances are indicative and will vary depending on the particular item of plant, local geotechnical conditions and the dominant frequency of the construction vibration levels. They apply to cosmetic damage of typical light-framed residential buildings and heritage/fragile buildings and assume that construction vibration could include low frequency content with associated increased risk of cosmetic damage. Vibration monitoring is recommended to confirm the minimum working distances at specific sites. Additionally, further detailed analysis based on the frequency dependent guideline vibration levels in BS7385-2:1993 and DIN4150-3:2016 may be utilised in conjunction with site-specific measurements to derive alternative cosmetic damage objectives and minimum working distances. For heritage listed / fragile structures, specialist advice from an appropriately qualified structural engineer who is familiar with heritage structures is required to support any proposed relaxation of the initial cosmetic damage screening criterion. Any such relaxation shall be approved by TfNSW or under the environmental license as relevant.

4.3 Operational Noise Criteria

Operational noise has not been assessed as noise from ferry operation is not expected to differ as a result of the proposal.

4.4 Australian Standards

The following Australian Standards provide criteria and methodologies that have been adopted in this assessment:

- > Australian Standard AS1055: Acoustics – Description and measurement of environmental noise.

5 Design Benchmarks

5.1 Construction Noise

The proposal area has been divided into noise catchment areas (NCA) where ambient noise levels are likely to be similar to assess the potential construction noise impacts on surrounding receivers. These catchment areas are shown in Figure 6-1.

Works may be carried out, outside of standard hours due to the nature of the proposal. For this reason noise management levels (NMLs) have been calculated for both standard and non-standard hours. The NMLs are detailed below in Table 5-1.

Taking into consideration the measured RBLs in Section 3.5.2 and the criteria from Section 4.1, the applicable construction noise management levels for standard and non-standard hours for the proposal are shown in Table 5-1.

Table 5-1 Construction noise management levels

Noise Catchment Area	Logger Label	Noise Management Level, dB(A)			*Sleep Disturbance $L_{A1, 1 \text{ min}}$
		Standard Hours (RBL + 10 dB(A))	Outside Standard Hours (RBL + 5 dB(A))		
		Day	Evening	Night	
1	1	55	47	43	60
2	2	55	45	39	60

*Sleep disturbance criteria has been calculated based on an assumed typical internal L_{Aeq} noise level of 35 dB(A) referenced from Australian Standard AS:2107 and corrected with a typical inside to outside noise reduction of 10 dB(A).

5.2 Construction Vibration

5.2.1 Human Comfort Criteria

The following vibration criteria for human comfort apply to this proposal.

Table 5-2 Preferred and maximum levels for human comfort

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x & y axis	z-axis	x & y axis
Continuous vibration³ (Weighted RMS Acceleration, m/s^2, 1-80Hz)					
Critical areas ²	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration³ (Weighted RMS Acceleration, m/s^2, 1-80Hz)					
Critical areas ²	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x & y axis	z-axis	x & y axis
Intermittent vibration⁴ (Vibration Dose Values, VDV, m/s^{1.75}, 1-80Hz)					
Critical areas ²	Day- or night-time	0.10	0.20	-	-
Residences	Daytime	0.20	0.40	-	-
	Night-time	0.13	0.26	-	-
Offices, schools, educational institutions and places of worship	Day- or night-time	0.40	0.80	-	-
Notes:	1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am 2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. 3. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-2008 4. For continuous and impulsive vibration the preferred and maximum values are weighted acceleration rms values (m/s ²) 5. For intermittent vibration the preferred and maximum values are vibration dose values (VDVs), based on the weighted acceleration values (m/s ^{1.75})				

5.2.2 Building Damage Criteria

The minimum 'safe limit' of vibration at low frequencies for commercial and industrial buildings are presented in DIN 4150.3 is provided in Table 5-3.

Table 5-3 DIN 4150-3 structural damage criteria

Group	Type of Structure	Vibration Velocity, mm/s			
		At Foundation at Frequency of			Plane of Floor uppermost Storey
		1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 - 40	40 - 50	40
2	Dwellings and buildings of similar design and/or use	5	5 - 15	15 - 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (e.g. buildings under a preservation order)	3	3 - 8	8 - 10	8
Note:	At frequencies above 100 Hz, the values given in this column may be used as minimum values				

6 Construction Noise Impact Assessment

6.1 Construction Noise Assessment Methodology

An assessment on the potential level of construction noise impact has been carried out to determine whether mitigation will be required, and to determine appropriate management controls.

Details of proposed plant to be used for each construction stage was provided by TfNSW. Sound power levels for various items of plant and equipment were adopted based upon construction plant noise data provided in Table F-1 of the Roads and Maritime Construction Noise and Vibration Guideline (CNVG). Plant noise levels were also sourced from AS2436 – Guide To Noise Control on Construction, Maintenance and Demolition Sites and measured library data where applicable.

This assessment has been prepared based on construction staging provided by TfNSW. A further assessment may be required to prepare a Construction Noise and Vibration Management Plan (CNVMP) once final construction staging detail becomes available during the next phase of the proposal.

The proposed works, with the potential to generate significant noise, are detailed in Section 6.6. To provide an indicative assessment of construction noise impact, a noise model was created for each of the construction stages (Section 6.3).

6.2 Noise Modelling Inputs And Assumptions

6.2.1 General Modelling Input Data

The modelling inputs and assumptions made for the modelling are shown in Table 6-1.

Table 6-1 Modelling assumptions

Modelling Element	Input / Assumption. Source Reference
Ground Elevation Geometry	Provided by Cardno
Proposed Elevation Geometry	Provided by Cardno
Road Alignment	Provided by Cardno
Ground Absorption	50% over soft ground 0% over water
Assessment Standard	ISO 9613-2:1996 – Acoustics – Attenuation of Sound During Propagation Outdoors (Part 2: General Method of Calculation)
Weather conditions	Receiver is downwind of the source, as per the assumptions of ISO 9613.
Receiver Height	Assumed to be 1.2 m above ground level for noise logger microphone heights for the verification model and 1.5 m above ground for prediction models for ground floor. Subsequent floor level receiver heights have been modelled at + 2.8 m above the floor below.

6.3 Modelled Construction Stages

The construction stages in Table 6-2 have been modelled for the proposed North Sydney Wharf upgrade.

Table 6-2 Modelled construction stages

Stage No.	Construction Stage Description
1a	Site establishment
1b	Demolition
2	Construction of Land Side Works
3a	Installation of Steel Piles Within Waterway – Drilling (outside of hours)
3b	Installation of Steel Piles Within Waterway – Hammering (outside of hours)
3c	Installation of Steel Piles Within Waterway – Piling (outside of hours)

Stage No.	Construction Stage Description
3d	Installation of Steel Piles Within Waterway – Day Works
4	Installation of Pontoon and Gangway
5	Installation of New and Improved Facilities
6	Site Clean Up

To provide an indicative assessment of construction noise impact, a noise model was created for each of the above construction stages.

6.4 Noise Catchment Areas

Noise modelling was conducted to determine the predicted level of noise impact at sensitive locations surrounding the proposal. Works associated with the modelled stages are likely to remain within a finite work area. Therefore construction works have been modelled as a number of point sources operating simultaneously for each construction stage to provide the worst case predicted noise levels at each sensitive location. Sensitive areas have been grouped into noise catchment areas as shown below in Figure 6-1.



Figure 6-1 Noise Catchment Areas

Noise contour maps showing the predicted noise levels for the modelled construction works are detailed in Appendix D.

6.5 Construction Timing

We understand that some construction works are likely to be proposed for outside of standard hours as well as during standard hours for traffic safety reasons. All night work would be undertaken in accordance with Roads and Maritime CNVG where feasible, or in consultation with the adjacent community.

6.6 Construction Plant and Equipment

The construction plant included in the noise models are presented in Table 6-3. The equipment sound power levels were sourced from the Roads and Maritime CNVG, AS2436 and Cardno's measurement library.

Table 6-3 Construction plant sound power levels

Plant	Number of Plant	Sound Power Level, L _{Aeq} , dB(A)
Scenario 1a – Site Establishment	Total L_{Aeq}	111
Truck (medium rigid)	1	103
Road Truck	1	108
Franna Crane	1	98
EWP	1	98
Floating Boom	1	105
Scenario 1b – Demolition	Total L_{Aeq}	121
Work Boat	1	108
Excavator	1	108
Floating Boom	1	105
Pneumatic Drill	1	115
Rock Breaker (mounted)	1	118
Scenario 2 – Construction of Land Side Works	Total L_{Aeq}	121
Excavator	1	108
Chainsaw	1	114
Truck	1	110
Jack Hammer	1	115
Pavement Profiler	1	117
Generator	1	98
Truck (medium rigid)	1	103
Vibratory Roller	1	109
Scenario 3A – Installation of Steel Piles (Screwing/Drilling) - outside of standard working hours	Total L_{Aeq}	119
Excavator	1	108
Truck	1	110
Rock Drill	1	118
Oxy Acetylene Cutting	1	96
Generator	1	98
Work Boat	1	108
Day-maker	2	98
Scenario 3B – Installation of Steel Piles (Hammering) - outside of standard working hours	Total L_{Aeq}	118
Excavator	1	108

Plant	Number of Plant	Sound Power Level, L _{Aeq} , dB(A)
Truck	1	110
Pneumatic Hammer	1	115
Oxy Acetylene Cutting	1	96
Generator	1	98
Work Boat	1	108
Day-maker	2	98
Scenario 3C – Installation of Steel Piles (Piling) - outside of standard working hours	Total L_{Aeq}	116
Excavator	1	108
Truck	1	110
Piling Rig (Screw)	1	112
Oxy Acetylene Cutting	1	96
Generator	1	98
Work Boat	1	108
Day-maker	2	98
Scenario 3D – Installation of Steel Piles (Day works)	Total L_{Aeq}	116
Excavator	1	108
Truck	1	110
Oxy Acetylene Cutting	1	96
Generator	1	98
Concrete Truck	1	109
Concrete Pump	1	109
Work Boat	1	108
Day-maker	2	98
Scenario 4 – Installation of Pontoon and Gangway	Total L_{Aeq}	113
Barge Crane	1	110
Generator	1	98
Truck (medium rigid)	1	103
Hand Tools	1	94
Workboat	1	108
Scenario 5 – Installation of New or Improved Facilities	Total L_{Aeq}	113
Excavator	1	108
Franna Crane	1	98
Bobcat	1	105
Truck (medium rigid)	1	103
Hand Tools	1	94
Workboat	1	108
Scenario 6 – Site Clean Up	Total L_{Aeq}	113
Bobcat	1	105
Truck (medium rigid)	1	103
Franna Crane	1	98

Plant	Number of Plant	Sound Power Level, L_{Aeq} , dB(A)
Road Truck	1	108
Tug Boat	1	108

6.7 Predicted Construction Noise Levels

The predicted noise impact from construction activities in the form of noise contour maps is presented in Appendix D with predicted levels at discrete receivers included in Appendix C. Predicted construction noise levels at each modelled NCA for each scenario are shown below in Table 6-4 to Table 6-7. The levels below represent the worst case predicted noise impact at the most affected receivers in each NCA. Noise levels as a result of construction activities are predicted to be lower than these levels for the remaining receivers within each associated NCA.

A full list of predicted noise levels at all modelled receivers is included in Appendix C.

The predicted reduction of expected construction noise impact with distance is shown in the noise contour maps

Table 6-4 Predicted construction noise levels – scenario 1a –site establishment – standard working hours

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level L_{Aeq} 15hr dB(A)	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable (> 55dB(A))									
Clearly audible (>65 dB(A))									
Moderately intrusive (> 75 dB(A))									
Highly intrusive / Highly noise affected (>75 dB(A))									
19a Wallaringa Avenue	24	F2	SW	1	57	55	43	2	14
183 High Street	1	GF	NE	2	80	55	39	25	41

The above results for Scenario 1a, moderately and highly intrusive noise levels, and significant exceedances of the ICNG noise management levels for all time periods for all NCAs to varying extents. Properties located on High Street, where the worksites would be located, would experience the highest exceedances.

If night works are considered to be necessary for safety reasons, reduced operations are recommended and careful planning would be required for proposed works for all time periods to manage potential impacts.

Table 6-5 Predicted construction noise levels – scenario 1b – demolition – standard working hours

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L _{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable (> 55dB(A))									
Clearly audible (>65 dB(A))									
Moderately intrusive (> 75 dB(A))									
Highly intrusive / Highly noise affected (>75 dB(A))									
19a Wallaringa Avenue	24	GF	SW	1	65	55	43	10	18
183 High Street	1	GF	NE	2	88	55	39	33	49

The above results for Scenario 1b, indicate clearly audible and highly intrusive noise levels, and significant exceedances of the ICNG noise management levels for all time periods for all NCAs to varying extents. Properties located on High Street, where the worksites would be located, would experience the highest exceedances.

If night works are considered to be necessary for road safety reasons, reduced operations are recommended and careful planning would be required for proposed works for all time periods to manage potential impacts.

Table 6-6 Predicted construction noise levels – scenario 2 – construction of land side works – standard working hours

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L _{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable (> 55dB(A))									
Clearly audible (>65 dB(A))									
Moderately intrusive (> 75 dB(A))									
Highly intrusive / Highly noise affected (>75 dB(A))									
19a Wallaringa Avenue	24	GF	SW	1	65	55	43	10	18
183 High Street	1	GF	NE	2	93	55	39	38	54

The above results for Scenario 2, indicate clearly audible and highly intrusive noise levels, and significant exceedances of the ICNG noise management levels for all time periods for all NCAs to varying extents. Properties located on High Street, where the worksites would be located, would experience the highest exceedances.

If night works are considered to be necessary for road safety reasons, reduced operations are recommended and careful planning would be required for proposed works for all time periods to manage potential impacts.

Table 6-7 Predicted construction noise levels – scenario 3a – screwing / drilling - outside of standard working hours (11pm to 6am)

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L_{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable: NML – 5dB(A) to NML + 5 dB(A)									
Clearly audible: NML +5 dB(A) to NML + 15 dB(A)									
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A)									
Highly Intrusive: >NML + 25 dB(A)									
OOHW Period 1 - Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm) (Evening)									
19a Wallaringa Avenue	24	F2	SW	1	64	55	47	9	17
183 High Street	1	GF	NE	2	85	55	45	30	40
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am) (Night)									
19a Wallaringa Avenue	24	F2	SW	1	64	55	43	9	19
183 High Street	1	GF	NE	2	85	55	39	30	46

The above results for Stage 3A, indicate exceedances of the ICNG NMLs for all time periods for both NCAs. Some highly intrusive exceedances are predicted during both the evening and the night periods.

It is proposed that Scenario 3A works would take place outside of standard working hours for safety reasons when the harbour is least busy and the water is calm. Reduced operations are recommended and careful planning would be required for the proposed works to manage potential impacts on both NCAs.

Table 6-8 Predicted construction noise levels – scenario 3b – hammering - outside of standard working hours (4am to 7am)

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L_{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable: NML – 5dB(A) to NML + 5 dB(A)									
Clearly audible: NML +5 dB(A) to NML + 15 dB(A)									
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A)									
Highly Intrusive: >NML + 25 dB(A)									
OOHW Period 1 - Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm) (Evening)									
19a Wallaringa Avenue	24	GF	SW	1	62	55	47	7	15
183 High Street	1	F1	NE	2	84	55	45	29	39
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am) (Night)									
19a Wallaringa Avenue	24	GF	SW	1	62	55	43	7	19
183 High Street	1	F1	NE	2	84	55	39	29	45

The above results for Stage 3B, indicate exceedances of the ICNG NMLs for all time periods for both NCAs. Some highly intrusive exceedances are predicted during both the evening and the night periods.

It is proposed that Scenario 3B works would take place outside of standard working hours for safety reasons when the harbour is least busy and the water is calm. Reduced operations are recommended and careful planning would be required for the proposed works to manage potential impacts on both NCAs.

Table 6-9 Predicted construction noise levels – scenario 3c – piling - outside of standard working hours (11pm to 6am)

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L_{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable: NML – 5dB(A) to NML + 5 dB(A)									
Clearly audible: NML +5 dB(A) to NML + 15 dB(A)									
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A)									
Highly Intrusive: >NML + 25 dB(A)									
OOHW Period 1 - Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm) (Evening)									
19a Wallaringa Avenue	24	F1	SW	1	61	55	47	6	14
183 High Street	1	F1	NE	2	83	55	45	28	38
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am) (Night)									
19a Wallaringa Avenue	24	F1	SW	1	61	55	43	6	18
183 High Street	1	F1	NE	2	83	55	39	28	44

The above results for Stage 3C, indicate exceedances of the ICNG NMLs for all time periods for both NCAs. Some highly intrusive exceedances are predicted during both the evening and the night periods.

It is proposed that Scenario 3C works would take place outside of standard working hours for safety reasons when the harbour is least busy and the water is calm. Reduced operations are recommended and careful planning would be required for the proposed works to manage potential impacts on both NCAs.

Table 6-10 Predicted construction noise levels – scenario 3d – piling - day-works

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L_{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable (> 55dB(A))									
Clearly audible (>65 dB(A))									
Moderately intrusive (> 75 dB(A))									
Highly intrusive / Highly noise affected (>75 dB(A))									
2 Hayes Street	12	F3	SW	1	61	55	43	6	18
183 High Street	1	F2	NE	2	84	55	39	29	45

The above results for Scenario 3D, indicate noticeable and highly intrusive noise levels, and significant exceedances of the ICNG noise management levels for all time periods for all NCAs to varying extents. Properties located on High Street, where the worksites would be located, would experience the highest exceedances.

If night works are considered to be necessary for road safety reasons, reduced operations are recommended and careful planning would be required for proposed works for all time periods to manage potential impacts.

Table 6-11 Predicted construction noise levels – scenario 4 – installation of pontoon and gangway – standard hours

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L _{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable (> 55dB(A))									
Clearly audible (>65 dB(A))									
Moderately intrusive (> 75 dB(A))									
Highly intrusive / Highly noise affected (>75 dB(A))									
19a Wallaringa Avenue	24	F2	SW	1	58	55	43	3	15
183 High Street	1	F2	NE	2	83	55	39	28	44

The above results for Scenario 4, indicate noticeable and highly intrusive noise levels, and significant exceedances of the ICNG noise management levels for all time periods for all NCAs to varying extents. Properties located on High Street, where the worksites would be located, would experience the highest exceedances.

If night works are considered to be necessary for road safety reasons, reduced operations are recommended and careful planning would be required for proposed works for all time periods to manage potential impacts.

Table 6-12 Predicted Construction Noise Levels – scenario 5 – installation of new or improved facilities – standard hours

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L _{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable (> 55dB(A))									
Clearly audible (>65 dB(A))									
Moderately intrusive (> 75 dB(A))									
Highly intrusive / Highly noise affected (>75 dB(A))									
19a Wallaringa Avenue	24	F2	SW	1	57	55	43	2	14
183 High Street	1	F1	NE	2	80	55	39	25	41

The above results for Scenario 5, indicate noticeable and highly intrusive noise levels, and significant exceedances of the ICNG noise management levels for all time periods for all NCAs to varying extents. Properties located on High Street, where the worksites would be located, would experience the highest exceedances. For this reason, it is recommended that Scenario 5 works are not carried out at night.

If night works are considered to be necessary for road safety reasons, reduced operations are recommended and careful planning would be required for proposed works for all time periods to manage potential impacts.

Table 6-13 Predicted construction noise levels – scenario 6 – site clean up

Most Affected Receivers	Obj No.	Floor	Facade Facing	NCA	Predicted Construction Noise Level dB(A), L _{Aeq} 15hr	ICNG Noise Management Levels (NMLs), dB(A)		Predicted Worst Case Exceedance of ICNG NMLs	
						Std. Hours	Non-Std. Hours	Day	Night
Noticeable (> 55dB(A))									
Clearly audible (>65 dB(A))									
Moderately intrusive (> 75 dB(A))									
Highly intrusive / Highly noise affected (>75 dB(A))									
19a Wallaringa Avenue	24	F2	SW	1	58	55	43	3	15
183 High Street	1	GF	NE	2	85	55	39	30	46

The above results for Scenario 6, indicate noticeable and highly intrusive noise levels, and significant exceedances of the ICNG noise management levels for all time periods for all NCAs to varying extents. Properties located on High Street, where the worksites would be located, would experience the highest exceedances. For this reason, it is recommended that Scenario 6 works are not carried out at night.

If night works are considered to be necessary for road safety reasons, reduced operations are recommended and careful planning would be required for proposed works for all time periods to manage potential impacts.

6.8 Construction Noise Results Summary

In accordance with the noise management levels stipulated in Section 5.1, residential sensitive receivers exposed to levels of construction noise above 75 dB(A) are considered highly noise affected, with dwellings exposed to levels above the noise management level (NML) or daytime RBL +10 dB(A) considered noise affected. The numbers of each are detailed below based on the modelling results. A modelled receiver has been applied to each floor of each exposed façade of each building expected to be affected by construction noise.

6.8.1 Predicted Number of Exceedances

The number of predicted exceedances for the southern worksite are detailed below in Table 6-14.

Table 6-14 Predicted number of receivers where NMLs are exceeded

Construction Stage	Standard Hours	Evening	Night	Highly Noise Affected
Scenario 1	91	256	271	14
Scenario 1a	252	274	274	19
Scenario 2	269	274	274	14
Scenario 3a	249	273	274	17
Scenario 3b	248	273	274	16
Scenario 3c	227	270	274	16
Scenario 3d	237	270	274	16
Scenario 4	158	268	273	10
Scenario 5	147	268	242	10
Scenario 6	167	257	273	13

Some receivers are expected to be highly noise affected for all construction scenarios associated with the wharf proposal.

Construction noise levels are predicted to exceed management levels for “standard” and “non-standard” hours of operation for all construction stages at the nearby residential receivers, particularly for construction Stages 3A, 3B and 3C.

It should be noted that this assessment has endeavoured to carry out “worst case” noise modelling, and noise levels are predicted based on all sources operating simultaneously within the worksite. This is therefore likely to represent the worst case scenario and construction noise levels would generally be less than those predicted.

6.8.2 Sleep Disturbance

6.8.2.1 Scenarios 3A, 3B and 3C

The most likely source of potential sleep disturbance from outside of construction hours works will be from hammering, pile screwing, and drilling.

Maximum noise levels have been predicted to the nearest affected residential receivers to allow a review of the potential for sleep disturbance from construction activities at night. In the absence of measurement data typical construction source L_{Amax} noise levels were assumed to be 10 dB(A) above the predicted L_{Aeq} noise levels, on the basis of measurements from previous projects. On this basis, the receivers where the sleep disturbance criteria is likely to be exceeded are summarised in Table 6-15.

Table 6-15 Predicted construction maximum (L_{Amax}) noise levels – scenarios 3A, 3B and 3C

Receiver	Obj No.	Floor	Facade Facing	NCA	Scenario 3A Construction Noise Level dB(A), L_{Amax}	Scenario 3B Construction Noise Level dB(A), L_{Amax}	Scenario 3C Construction Noise Level dB(A), L_{Amax}	Criteria, (RBL + 15 dB(A))
1 Wallaringa Avenue	28	GF	W	1	61	59	58	60
1 Wallaringa Avenue	28	F 9	W	1	63	61	59	60
107 Kurraba Road	30	GF	W	1	61	59	58	60
107 Kurraba Road	30	F 1	W	1	61	60	58	60
107 Kurraba Road	30	F 2	W	1	62	60	58	60
109 Kurraba Road	31	GF	W	1	62	60	58	60
109 Kurraba Road	31	F 1	W	1	62	60	58	60
109 Kurraba Road	31	F 2	W	1	62	60	58	60
11 Lower Wycombe Lane	18	GF	S	1	62	59	58	60
11 Lower Wycombe Lane	18	F 1	S	1	62	59	58	60
11 Lower Wycombe Lane	18	F 2	S	1	62	59	58	60
11 Lower Wycombe Lane	18	F 3	S	1	63	60	58	60
119 Kurraba Road	32	GF	W	1	62	60	58	60
119 Kurraba Road	32	F 1	W	1	62	60	59	60
119 Kurraba Road	32	F 2	W	1	62	60	59	60
121 Kurraba Road	33	GF	W	1	64	62	60	60
121 Kurraba Road	33	F 1	W	1	64	62	60	60
121 Kurraba Road	33	F 2	W	1	64	62	61	60
125 Kurraba Road	34	GF	W	1	61	59	58	60
125 Kurraba Road	34	F 1	W	1	61	60	58	60
125 Kurraba Road	34	F 2	W	1	62	60	58	60
13 Lower Wycombe Lane	19	GF	S	1	61	59	58	60
13 Lower Wycombe Lane	19	F 1	S	1	61	59	58	60
13 Lower Wycombe Lane	19	F 2	S	1	61	59	58	60
13 Lower Wycombe Lane	19	F 3	S	1	62	60	58	60
133 Kurraba Road	35	GF	W	1	61	59	58	60
133 Kurraba Road	35	F 1	W	1	61	60	58	60
133 Kurraba Road	35	F 2	W	1	62	60	58	60
135 Kurraba Road	36	GF	W	1	61	59	58	60
135 Kurraba Road	36	F 1	W	1	61	60	58	60
135 Kurraba Road	36	F 2	W	1	62	60	58	60
147 Kurraba Road	40	GF	W	1	61	59	58	60
147 Kurraba Road	40	F 1	W	1	62	60	59	60

Receiver	Obj No.	Floor	Facade Facing	NCA	Scenario 3A Construction Noise Level dB(A), L _{AMax}	Scenario 3B Construction Noise Level dB(A), L _{AMax}	Scenario 3C Construction Noise Level dB(A), L _{AMax}	Criteria, (RBL + 15 dB(A))
147 Kurraba Road	40	F 2	W	1	62	60	59	60
15 Lower Wycombe Lane	21	GF	S	1	61	59	58	60
15 Lower Wycombe Lane	21	F 1	S	1	61	59	58	60
15 Lower Wycombe Lane	21	F 2	S	1	61	59	58	60
15 Lower Wycombe Lane	21	F 3	S	1	61	59	58	60
15a Lower Wycombe Lane	20	GF	S	1	61	59	58	60
15a Lower Wycombe Lane	20	F 1	S	1	61	59	58	60
15a Lower Wycombe Lane	20	F 2	S	1	61	59	58	60
15a Lower Wycombe Lane	20	F 3	S	1	61	59	58	60
19a Wallaringa Avenue	24	GF	SW	1	64	62	60	60
19a Wallaringa Avenue	24	F 1	SW	1	64	62	61	60
19a Wallaringa Avenue	24	F 2	SW	1	64	62	61	60
19a Wallaringa Avenue	24	F 3	SW	1	62	60	59	60
19c Wallaringa Avenue	23	GF	SW	1	63	61	60	60
19c Wallaringa Avenue	23	F 1	SW	1	63	61	60	60
19c Wallaringa Avenue	23	F 2	SW	1	63	62	60	60
19c Wallaringa Avenue	23	F 3	SW	1	64	62	60	60
19d Wallaringa Avenue	22	GF	S	1	61	59	57	60
19d Wallaringa Avenue	22	F 1	S	1	61	59	58	60
19d Wallaringa Avenue	22	F 2	S	1	61	59	58	60
19d Wallaringa Avenue	22	F 3	S	1	62	60	58	60
1a Hayes Street	14	F 2	S	1	61	59	58	60
1a Hayes Street	14	F 3	S	1	61	60	58	60
2 Hayes Street	12	GF	S	1	63	61	60	60
2 Hayes Street	12	F 1	S	1	63	61	60	60
2 Hayes Street	12	F 2	S	1	64	62	61	60
2 Hayes Street	12	F 3	S	1	64	62	61	60
5 Wallaringa Avenue	25	GF	SW	1	62	60	58	60
5 Wallaringa Avenue	25	F 1	SW	1	62	60	58	60
5 Wallaringa Avenue	25	F 2	SW	1	62	60	59	60
5 Wallaringa Avenue	25	F 3	SW	1	62	60	59	60
7 Lower Wycombe Lane	16	GF	S	1	62	60	59	60
7 Lower Wycombe Lane	16	F 1	S	1	62	60	59	60
7 Lower Wycombe Lane	16	F 2	S	1	62	60	59	60
7 Lower Wycombe Lane	16	F 3	S	1	62	60	59	60
7 Wallaringa Avenue	26	GF	SW	1	62	60	58	60
7 Wallaringa Avenue	26	F 1	SW	1	62	60	58	60
7 Wallaringa Avenue	26	F 2	SW	1	62	60	59	60
7 Wallaringa Avenue	26	F 3	SW	1	62	60	59	60
7a Hayes Street	13	GF	S	1	63	61	60	60
7a Hayes Street	13	F 1	S	1	63	61	60	60
7a Hayes Street	13	F 2	S	1	63	62	60	60
7a Hayes Street	13	F 3	S	1	64	62	61	60
9 Hayes Street	15	GF	S	1	62	60	59	60
9 Hayes Street	15	F 1	S	1	62	60	59	60
9 Hayes Street	15	F 2	S	1	62	60	59	60
9 Hayes Street	15	F 3	S	1	62	60	59	60
9 Lower Wycombe Lane	17	GF	S	1	61	59	58	60
9 Lower Wycombe Lane	17	F 1	S	1	61	60	58	60
9 Lower Wycombe Lane	17	F 2	S	1	62	60	58	60
9 Lower Wycombe Lane	17	F 3	S	1	62	60	59	60
9 Wallaringa Avenue	27	GF	SW	1	61	59	58	60
9 Wallaringa Avenue	27	F 1	SW	1	61	60	58	60
9 Wallaringa Avenue	27	F 2	SW	1	62	60	58	60
9 Wallaringa Avenue	27	F 3	SW	1	62	60	58	60
99 Kurraba Road	29	GF	SW	1	62	62	59	60
99 Kurraba Road	29	F 1	SW	1	62	62	59	60
99 Kurraba Road	29	F 2	SW	1	62	62	59	60
1 Elamang Street	82	GF	NW	2	63	61	59	60
1 Elamang Street	82	F 1	NW	2	63	61	59	60

Receiver	Obj No.	Floor	Facade Facing	NCA	Scenario 3A Construction Noise Level dB(A), L _{AMax}	Scenario 3B Construction Noise Level dB(A), L _{AMax}	Scenario 3C Construction Noise Level dB(A), L _{AMax}	Criteria, (RBL + 15 dB(A))
1 Elamang Street	82	F 2	NW	2	63	61	60	60
13 Elamang Street	63	GF	NE	2	64	63	61	60
13 Elamang Street	63	F 1	NE	2	65	63	61	60
13 Elamang Street	63	F 2	NE	2	65	63	61	60
142 High Street	9	GF	S	2	63	68	63	60
142 High Street	9	F 1	S	2	64	68	64	60
142 High Street	9	F 2	S	2	65	69	64	60
142 High Street	9	F 3	S	2	65	69	65	60
144 High Street	8	GF	SE	2	62	60	58	60
144 High Street	8	F 1	SE	2	63	60	60	60
144 High Street	8	F 2	SE	2	64	61	61	60
144 High Street	8	F 3	SE	2	65	63	62	60
144 High Street	8	F 4	SE	2	69	67	66	60
144 High Street	8	F 5	SE	2	73	72	71	60
145 High Street	77	GF	NE	2	62	62	62	60
145 High Street	77	F 1	NE	2	63	63	63	60
145 High Street	77	F 2	NE	2	63	63	63	60
146 High Street	3	GF	SE	2	83	81	80	60
146 High Street	3	F 1	SE	2	85	82	81	60
146 High Street	3	F 2	SE	2	84	82	81	60
146 High Street	3	F 3	SE	2	84	82	81	60
147 High Street	76	GF	NE	2	62	62	62	60
147 High Street	76	F 1	NE	2	63	63	63	60
147 High Street	76	F 2	NE	2	64	65	64	60
149 High Street	75	GF	NE	2	64	64	64	60
149 High Street	75	F 1	NE	2	65	65	65	60
149 High Street	75	F 2	NE	2	67	66	65	60
15 Elamang Street	62	GF	NE	2	64	62	61	60
15 Elamang Street	62	F 1	NE	2	64	62	61	60
15 Elamang Street	62	F 2	NE	2	65	63	61	60
161 High Street	74	GF	NE	2	65	65	64	60
161 High Street	74	F 1	NE	2	66	66	65	60
161 High Street	74	F 2	NE	2	68	67	65	60
165 High Street	10	GF	SE	2	73	70	70	60
165 High Street	10	F 1	SE	2	74	71	70	60
165 High Street	10	F 2	SE	2	74	71	71	60
169 High Street	11	F 2	NE	2	65	63	63	60
17 Elamang Street	61	GF	NE	2	65	63	61	60
17 Elamang Street	61	F 1	NE	2	65	63	61	60
17 Elamang Street	61	F 2	NE	2	65	63	61	60
171 High Street	7	GF	NE	2	72	69	66	60
171 High Street	7	F 1	NE	2	73	70	68	60
171 High Street	7	F 2	NE	2	74	72	70	60
173 High Street	6	GF	NE	2	74	71	70	60
173 High Street	6	F 1	NE	2	75	73	71	60
173 High Street	6	F 2	NE	2	76	74	72	60
179 High Street	5	GF	NE	2	78	76	75	60
179 High Street	5	F 1	NE	2	79	77	76	60
179 High Street	5	F 2	NE	2	80	78	77	60
181 High Street	4	GF	NE	2	80	78	77	60
181 High Street	4	F 1	NE	2	81	80	79	60
181 High Street	4	F 2	NE	2	82	80	80	60
183 High Street	2	GF	SE	2	81	80	79	60
183 High Street	2	F 1	SE	2	83	82	82	60
183 High Street	2	F 2	SE	2	84	82	82	60
183 High Street	1	GF	NE	2	84	83	82	60
183 High Street	1	F 1	NE	2	85	84	83	60
183 High Street	1	F 2	NE	2	85	84	83	60
19 Elamang Street	60	GF	NE	2	65	63	62	60
19 Elamang Street	60	F 1	NE	2	65	63	62	60

Receiver	Obj No.	Floor	Facade Facing	NCA	Scenario 3A Construction Noise Level dB(A), L _{AMax}	Scenario 3B Construction Noise Level dB(A), L _{AMax}	Scenario 3C Construction Noise Level dB(A), L _{AMax}	Criteria, (RBL + 15 dB(A))
19 Elamang Street	60	F 2	NE	2	65	63	62	60
21 Elamang Street	59	GF	NE	2	66	64	62	60
21 Elamang Street	59	F 1	NE	2	66	64	62	60
21 Elamang Street	59	F 2	NE	2	66	64	63	60
23 Elamang Street	58	GF	NE	2	66	64	62	60
23 Elamang Street	58	F 1	NE	2	66	64	62	60
23 Elamang Street	58	F 2	NE	2	66	64	63	60
24 Elamang Street	67	GF	NE	2	63	61	60	60
24 Elamang Street	67	F 1	NE	2	63	61	60	60
24 Elamang Street	67	F 2	NE	2	63	61	60	60
25 Elamang Street	57	GF	NE	2	66	64	63	60
25 Elamang Street	57	F 1	NE	2	66	64	63	60
25 Elamang Street	57	F 2	NE	2	66	64	63	60
27 Elamang Street	56	GF	NE	2	66	64	63	60
27 Elamang Street	56	F 1	NE	2	66	64	63	60
27 Elamang Street	56	F 2	NE	2	66	64	63	60
27a Elamang Street	55	GF	NE	2	66	64	62	60
27a Elamang Street	55	F 1	NE	2	66	64	63	60
27a Elamang Street	55	F 2	NE	2	66	64	63	60
27b Elamang Street	54	GF	N	2	57	62	55	60
27b Elamang Street	54	F 1	N	2	57	62	56	60
27b Elamang Street	54	F 2	N	2	57	62	56	60
29 Elamang Street	53	GF	N	2	55	61	54	60
29 Elamang Street	53	F 1	N	2	55	62	55	60
29 Elamang Street	53	F 2	N	2	56	62	55	60
33 Peel Street	68	GF	N	2	62	60	59	60
33 Peel Street	68	F 1	N	2	62	61	59	60
33 Peel Street	68	F 2	N	2	63	61	59	60
5 Elamang Street	66	GF	NE	2	63	61	60	60
5 Elamang Street	66	F 1	NE	2	63	61	60	60
5 Elamang Street	66	F 2	NE	2	63	62	60	60
7 Elamang Street	65	GF	NE	2	65	64	62	60
7 Elamang Street	65	F 1	NE	2	66	64	62	60
7 Elamang Street	65	F 2	NE	2	63	61	60	60
9 Elamang Street	64	GF	NE	2	64	62	60	60
9 Elamang Street	64	F 1	NE	2	64	62	60	60
9 Elamang Street	64	F 2	NE	2	64	62	61	60
Loreto B Kirribilli	70	GF	N	2	62	60	58	60
Loreto B Kirribilli	70	F 1	N	2	63	60	58	60
Loreto B Kirribilli	70	F 2	N	2	63	60	59	60
Loreto C Kirribilli	72	F 2	NE	2	62	60	58	60
Loreto D Kirribilli	71	GF	N	2	63	62	60	60
Loreto D Kirribilli	71	F 1	N	2	64	62	60	60
Loreto D Kirribilli	71	F 2	N	2	64	62	60	60
Loreto E Kirribilli	73	GF	NE	2	62	60	59	60
Loreto E Kirribilli	73	F 1	NE	2	62	60	59	60
Loreto E Kirribilli	73	F 2	NE	2	62	60	59	60

The predicted L_{AMax} results detailed above indicate that maximum construction noise levels at NCA 1 & 2 are likely to exceed the sleep disturbance criteria for all “outside of standard hours” construction scenarios, when construction works are located nearby. For this reason it is recommended that activities with potentially high maximum levels such as the use of pneumatic tools and drilling are minimised at these locations during the quietest periods of the overall night-time period.

7 Construction Vibration Assessment

7.1 Vibration Limits

Vibration from construction activities associated with the project could potentially impact on the amenity of the occupants of dwellings or buildings located close to the construction works. Generally, vibration impact can be summarised into two categories:

- Effect on human comfort
- Structural or cosmetic damage to buildings.

Vibration criteria is addressed in the NSW ICNG and refers to Section 2.5 of the document *Assessing Vibration: A Technical Guideline (NSW AVATG)* issued by DEC (2006). The NSW AVATG outlines vibration limits in relation to human comfort. Criteria in this guideline are based on the British Standard BS6472-1992 *Evaluation of human exposure to vibration in buildings (1-80Hz)*. A summary of these criteria are detailed in Table 5-2.

In relation to structural damage, there is currently no Australian Standard that provides criteria for the assessment of structural damage to buildings. However, the British Standard BS7385 Part 2 can be used to assess structural damage to buildings. It defines damage in several categories including, for example, “cosmetic”, “minor” and “major” damage. Alternatively, the German Standard DIN4150 Part 3 provides maximum vibration levels, which are assessed over a frequency range. These criteria are summarised in Table 5-3.

The recommended minimum working distance between vibration intensive plant and sensitive receivers for minimising the risk of cosmetic damage are listed in the *Roads and Maritime Construction Noise and Vibration Guideline* and are shown in Table 7-1.

The minimum working distances for cosmetic damage as outlined in Table 7-1 must be adhered to unless otherwise approved by TfNSW.

7.1.1 Vibration Assessment

For the purposes of this assessment, the following proposed plant with the potential to generate significant vibration has been considered:

- > Bored piling rig
- > Vibratory roller
- > Rock hammers
- > Rock drill
- > Truck movements.

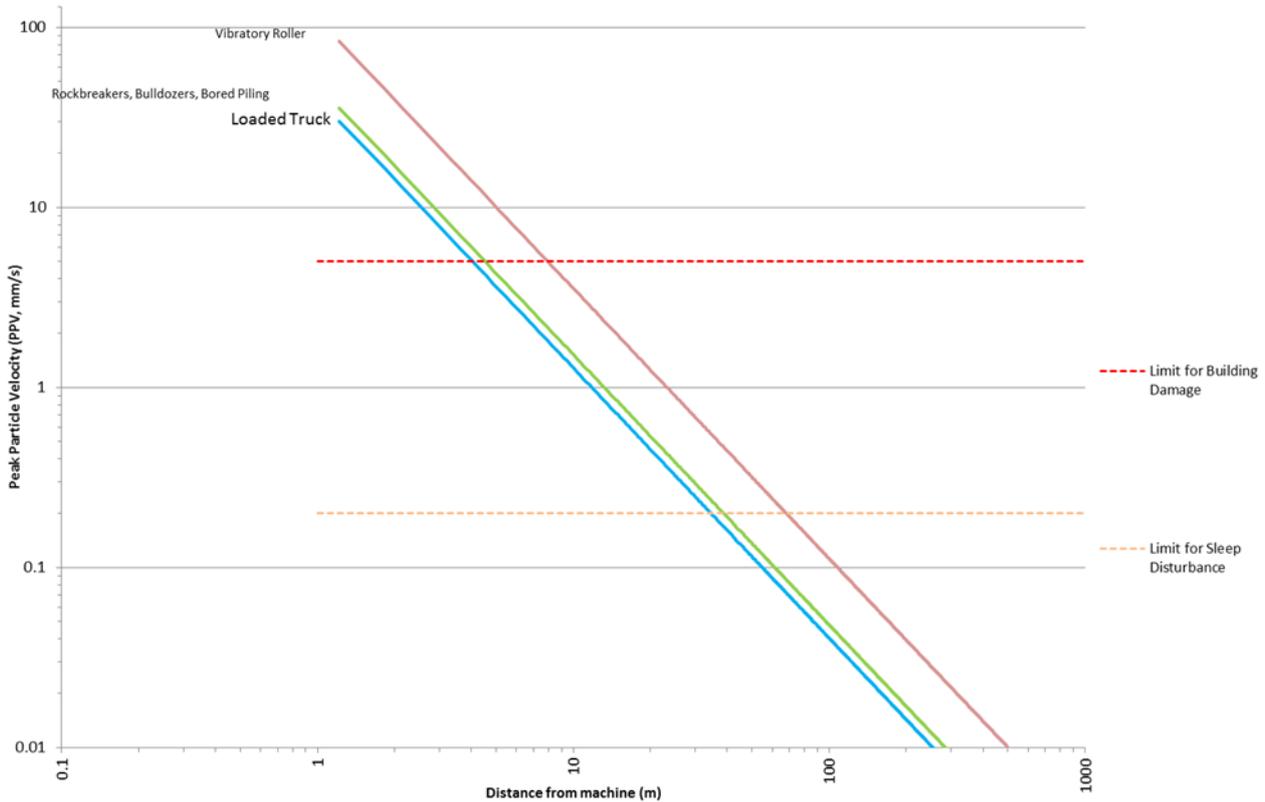
Construction vibration levels vary depending on the distance from the equipment in use, the energy level imparted to the ground by the construction process, and the bedrock type. The most significant vibration sources associated with the construction work will be vibratory rollers and piling rigs. It is anticipated that no blasting would be required as part of this proposal.

The *Transit Noise and Vibration Impact Assessment (TNVIA)* (US Federal Transit Administration (FTA), 2006) outlines calculation methods for construction equipment vibration levels. These levels are expressed in terms of Peak Particle Velocity (PPV, mm/s), with vibration levels provided for a number of plant items. The TNVIA specifies that:

“It should be noted that there is a considerable variation in reported ground vibration levels from construction sites. The data provides a reasonable estimate for a wide range of soil conditions.”

The data provided by the TNVIA results in a graph as shown in Figure 7-1.

Depending on the actual ground conditions (i.e. greater density of rock) vibration levels may increase and affect residents to a greater extent subjectively.



Note: The predicted vibration levels in the figure above include a safety margin for carrying ground types.

Figure 7-1 Estimates of vibration levels generated by common construction activities / equipment at various distances (Source: FTA 2006).

Construction works including bored piling may be undertaken with a minimum separation distance of 4-5 metres from the nearest residential buildings, based on the expected plant to be used for the project as detailed in Table 6-3. Where impacted buildings are heritage listed or of similar more sensitive construction the minimum separation distance should be increased to 40 metres for bored piling.

However for rock hammers and vibratory rollers the minimum required safe working distance is increased as detailed below in Table 7-1 between construction activities and sensitive receivers to reduce vibration to within levels unlikely to cause building damage.

7.1.2 Minimum Working Distance (Roads and Maritime CNVG)

The minimum working distance for vibration intensive plant from sensitive receivers is listed in Table 2 of the CNVG. Table 7-1 below presents these recommended minimum working distances for specific construction activities.

Table 7-1 Recommended minimum working distances for vibration intensive plant from sensitive receivers

Plant Item	Rating / Description	Minimum Working Distance		
		Cosmetic Damage (BS 7385)	Cosmetic damage (DIN 4150) Heritage and other sensitive structures	Human Response (OH&E Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	14 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	16 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	33 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	41 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	54 m	100 m
	> 300 kN (> 18 tonnes)	25 m	68 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	19 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	60 m	73 m
Vibratory Pile Driver	Sheet Piles	2 m to 20 m	50 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	40 m	4 m
Jackhammer	Hand Held	1 m (nominal)	2 m	2 m

The seawall (located within the curtilage of the locally heritage listed Kesterton Park) is in close proximity to the proposed piling works. The existing heritage structure located to the south of the works is located approximately 25-30 metres to the south of the proposed piling works. Both of these items are likely to be inside the safe working limits recommended by DIN 4150.3, and predicted vibration levels of > 5mm/s could be experienced at the sea wall in particular.

Where works are proposed within the safe working limits, specialist advice should be sought from an appropriately qualified structural engineer who is familiar with heritage structures to support any proposed relaxation of the initial cosmetic damage screening criterion. Any such relaxation shall be approved by TfNSW or under the environmental license as relevant.

In addition and in conjunction with the above specialist advice from a structural engineer, test vibration measurements of piling and other vibration intensive plant at the work location closest to the structure should be carried out prior to works commencing to determine the level of vibration at the sensitive structure. If vibration levels exceed the Heritage Building limits detailed in Table 5-3, alternative work methods should be sought.

8 Recommended Mitigation Measures

8.1 ICNG & AS 2436 Recommended Mitigation Measures

The best practice construction noise and vibration mitigation measures outlined in Table 8-1 are based on recommendations provided within the NSW ICNG and Australian Standard AS 2436-1981: Guide to Noise Control on Construction, Maintenance and Demolition Sites.

Table 8-1 Noise and vibration safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
Noise and vibration	NV1	<p>Preparation of a noise and vibration management plan based on recommendations provided within the NSW ICNG and Australian Standard AS 2436-1981: Guide to Noise Control on Construction, Maintenance and Demolition Sites. This is to include, but not be limited to:</p> <ul style="list-style-type: none"> • Plant controls: <ul style="list-style-type: none"> – Use of noise attenuating controls at the source, such as mufflers, acoustic screens, etc. – Plant and equipment would be in good working order to prevent excess noise generation. – Locating static sources of noise such as the generators as remotely as possible from noise sensitive receivers – Use of broadband reversing alarms, or “quackers”, on mobile equipment in accordance with the relevant health and safety regulations – Use of temporary noise barriers where practical. The height and location of these barriers would be determined during preparation of the construction noise and vibration management plan when more information regarding the proposed plant to be used for each construction stage is available. – Investigate whether “at plant” mitigation or muffled plant is available for plant with high source noise levels such as rock hammers and piling rigs, and plant emitting continuous noise such as generators. – Acoustic curtains (generally loaded vinyl based products), attached to wire construction fencing or laid over steel scaffold can also provide practical temporary noise barriers. We recommend that this is investigated for stationery plant within the worksites once a detailed schedule of works and plant is available. – Provision of a solid 2 metre high anti-gawk barrier along the site work area boundaries may provide some reduction to nearby receivers, however this is only expected to benefit the lower levels of the nearby receivers. Local barriers will have minimal effects on noise reduction for receivers with multiple levels as there will still be a clear line of sight from the works to the receivers. Inclusion of an angled return at the top of the barrier (if this is practical to construct) may provide increased benefit to multiple storey receivers when the plant is located close to the barrier and is generally stationery. We recommend that this is further investigated once a detailed schedule of works and plant is available. • Management and behavioural controls: <ul style="list-style-type: none"> – Ensure that managers effectively communicate acceptable and unacceptable work practices for the site, through staff site inductions, notice boards, and prestart meetings. – Avoid the need for reversing in the construction area by creating a loop road or similar. – Avoid dropping materials from height. 	Contractor	Pre-construction

Impact	ID	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> – Workers should avoid shouting, minimise talking loudly, and avoid slamming vehicle doors. • Allowing construction to occur only during approved construction hours, unless otherwise required as a condition of TfNSW safety requirements. • Conducting noise monitoring during all construction phases/scenarios considering the potential exceedances for the purposes of assisting in noise mitigation and to verify the findings of this noise assessment. • Implementing a procedure for dealing with complaints to ensure that all complaints are registered and dealt with appropriately. • Conducting additional monitoring if complaints are received or proposed activities and number of plant exceed those assumed in this assessment. • Modification of work activities where noise or vibration is found to cause unacceptable impact. • Application of respite periods for noise activities. 		
Noise and vibration	NV2	<ul style="list-style-type: none"> • Carrying out works within standard daytime hours as follows: <ul style="list-style-type: none"> – 7:00 am to 6:00 pm Monday to Friday – 8:00 am to 1:00 pm Saturdays, no work on Sundays or public holidays. • Do not carry out operations during evening or night-time hours, unless required for safety reasons when the water is calmer during the night period (including early morning). • Should operations be required outside standard hours, an Out of Hours Procedure detailing works schedule, approval process, communications requirements and management measures will be prepared. All reasonable and feasible efforts should be undertaken to ensure noise levels would not exceed the ICNG noise management levels stated in Section 5.1 of this assessment by carrying out night-works with reduced numbers of plant for example. 	Contractor	Construction
	NV3	<ul style="list-style-type: none"> • Notification of potentially affected receivers detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the work (where applicable) and contact telephone number. • Notification should be a minimum of 7 calendar days prior to the start of work. • A contact telephone number and email address will be available for community feedback 	TfNSW / Contractor	Pre-construction
	NV4	Conduct short term background noise monitoring prior to construction to confirm the ambient noise levels presented in this report, which were carried out during COVID 19 and may not be representative of typical levels.	TfNSW / Contractor	Pre-construction
Vibration impact to	NV5	Where works are proposed within the safe working limits for the heritage structures, specialist advice should be sought from an appropriately qualified structural engineer who is familiar with heritage structures to assess if vibrations associated with the proposed works will potentially result in impacts	Contractor	Pre-construction

Impact	ID	Environmental safeguards	Responsibility	Timing
heritage structures		to heritage structures. Vibration monitoring should be carried out to confirm vibration levels prior to construction commencement.		
	NV6	<p>Regular inspections of the construction activities and work areas should be undertaken by structural engineers and any other required specialist to monitor and review the construction methodology and confirm the integrity of the heritage structures. Assessment and monitoring of vibration impacts should adhere to:</p> <ul style="list-style-type: none"> British Standard BS 7385: Part 2: Evaluation and Measurement for Vibrations in Buildings –Part 2 Guide to Damage Levels from Ground-Borne Vibration German Standard DIN 4150, Part 3: Structural Vibration in Buildings: Effects on Structures 	Contractor	Construction
Vibration	NV7	Where buildings are located within the safe working distance zone, dilapidation surveys should be carried out prior to construction.	Contractor	Pre-construction / Construction
Vibration	NV8	Where receivers are located within the safe work distance zones, vibration monitoring should be carried out to ensure compliance with the required criteria. If exceedances are recorded, works should be modified accordingly to reduce vibration levels.	Contractor	Pre-construction / Construction

8.2 Roads and Maritime Construction Noise and Vibration Guideline Noise Management Recommendations

The Roads and Maritime CNVG stipulates that additional noise management measures may be required where noise levels are predicted to exceed the noise management levels.

The range of additional mitigation measures include, but are not limited to:

- > Notification via letterbox or phone call
- > Respite periods
- > Alternative accommodation.

Identification of where additional mitigation measures may be required is based on the information presented below in Table 8-2.

Table 8-2 Triggers for additional mitigation measures – airborne noise

Predicted airborne $L_{Aeq(15min)}$ noise level at receiver				
Perception	dB(A) above RBL	dB(A) above NML	Type of Additional Mitigation Measures	Mitigation Levels:
All hours				
75dBA or greater			N, V, PC, RO	HA
Standard Hours: Mon - Fri (7am - 6pm), Sat (8am - 1pm), Sun/Pub Hol (Nil)				
Noticeable	5 to 10	0	-	NML
Clearly audible	10 to 20	< 10	-	NML
Moderately intrusive	20 to 30	10 to 20	N, V	NML + 10
Highly intrusive	> 30	> 20	N, V	NML + 20
OOHW Period 1: Mon - Fri (6pm - 10pm), Sat (7am - 8am & 1pm - 10pm), Sun/Pub Hol (8am - 6pm)				
Noticeable	5 to 10	< 5	-	NML
Clearly audible	10 to 20	5 to 15	N, R1, DR	NML + 5
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR	NML + 15
Highly intrusive	> 30	> 25	V, IB, N, R1, DR, PC, SN	NML + 25
OOHW Period 2: Mon - Fri (10pm - 7am), Sat (10pm - 8am), Sun/Pub Hol (6am - 7am)				
Noticeable	5 to 10	< 5	N	NML
Clearly audible	10 to 20	5 to 15	V, N, R2, DR	NML + 5
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR	NML + 15
Highly intrusive	> 30	> 25	AA, V, IB, N, PC, SN, R2, DR	NML + 25
Notes:				
<i>AA = Alternative Accommodation</i>		<i>R1 = Respite Period 1</i>		
<i>V = Verification</i>		<i>R2 = Respite Period 2</i>		
<i>IB = Individual Briefings</i>		<i>DR = Duration Respite</i>		
<i>N = Notification</i>		<i>Perception = relates to level above RBL</i>		
<i>PC = Phone Calls</i>		<i>NML = Noise Management Level</i>		
<i>SN = Specific Notifications</i>		<i>HA = Highly Affected (> 75 dB(A) - applies to residences only)</i>		

A detailed description of each additional mitigation measure is presented below.

Additional mitigation measures may be required where noise levels are predicted to exceed the noise management levels. Refer to Appendix D for areas where this is predicted to occur.

The range of additional mitigation measures are itemised below.

Notification (N)

Notification using letterbox drop or equivalent for advanced warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of a letterbox drop (or equivalent) detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works. The approval conditions for projects may also specify requirements for notification to the community about works that may impact on them.

Specific notifications (SN)

Specific notifications are letterbox dropped (or equivalent) to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. The specific notification provides additional information when relevant and informative to more highly affected receivers than covered in general letterbox drops.

The exact conditions under which specific notifications would proceed are defined in Table 8-3 below. This form of communication is used to support periodic notifications, or to advertise unscheduled works.

Phone calls (PC)

Phone calls detailing relevant information made to identified/affected stakeholders within seven calendar days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs. Where the resident cannot be telephoned then an alternative form of engagement should be used.

Individual briefings (IB)

Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Project representatives would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project. Where the resident cannot be met with individually then an alternative form of engagement should be used.

Respite Offers (RO)

Respite Offers should be considered made where there are high noise and vibration generating activities near receivers. As a guide work should be carried out in continuous blocks that do not exceed 3 hours each, with a minimum respite period of one hour between each block. The actual duration of each block of work and respite should be flexible to accommodate the usage of and amenity at nearby receivers.

The purpose of such an offer is to provide residents with respite from an ongoing impact. This measure is evaluated on a project-by-project basis, and may not be applicable to all projects.

Respite Period 1 (R1)

Out of hours construction noise in out of hours period 1 shall be limited to no more than three consecutive evenings per week except where there is a Duration Respite. For night work these periods of work should be separated by not less than one week and no more than 6 evenings per month.

Respite Period 2 (R2)

Night time construction noise in out of hours period 2 shall be limited to two consecutive nights except for where there is a Duration Respite. For night work these periods of work should be separated by not less than one week and 6 nights per month. Where possible, high noise generating works shall be completed before 11pm.

Duration Respite (DR)

Respite offers and respite periods 1 and 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance and where it can be strongly justified it may be beneficial to increase the work duration, number of evenings or nights worked through Duration Respite so that the project can be completed more quickly.

The project team should engage with the community where noise levels are expected to exceed the NML to demonstrate support for Duration Respite.

Where there are few receivers above the NML each of these receivers should be visited to discuss the project to gain support for Duration Respite.

Alternative Accommodation (AA)

Alternative accommodation options may be offered to residents living in close proximity to construction works that are likely to experience highly intrusive noise levels. The specifics of the offer will be identified on a project-by-project basis. Additional aspects for consideration shall include whether the highly intrusive activities occur throughout the night or before midnight.

Verification (V)

Routine checks of noise levels or following reasonable complaints. This verification should include measurement of the background noise level and construction noise. Note this is not required for projects less than three weeks unless to assist in managing complaints.

Table 8-3 identifies additional mitigation measures that may be implemented where exceedances of the NML are predicted.

Table 8-3 Additional mitigation measures where exceedances of the NML are predicted

Construction Activity	Out of Hours Work	Type of Additional Mitigation Measures for Noise Catchment Area	
		1	2
(3a) Installation of Steel Piles – Drilling	Period 1	V, N, R1, DR	V, IB, N, R1, DR, PC, SN
	Period 2	V, IB, N, PC, SN, R2, DR	AA,V, IB, N, PC, SN, R2, DR
(3b) Installation of Steel Piles -Hammering	Period 1	N, R1, DR	V, IB, N, R1, DR, PC, SN
	Period 2	V, IB, N, PC, SN, R2, DR	AA,V, IB, N, PC, SN, R2, DR
(3c) Installation of Steel Piles – Piling	Period 1	N, R1, DR	V, IB, N, R1, DR, PC, SN
	Period 2	V, IB, N, PC, SN, R2, DR	AA,V, IB, N, PC, SN, R2, DR

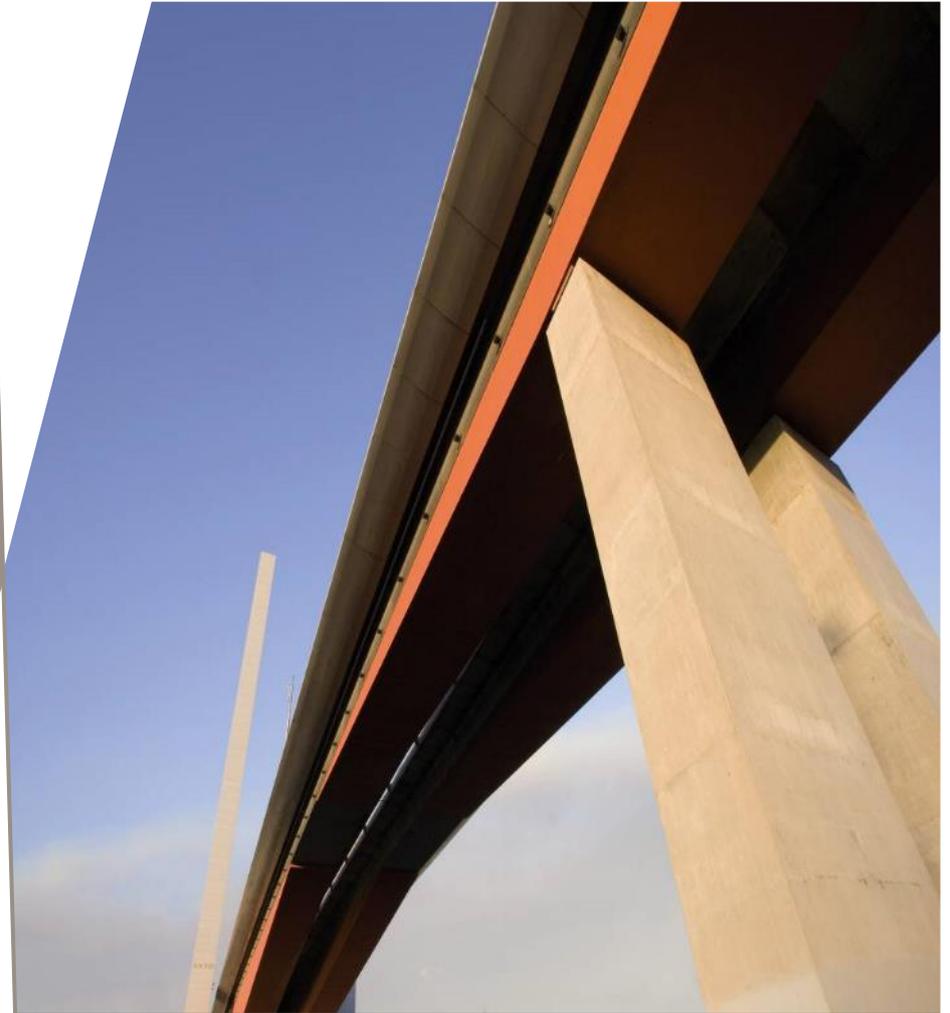
9 Conclusions

This assessment has determined the following conclusions:

- > In accordance with the noise management levels stipulated in Section 5.1, dwellings exposed to levels of construction noise above 75 dB(A) are considered highly noise affected, with dwellings exposed to levels above the daytime RBL +10 dB(A) considered noise affected
- > Construction noise levels are predicted to exceed the NSW ICNG noise management levels (NML) for “standard” hours at all NCAs for standard construction hours for all construction stages
- > Construction noise levels are predicted to significantly exceed management levels for “non-standard” hours of operation for Stage 3a, 3b and 3c at the nearby residential receivers in both NCAs, particularly for receivers located on High Street. This is due to the proximity of receivers to the construction works
- > Predicted levels are expected to be highly intrusive at a significant number of receivers in NCA 2 for Stage 3a, 3b and 3c for works during OOH1 and OOH2 time periods. Construction noise is likely to have a higher impact on and cause sleep disturbance at sensitive receivers located on High Street due to their proximity to the proposed work site
- > Highly intrusive noise levels were not predicted for NCA1 for any of the construction stages
- > It should be noted that this assessment has endeavoured to carry out “worst case” noise modelling, and noise levels are predicted based all modelled sources operating simultaneously. Should the work sites or plant and equipment be amended, the predicted noise levels will change accordingly
- > The predicted exceedances are generally a result of works being located in close proximity to the adjacent receivers. This modelling has been carried out to provide a worst case scenario and it may be possible to reduce the number of plant operating simultaneously, particularly at night, once detailed construction schedules are known
- > Provision of temporary noise barriers is not likely to be practical for this site given the elevated nature of the surrounding receivers. However, provision of anti-gawk screens with no gaps around the work site may provide some screening to the closest ground level receivers, and should be investigated further as part of the project CNVMP assessment
- > Best practice mitigation measures are recommended in Section 8 of this report
- > An indicative assessment only of expected L_{Amax} impact has been carried out for this assessment as it is difficult to predict L_{Amax} for construction noise sources. It is generally expected that sleep disturbance criteria are likely to be exceeded unless the proposed number and type of plant are reduced for out of hours works;
- > A detailed construction noise and vibration management plan should be prepared for the project prior to construction commencement to incorporate the recommendations detailed in Section 8 and updated to reflect the proposed staging and plant to be adopted for the project
- > The minimum working distances indicated in Table 7-1 for cosmetic damage must be complied with at all times, unless otherwise approved by TfNSW or under the environmental license as relevant, as stipulated in the NSW CNVG
- > A detailed construction noise and vibration management plan should be prepared for the project prior to construction commencement to incorporate the recommendations detailed in Section 8 and updated to reflect the proposed staging and plant to be adopted for the project.

North Sydney
Wharf Upgrade

APPENDIX A
NOISE
MONITORING
CHARTS



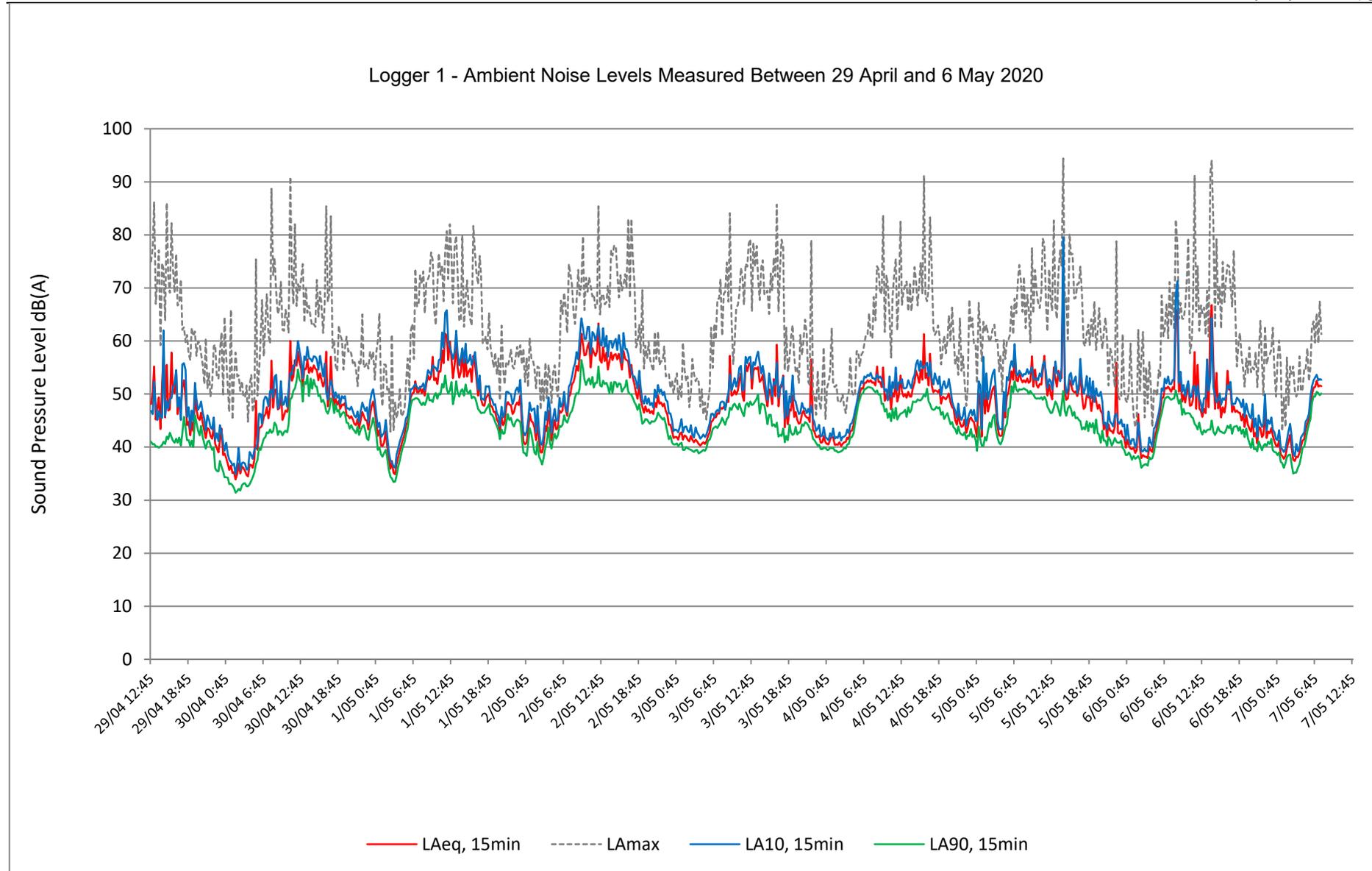


Figure A1 Ambient noise levels measured between 29 April and 6 May 2020 at logger location 1

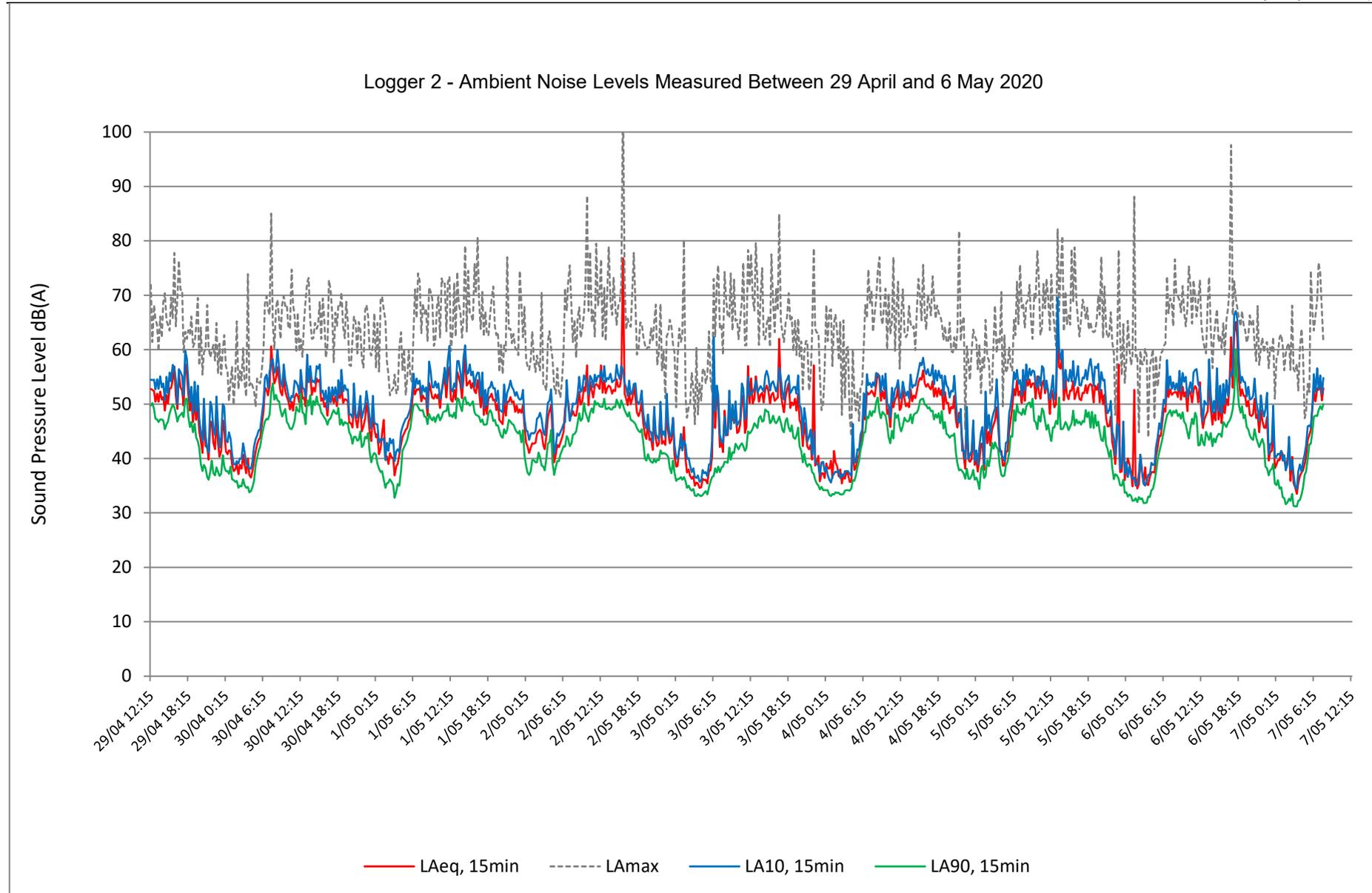


Figure A2 Ambient noise levels measured between 29 April and 6 May 2020 at logger location 2

North Sydney
Wharf Upgrade

APPENDIX B
WEATHER DATA
DURING THE
MONITORING
PERIOD



The following weather conditions occurred during the monitoring period.

Table B1: Weather conditions during the monitoring period

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain / 10 mins mm
30/04/2020 0:30	20.2	68.7	2.1	NE	0
30/04/2020 1:00	20.5	71	2.9	NE	0
30/04/2020 1:30	20.9	71	1.5	NE	0
30/04/2020 2:00	21.1	75	1.5	NE	0
30/04/2020 2:30	21	77	1.9	NE	0
30/04/2020 3:00	20.9	77	1.9	NNE	0
30/04/2020 3:30	20.9	73	1.7	NE	0
30/04/2020 4:00	20.6	72.3	1.3	NE	0
30/04/2020 4:30	20.4	73	1.7	NE	0
30/04/2020 5:00	20.3	72.7	2.3	NNE	0
30/04/2020 5:30	20.5	71.3	2.4	N	0
30/04/2020 6:00	20.6	70.3	2	NNE	0
30/04/2020 6:30	20.6	69.7	2.4	NNE	0
30/04/2020 7:00	20.5	70.7	2.4	NNE	0
30/04/2020 7:30	20.2	72.7	2.3	NNE	0
30/04/2020 8:00	20.3	72	1.7	NNE	0
30/04/2020 8:30	20.4	72	1.6	N	0
30/04/2020 9:00	21	70.7	2	NNE	0.2
30/04/2020 9:30	21	70	1.5	NNE	0
30/04/2020 10:00	20.8	71.3	1	NNE	0
30/04/2020 10:30	20.4	74	1.2	NNE	0.2
30/04/2020 11:00	19.1	78.7	4.1	WNW	0.4
30/04/2020 11:30	16.8	80.3	4.8	W	1.8
30/04/2020 12:00	14.9	80.3	5.9	WSW	1
30/04/2020 12:30	13.8	84.7	3.5	WSW	0.8
30/04/2020 13:00	14	85.7	2.7	W	0
30/04/2020 13:30	14.1	86.3	2.7	W	1.6
30/04/2020 14:00	14.2	87.7	2.1	W	1.6
30/04/2020 14:30	14.1	87.7	1.6	WSW	1.8
30/04/2020 15:00	14.1	88	1.9	WSW	1.8
30/04/2020 15:30	14	87.7	2.3	WSW	1
30/04/2020 16:00	13.9	86.3	3.2	WNW	0.4
30/04/2020 16:30	13.2	78.3	2.6	NW	0
30/04/2020 17:00	12.9	77.7	3	WNW	0
30/04/2020 17:30	12.9	79.3	3.6	WNW	0.2
30/04/2020 18:00	12.5	81.3	3.3	NW	0.2
30/04/2020 18:30	12.5	81.3	2.9	NW	0
30/04/2020 19:00	12.4	79	2.6	NW	0
30/04/2020 19:30	12.4	79.3	3.4	NW	0
30/04/2020 20:00	12.2	77	2.7	WNW	0
30/04/2020 20:30	12.1	75.3	2.4	WNW	0
30/04/2020 21:00	11.8	75	2.9	NW	0
30/04/2020 21:30	11.8	74.7	3.9	NNW	0
30/04/2020 22:00	11.8	71.3	4.3	NNW	0
30/04/2020 22:30	11.8	69.7	4.6	NW	0
30/04/2020 23:00	11.8	69	4.3	NW	0
30/04/2020 23:30	11.9	65	3.2	WNW	0
1/05/2020 0:00	12	63.7	4.1	NW	0
1/05/2020 0:30	11.8	63.7	4.2	WNW	0
1/05/2020 1:00	11.8	61	2.5	NW	0
1/05/2020 1:30	11.7	60	2.5	NW	0
1/05/2020 2:00	11.6	58.3	3.3	NW	0
1/05/2020 2:30	11.6	57	2.5	NW	0
1/05/2020 3:00	11.2	57.3	2.5	N	0
1/05/2020 3:30	11.1	56.3	3.3	N	0
1/05/2020 4:00	10.8	58.3	3	N	0
1/05/2020 4:30	10.6	61	3.4	N	0
1/05/2020 5:00	11	60.7	4	N	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain / 10 mins mm
1/05/2020 5:30	11.1	58.3	3.7	N	0
1/05/2020 6:00	11	58.7	4	NNW	0
1/05/2020 6:30	11	58.3	3.8	N	0
1/05/2020 7:00	11.4	57.3	4.1	NNW	0
1/05/2020 7:30	11.8	57	3.5	NNW	0
1/05/2020 8:00	12.7	54	2.5	NW	0
1/05/2020 8:30	12.7	53	3.3	NW	0
1/05/2020 9:00	13.5	48	4	NW	0
1/05/2020 9:30	14	46.3	4.7	NW	0
1/05/2020 10:00	14.4	43.3	4.7	NW	0
1/05/2020 10:30	14.8	41.3	5	NW	0
1/05/2020 11:00	15	36.7	5.1	NW	0
1/05/2020 11:30	15.3	34.3	6.6	WNW	0
1/05/2020 12:00	15.8	34.3	5.5	WNW	0
1/05/2020 12:30	16.2	32.7	5.9	W	0
1/05/2020 13:00	15.9	35	5	WNW	0.2
1/05/2020 13:30	16.3	35.3	5.8	WNW	0
1/05/2020 14:00	16.1	33.3	5.3	WNW	0
1/05/2020 14:30	16.4	34	5.9	NW	0
1/05/2020 15:00	16.6	31.7	6.5	NW	0
1/05/2020 15:30	16.1	32.7	5.6	NW	0
1/05/2020 16:00	15.9	31.7	6.1	WNW	0
1/05/2020 16:30	15.5	32.7	5.6	WNW	0
1/05/2020 17:00	15	34	3.8	WNW	0
1/05/2020 17:30	14.8	35.3	3.6	NW	0
1/05/2020 18:00	14.4	37.7	3.6	NW	0
1/05/2020 18:30	14	43	3.9	NW	0
1/05/2020 19:00	13.8	44.7	4.1	NW	0
1/05/2020 19:30	13.5	45.3	3.9	NNW	0
1/05/2020 20:00	13.3	46	3.9	NNW	0
1/05/2020 20:30	13	47.3	4	N	0
1/05/2020 21:00	12.8	49	4.5	N	0
1/05/2020 21:30	12.9	51	6.6	NNW	0
1/05/2020 22:00	12.8	52.3	6.4	NNW	0
1/05/2020 22:30	12.8	53	5.5	NNW	0
1/05/2020 23:00	13.4	53	5.1	NNW	0
1/05/2020 23:30	13.5	53.3	5.2	NW	0
2/05/2020 0:00	13.4	53	2.9	NW	0
2/05/2020 0:30	13.3	53	2.4	NW	0
2/05/2020 1:00	13.4	53.7	4.3	NW	0
2/05/2020 1:30	13.2	54.7	3.6	NW	0
2/05/2020 2:00	13	55.3	4.1	NW	0
2/05/2020 2:30	13	56.3	4.9	NW	0
2/05/2020 3:00	13	53.7	3.9	NNW	0
2/05/2020 3:30	12.8	53	5	NNW	0
2/05/2020 4:00	12.9	54.3	5.2	NNW	0
2/05/2020 4:30	13	53.7	2.9	NW	0
2/05/2020 5:00	13.5	50.7	3.6	NW	0
2/05/2020 5:30	13.6	51	4	NW	0
2/05/2020 6:00	13.7	50	4	NW	0
2/05/2020 6:30	13.4	50.7	3.4	NW	0
2/05/2020 7:00	13.6	51	3.9	NW	0
2/05/2020 7:30	14	50.3	4.7	NW	0
2/05/2020 8:00	14.5	47.3	4.9	NW	0
2/05/2020 8:30	14.3	43.3	5.9	WNW	0
2/05/2020 9:00	14.6	39.3	5.5	NW	0
2/05/2020 9:30	14.7	36.3	8.3	WNW	0
2/05/2020 10:00	14.8	35.7	7.3	W	0
2/05/2020 10:30	15.4	36.3	6.4	W	0
2/05/2020 11:00	16.1	35.3	7	WNW	0
2/05/2020 11:30	16.7	33.3	6.4	W	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain / 10 mins mm
2/05/2020 12:00	17.4	31.7	6.7	WNW	0
2/05/2020 12:30	17.9	31	6.8	WNW	0
2/05/2020 13:00	18.3	31.7	7.3	NW	0
2/05/2020 13:30	18.2	30.3	7.8	NW	0
2/05/2020 14:00	18.4	29.7	5.5	WNW	0
2/05/2020 14:30	18.3	30.3	6	WNW	0
2/05/2020 15:00	18.3	30	6.8	WNW	0
2/05/2020 15:30	18	29.3	5.8	WNW	0
2/05/2020 16:00	17.4	30.3	6.4	WNW	0
2/05/2020 16:30	16.8	31.7	6.2	W	0
2/05/2020 17:00	16.2	34.7	6.8	W	0
2/05/2020 17:30	15.7	35.7	5.4	W	0
2/05/2020 18:00	15.3	39.3	5.4	W	0
2/05/2020 18:30	15.1	39.7	4	W	0
2/05/2020 19:00	14.5	40.3	3.9	W	0
2/05/2020 19:30	14.2	40.7	2.9	WSW	0
2/05/2020 20:00	13.9	41	3.5	W	0
2/05/2020 20:30	13.6	42	4.3	W	0
2/05/2020 21:00	13.4	40.7	4.2	W	0
2/05/2020 21:30	13.2	41	4.6	W	0
2/05/2020 22:00	13.1	41.7	5.2	W	0
2/05/2020 22:30	13.2	40.3	4.8	W	0
2/05/2020 23:00	13	41.3	3.7	W	0
2/05/2020 23:30	12.6	42.3	3.2	WNW	0
3/05/2020 0:00	12.5	44.7	2.9	NW	0
3/05/2020 0:30	12.3	46.7	2.6	NW	0
3/05/2020 1:00	12.1	48.3	2.6	NW	0
3/05/2020 1:30	12.3	51	2.9	W	0
3/05/2020 2:00	12.1	51	2.5	NW	0
3/05/2020 2:30	12.1	52.7	3.3	W	0
3/05/2020 3:00	12.2	53.3	3.3	W	0
3/05/2020 3:30	12.1	53	2.7	W	0
3/05/2020 4:00	12.1	52.3	3.5	W	0
3/05/2020 4:30	12	52	3.7	W	0
3/05/2020 5:00	11.8	53.3	3.4	W	0
3/05/2020 5:30	11.5	54.3	3.2	W	0
3/05/2020 6:00	11.4	54	3.2	W	0
3/05/2020 6:30	11.4	54	3.6	W	0
3/05/2020 7:00	11.5	54	3.4	W	0
3/05/2020 7:30	12	53	4	W	0
3/05/2020 8:00	13	48.7	4.1	W	0
3/05/2020 8:30	13.1	49.7	3.6	W	0
3/05/2020 9:00	13.6	48	4.8	W	0
3/05/2020 9:30	14	45.7	5.2	W	0
3/05/2020 10:00	14.9	44.7	5.1	W	0
3/05/2020 10:30	15.6	41.7	3.9	WSW	0
3/05/2020 11:00	16.2	41	3.5	SW	0
3/05/2020 11:30	17.3	39.7	4.2	S	0
3/05/2020 12:00	18.5	36.7	4.2	SSW	0
3/05/2020 12:30	19.1	34.3	3.9	S	0
3/05/2020 13:00	19.4	33.3	3.8	SSW	0
3/05/2020 13:30	20	33.7	4	SSW	0
3/05/2020 14:00	19.8	31.7	3.3	SSW	0
3/05/2020 14:30	20	32.3	3.9	SSW	0
3/05/2020 15:00	19.6	31.7	3.6	SSW	0
3/05/2020 15:30	19.3	34.3	3.3	SSW	0
3/05/2020 16:00	18.4	35.7	2.6	S	0
3/05/2020 16:30	17.2	39	2.6	SSE	0
3/05/2020 17:00	16.4	42	1.8	SSE	0
3/05/2020 17:30	15.8	44.3	0.7	SSE	0
3/05/2020 18:00	15.4	46.7	0.9	SSE	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain / 10 mins mm
3/05/2020 18:30	15.3	48	0.8	S	0
3/05/2020 19:00	15.3	49	0.8	SW	0
3/05/2020 19:30	14.7	59.7	2	WNW	0
3/05/2020 20:00	13.8	63	1.9	W	0
3/05/2020 20:30	13.4	64.7	2.2	W	0
3/05/2020 21:00	12.9	68.7	2.6	W	0
3/05/2020 21:30	12.6	71.7	3	W	0
3/05/2020 22:00	12.2	71.3	3.2	W	0
3/05/2020 22:30	12.3	64	3.3	W	0
3/05/2020 23:00	12.5	60.3	3.4	W	0
3/05/2020 23:30	12.2	61	2.9	W	0
4/05/2020 0:00	12	61.3	3.4	W	0
4/05/2020 0:30	12	62	3.6	W	0
4/05/2020 1:00	11.6	63.7	3.4	W	0
4/05/2020 1:30	11.2	65.3	3.4	W	0
4/05/2020 2:00	11.2	65.3	4	W	0
4/05/2020 2:30	11	66	4	W	0
4/05/2020 3:00	10.9	66.7	3.6	W	0
4/05/2020 3:30	10.8	66.3	3.6	W	0
4/05/2020 4:00	10.5	67.7	3.8	W	0
4/05/2020 4:30	10.4	68.3	3.8	W	0
4/05/2020 5:00	10	70.3	3.5	W	0
4/05/2020 5:30	9.9	72.7	4.2	W	0
4/05/2020 6:00	9.7	75.3	4	WNW	0
4/05/2020 6:30	9.7	75	4	W	0
4/05/2020 7:00	9.9	72.7	3.7	WNW	0
4/05/2020 7:30	10.6	69.7	4.1	WNW	0
4/05/2020 8:00	11.9	63	4	W	0
4/05/2020 8:30	12	61.7	4.3	W	0
4/05/2020 9:00	12.5	62.3	4	W	0
4/05/2020 9:30	13.4	60.3	3.4	WNW	0
4/05/2020 10:00	14.4	58	3	WNW	0
4/05/2020 10:30	15.6	55.7	1.9	WNW	0
4/05/2020 11:00	16.6	54.3	1.8	WNW	0
4/05/2020 11:30	17.3	48.3	2.7	S	0
4/05/2020 12:00	18.1	47.3	2.7	S	0
4/05/2020 12:30	19.2	43	2.7	S	0
4/05/2020 13:00	19.1	42.3	3.1	S	0
4/05/2020 13:30	19.2	42.7	3.2	SSW	0
4/05/2020 14:00	19	42	3.4	S	0
4/05/2020 14:30	18.4	42.7	3.8	S	0
4/05/2020 15:00	17.7	46	4.1	S	0
4/05/2020 15:30	17.9	46.7	3.1	S	0
4/05/2020 16:00	17.5	47.3	3.5	S	0
4/05/2020 16:30	16.6	51.3	3.3	S	0
4/05/2020 17:00	16.2	52.3	3	S	0
4/05/2020 17:30	15.9	54.3	2	S	0
4/05/2020 18:00	15.8	56.7	3.4	S	0
4/05/2020 18:30	15.5	57.7	2.9	SSW	0
4/05/2020 19:00	15.2	59.3	2.5	SSW	0
4/05/2020 19:30	15	61	2.8	SSW	0
4/05/2020 20:00	15.2	61	2.6	SSW	0
4/05/2020 20:30	15.4	60.3	2.6	SSW	0
4/05/2020 21:00	15.6	58.7	2.7	WSW	0
4/05/2020 21:30	15.5	59	2.9	WSW	0
4/05/2020 22:00	15.3	60.3	3.2	WSW	0
4/05/2020 22:30	15.3	60.7	3.1	WSW	0
4/05/2020 23:00	14.8	61	3.4	W	0
4/05/2020 23:30	14.4	62.7	3.3	W	0
5/05/2020 0:00	14	66	3.4	W	0
5/05/2020 0:30	14.1	68.7	1.9	W	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain / 10 mins mm
5/05/2020 1:00	13.7	72.3	1.5	NNW	0
5/05/2020 1:30	13.5	72.3	3.4	WNW	0
5/05/2020 2:00	13.1	76.3	3.1	W	0.6
5/05/2020 2:30	12.9	80.7	3.4	W	0.8
5/05/2020 3:00	13	84.7	3.6	W	2.6
5/05/2020 3:30	12.8	87	3.6	W	1
5/05/2020 4:00	12.4	86	4.1	WNW	0.2
5/05/2020 4:30	12.2	86	3.3	W	0
5/05/2020 5:00	12.1	86	3	W	0.2
5/05/2020 5:30	12.4	87	2.7	W	0.8
5/05/2020 6:00	12.4	88	3.7	W	1
5/05/2020 6:30	12.6	88	3.2	W	1.8
5/05/2020 7:00	12.6	88.7	3.3	W	0.8
5/05/2020 7:30	12.5	88	3	WNW	0
5/05/2020 8:00	12.7	88	3.6	W	0
5/05/2020 8:30	13.2	87	3.5	W	0
5/05/2020 9:00	14	85	3.5	W	0
5/05/2020 9:30	14.5	81.3	2.5	W	0
5/05/2020 10:00	15.9	79	2.5	WSW	0
5/05/2020 10:30	17	73.7	3.2	S	0
5/05/2020 11:00	17.7	68.7	3.4	S	0.2
5/05/2020 11:30	17.9	66.3	3.2	SSW	0
5/05/2020 12:00	18.4	64.3	2.9	S	0
5/05/2020 12:30	19	61.7	3.3	SSW	0
5/05/2020 13:00	19.1	60.3	3.4	S	0
5/05/2020 13:30	19.7	59.7	2.6	SSE	0
5/05/2020 14:00	19.9	58.3	2.7	S	0
5/05/2020 14:30	20.6	57.7	2.8	S	0
5/05/2020 15:00	20.5	55.7	2.3	S	0
5/05/2020 15:30	20.6	56.3	2.4	S	0
5/05/2020 16:00	20.4	55.7	2.3	SSE	0
5/05/2020 16:30	18.5	60	2	SSE	0
5/05/2020 17:00	17.6	65.7	2.1	SSE	0
5/05/2020 17:30	17	69	1	SSE	0
5/05/2020 18:00	16.7	72	0.6	S	0
5/05/2020 18:30	16.4	73.3	0.6	WSW	0
5/05/2020 19:00	15.9	76.3	0.6	WSW	0
5/05/2020 19:30	15.7	80	1.1	WNW	0
5/05/2020 20:00	15.3	81.3	1.7	WNW	0
5/05/2020 20:30	15	82.3	1.1	WNW	0
5/05/2020 21:00	14.8	83.7	1.1	NW	0
5/05/2020 21:30	14.4	84	1.3	W	0
5/05/2020 22:00	14.3	84	1.8	WNW	0
5/05/2020 22:30	14.1	85	3.2	WNW	0
5/05/2020 23:00	13.7	84	3.1	W	0
5/05/2020 23:30	13.5	84	3.3	WNW	0
6/05/2020 0:00	13.4	84	2.6	W	0
6/05/2020 0:30	13.3	83.7	2.5	WNW	0
6/05/2020 1:00	13.1	84	2.4	W	0
6/05/2020 1:30	12.9	84.7	2.2	WNW	0
6/05/2020 2:00	12.8	85.7	2.6	WNW	0
6/05/2020 2:30	12.5	86	2.7	W	0
6/05/2020 3:00	12.3	86.3	3	W	0
6/05/2020 3:30	12.1	87	2.7	W	0
6/05/2020 4:00	12.1	87	2.6	W	0
6/05/2020 4:30	12.1	87.7	2.4	W	0
6/05/2020 5:00	11.8	87.3	2.7	W	0
6/05/2020 5:30	11.8	88	3.4	W	0
6/05/2020 6:00	11.7	88	3.1	W	0
6/05/2020 6:30	11.6	88	3.3	WNW	0
6/05/2020 7:00	11.5	88	3.1	W	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain / 10 mins mm
6/05/2020 7:30	11.8	88	2.9	W	0
6/05/2020 8:00	12.8	83.7	2.7	W	0
6/05/2020 8:30	12.9	80.7	2.3	W	0
6/05/2020 9:00	13.2	80.3	2.9	WNW	0
6/05/2020 9:30	13.8	78.3	2.5	W	0
6/05/2020 10:00	14.7	75.3	2.5	W	0
6/05/2020 10:30	15.7	72.3	2.7	W	0
6/05/2020 11:00	16.8	67.7	2.2	W	0
6/05/2020 11:30	17.8	64.7	1.9	W	0
6/05/2020 12:00	19.1	57.7	1.7	W	0
6/05/2020 12:30	21.3	47	1.8	NNW	0
6/05/2020 13:00	22.5	38	1.8	NW	0
6/05/2020 13:30	23	34	1.4	NW	0
6/05/2020 14:00	23.6	32.7	2.1	WNW	0
6/05/2020 14:30	23.6	32	1.4	NNW	0
6/05/2020 15:00	23.6	32	2.1	NE	0
6/05/2020 15:30	23.7	31	2.3	ENE	0
6/05/2020 16:00	22.4	38.7	2.5	NE	0
6/05/2020 16:30	20.9	43.3	1.9	NNE	0
6/05/2020 17:00	19.9	47.7	1.1	N	0
6/05/2020 17:30	19.1	51.7	1	N	0
6/05/2020 18:00	18.6	55.7	0.6	NE	0
6/05/2020 18:30	18.6	62	0.6	N	0
6/05/2020 19:00	18.4	64	0.7	N	0
6/05/2020 19:30	18	63.7	0.5	NE	0
6/05/2020 20:00	17.8	65.3	1	ENE	0
6/05/2020 20:30	17.6	65.3	1.1	ENE	0
6/05/2020 21:00	17.4	65	1.1	ENE	0
6/05/2020 21:30	17	66.3	0.7	NE	0
6/05/2020 22:00	16.5	67.3	0.7	NNE	0
6/05/2020 22:30	15.7	70.3	1.2	NNW	0
6/05/2020 23:00	15.1	74	1.5	WNW	0
6/05/2020 23:30	14.5	76	2.3	WNW	0
7/05/2020 0:00	14.4	76	1.9	WNW	0
7/05/2020 0:30	14.3	76	1.7	W	0
7/05/2020 1:00	14	77	1.7	W	0
7/05/2020 1:30	14.1	75	1.9	W	0
7/05/2020 2:00	13.8	75.7	1.9	W	0
7/05/2020 2:30	13.5	77	1.8	WNW	0
7/05/2020 3:00	13.4	78.7	2.2	WNW	0
7/05/2020 3:30	13.1	79.7	1.6	W	0
7/05/2020 4:00	13	78.3	1.5	W	0
7/05/2020 4:30	12.7	78	1.4	WNW	0
7/05/2020 5:00	12.5	78	2.2	W	0
7/05/2020 5:30	12.1	78.7	1.8	WNW	0
7/05/2020 6:00	11.9	80	1.8	NW	0
7/05/2020 6:30	11.8	81.3	2.5	WNW	0
7/05/2020 7:00	11.9	81.3	2.4	WNW	0
7/05/2020 7:30	12.4	79	2.6	W	0
7/05/2020 8:00	13	74.3	1.9	NW	0
7/05/2020 8:30	13.4	73	1.5	WNW	0
7/05/2020 9:00	14	71.3	1.7	WNW	0
7/05/2020 9:30	14.5	70.7	1.8	W	0
7/05/2020 10:00	15.1	69	1.4	W	0
7/05/2020 10:30	16	67.7	1.5	W	0
7/05/2020 11:00	17.2	65.7	0.9	W	0
7/05/2020 11:30	18.7	59.3	1.9	N	0
7/05/2020 12:00	20.2	51.7	1.1	ESE	0
7/05/2020 12:30	21.4	49.7	1.5	ENE	0
7/05/2020 13:00	22.2	47.3	2.4	NNW	0
7/05/2020 13:30	23.6	44.7	2.3	N	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain / 10 mins mm
7/05/2020 14:00	24.3	40	2.4	N	0
7/05/2020 14:30	24.6	39.3	2.5	N	0
7/05/2020 15:00	24.4	39.3	2.5	N	0
7/05/2020 15:30	24.1	39.3	2.2	N	0
7/05/2020 16:00	23.3	41.7	2.4	NNW	0
7/05/2020 16:30	22	43.7	3.1	NW	0
7/05/2020 17:00	21.1	45.3	2.7	N	0
7/05/2020 17:30	20.7	47.7	2.6	N	0
7/05/2020 18:00	20.2	50.3	2.5	N	0
7/05/2020 18:30	19.9	50.7	2.6	N	0
7/05/2020 19:00	19.6	51.3	1.9	N	0
7/05/2020 19:30	19.4	52	2.3	NNW	0
7/05/2020 20:00	19.2	54.3	1.6	NNW	0
7/05/2020 20:30	18.9	57	1.9	NNW	0
7/05/2020 21:00	18.6	58	3	NNW	0
7/05/2020 21:30	18.5	59	2.5	NNW	0
7/05/2020 22:00	18.2	60	2	N	0
7/05/2020 22:30	18.3	60	2.8	N	0
7/05/2020 23:00	18.2	60.3	3.4	N	0
7/05/2020 23:30	17.8	61.7	3.3	NNW	0

North Sydney
Wharf Upgrade

APPENDIX C
PREDICTED
CONSTRUCTION
NOISE LEVELS



Table C1 Predicted construction LAeq noise levels (Stage 1) compared to RMS daytime noise impact categories, dB(A). – NCA 1 & 2

Receiver	NCA	Obj.-No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable (> 55dB(A))														
Clearly audible (>65 dB(A))														
Moderately intrusive (> 75 dB(A))														
Highly intrusive / Highly noise affected (>75 dB(A))														
1 Baden Road	1	47	GF	W	49	59	59	-	-	-	55	51	51	51
1 Baden Road	1	47	F 1	W	50	59	60	-	-	-	55	52	52	51
1 Baden Road	1	47	F 2	W	50	59	60	-	-	-	55	52	52	51
1 Wallaringa Avenue	1	28	GF	W	53	62	63	-	-	-	58	55	55	55
1 Wallaringa Avenue	1	28	F 1	W	53	62	63	-	-	-	58	55	55	55
1 Wallaringa Avenue	1	28	F 2	W	53	62	63	-	-	-	58	55	55	56
1 Wallaringa Avenue	1	28	F 3	W	53	63	63	-	-	-	58	55	55	56
1 Wallaringa Avenue	1	28	F 4	W	53	63	63	-	-	-	58	56	55	56
1 Wallaringa Avenue	1	28	F 5	W	54	63	63	-	-	-	59	56	55	56
1 Wallaringa Avenue	1	28	F 6	W	54	63	63	-	-	-	59	56	55	56
1 Wallaringa Avenue	1	28	F 7	W	54	63	63	-	-	-	59	56	55	56
1 Wallaringa Avenue	1	28	F 8	W	54	63	63	-	-	-	59	56	55	56
1 Wallaringa Avenue	1	28	F 9	W	54	63	64	-	-	-	59	56	56	56
107 Kurraba Road	1	30	GF	W	53	62	63	-	-	-	58	55	55	55
107 Kurraba Road	1	30	F 1	W	53	62	63	-	-	-	58	55	55	55
107 Kurraba Road	1	30	F 2	W	53	62	63	-	-	-	58	55	55	56
109 Kurraba Road	1	31	GF	W	53	62	63	-	-	-	58	55	55	56
109 Kurraba Road	1	31	F 1	W	53	63	63	-	-	-	58	55	55	56
109 Kurraba Road	1	31	F 2	W	53	63	63	-	-	-	58	56	55	56
11 Lower Wycombe Lane	1	18	GF	S	54	62	63	-	-	-	58	54	54	55
11 Lower Wycombe Lane	1	18	F 1	S	54	62	63	-	-	-	58	55	54	55
11 Lower Wycombe Lane	1	18	F 2	S	54	62	63	-	-	-	58	55	54	55
11 Lower Wycombe Lane	1	18	F 3	S	54	62	63	-	-	-	58	55	55	55
119 Kurraba Road	1	32	GF	W	53	63	63	-	-	-	58	56	55	56
119 Kurraba Road	1	32	F 1	W	53	63	63	-	-	-	58	56	55	56
119 Kurraba Road	1	32	F 2	W	53	63	63	-	-	-	59	56	55	56
121 Kurraba Road	1	33	GF	W	55	65	65	-	-	-	60	57	57	58
121 Kurraba Road	1	33	F 1	W	55	65	65	-	-	-	60	58	57	58
121 Kurraba Road	1	33	F 2	W	55	65	65	-	-	-	60	58	57	58
125 Kurraba Road	1	34	GF	W	53	62	63	-	-	-	58	55	55	55
125 Kurraba Road	1	34	F 1	W	53	62	63	-	-	-	58	55	55	55
125 Kurraba Road	1	34	F 2	W	53	62	63	-	-	-	58	55	55	56
13 Lower Wycombe Lane	1	19	GF	S	54	62	63	-	-	-	58	55	54	54
13 Lower Wycombe Lane	1	19	F 1	S	54	62	63	-	-	-	58	55	54	54
13 Lower Wycombe Lane	1	19	F 2	S	54	62	63	-	-	-	58	55	54	54
13 Lower Wycombe Lane	1	19	F 3	S	54	62	63	-	-	-	58	55	55	55
133 Kurraba Road	1	35	GF	W	53	62	63	-	-	-	58	55	55	55

Receiver	NCA	Obj.-No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable (> 55dB(A))														
Clearly audible (>65 dB(A))														
Moderately intrusive (> 75 dB(A))														
Highly intrusive / Highly noise affected (>75 dB(A))														
133 Kurraba Road	1	35	F 1	W	53	62	63	-	-	-	58	55	55	55
133 Kurraba Road	1	35	F 2	W	53	62	63	-	-	-	58	55	55	56
135 Kurraba Road	1	36	GF	W	53	62	63	-	-	-	58	55	55	56
135 Kurraba Road	1	36	F 1	W	53	62	63	-	-	-	58	55	55	56
135 Kurraba Road	1	36	F 2	W	53	62	63	-	-	-	58	55	55	56
141 Kurraba Road	1	37	GF	W	51	61	61	-	-	-	56	54	53	54
141 Kurraba Road	1	37	F 1	W	51	61	61	-	-	-	56	54	53	54
141 Kurraba Road	1	37	F 2	W	51	61	61	-	-	-	57	54	53	54
143 Kurraba Road	1	38	GF	W	52	61	62	-	-	-	57	54	53	54
143 Kurraba Road	1	38	F 1	W	52	61	62	-	-	-	57	54	54	54
143 Kurraba Road	1	38	F 2	W	52	61	62	-	-	-	57	54	54	54
145 Kurraba Road	1	39	GF	W	50	60	60	-	-	-	55	52	52	52
145 Kurraba Road	1	39	F 1	W	51	61	61	-	-	-	56	53	53	53
145 Kurraba Road	1	39	F 2	W	51	61	61	-	-	-	56	54	53	54
147 Kurraba Road	1	40	GF	W	53	62	63	-	-	-	58	55	55	55
147 Kurraba Road	1	40	F 1	W	54	63	64	-	-	-	59	56	56	55
147 Kurraba Road	1	40	F 2	W	54	63	64	-	-	-	59	56	56	55
15 Lower Wycombe Lane	1	21	GF	S	54	62	62	-	-	-	57	56	55	56
15 Lower Wycombe Lane	1	21	F 1	S	54	62	62	-	-	-	57	56	55	56
15 Lower Wycombe Lane	1	21	F 2	S	54	62	63	-	-	-	58	56	55	56
15 Lower Wycombe Lane	1	21	F 3	S	54	62	63	-	-	-	58	55	55	56
153 Kurraba Road	1	41	GF	W	52	61	62	-	-	-	57	54	54	54
153 Kurraba Road	1	41	F 1	W	52	61	62	-	-	-	57	54	54	54
153 Kurraba Road	1	41	F 2	W	52	61	62	-	-	-	57	54	54	54
15a Lower Wycombe Lane	1	20	GF	S	54	62	63	-	-	-	57	54	54	54
15a Lower Wycombe Lane	1	20	F 1	S	54	62	63	-	-	-	58	55	54	54
15a Lower Wycombe Lane	1	20	F 2	S	54	62	63	-	-	-	58	55	54	54
15a Lower Wycombe Lane	1	20	F 3	S	54	62	63	-	-	-	58	55	54	55
192b Kurraba Road	1	42	GF	SW	39	49	50	-	-	-	44	41	41	41
192b Kurraba Road	1	42	F 1	SW	42	52	53	-	-	-	47	44	44	44
192b Kurraba Road	1	42	F 2	SW	46	55	56	-	-	-	50	47	47	47
194 Kurraba Road	1	43	GF	W	47	56	57	-	-	-	51	48	48	49
194 Kurraba Road	1	43	F 1	W	49	58	59	-	-	-	54	51	51	51
194 Kurraba Road	1	43	F 2	W	49	58	59	-	-	-	54	51	51	51
196 Kurraba Road	1	44	GF	W	43	52	53	-	-	-	47	44	44	45
196 Kurraba Road	1	44	F 1	W	48	58	59	-	-	-	53	50	50	50
196 Kurraba Road	1	44	F 2	W	49	58	59	-	-	-	54	51	51	51
198 Kurraba Road	1	45	GF	W	44	53	55	-	-	-	49	45	46	46

Receiver	NCA	Obj.- No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable (> 55dB(A))														
Clearly audible (>65 dB(A))														
Moderately intrusive (> 75 dB(A))														
Highly intrusive / Highly noise affected (>75 dB(A))														
198 Kurraba Road	1	45	F 1	W	48	58	59	-	-	-	53	50	50	50
198 Kurraba Road	1	45	F 2	W	49	58	59	-	-	-	54	51	51	51
19a Wallaringa Avenue	1	24	GF	SW	56	65	65	-	-	-	60	57	57	58
19a Wallaringa Avenue	1	24	F 1	SW	56	65	65	-	-	-	60	57	57	58
19a Wallaringa Avenue	1	24	F 2	SW	57	65	65	-	-	-	61	58	57	58
19a Wallaringa Avenue	1	24	F 3	SW	55	63	63	-	-	-	58	55	55	56
19c Wallaringa Avenue	1	23	GF	SW	56	64	64	-	-	-	60	57	56	57
19c Wallaringa Avenue	1	23	F 1	SW	56	64	65	-	-	-	60	57	56	57
19c Wallaringa Avenue	1	23	F 2	SW	56	64	65	-	-	-	60	57	56	57
19c Wallaringa Avenue	1	23	F 3	SW	56	64	65	-	-	-	60	57	57	57
19d Wallaringa Avenue	1	22	GF	S	54	62	62	-	-	-	57	54	54	55
19d Wallaringa Avenue	1	22	F 1	S	54	62	62	-	-	-	57	54	54	55
19d Wallaringa Avenue	1	22	F 2	S	54	62	62	-	-	-	58	55	54	55
19d Wallaringa Avenue	1	22	F 3	S	55	63	63	-	-	-	58	55	55	56
1a Hayes Street	1	14	GF	S	45	55	56	-	-	-	49	50	48	49
1a Hayes Street	1	14	F 1	S	49	59	60	-	-	-	54	52	52	52
1a Hayes Street	1	14	F 2	S	53	62	63	-	-	-	58	55	54	55
1a Hayes Street	1	14	F 3	S	53	62	63	-	-	-	58	54	54	55
2 Hayes Street	1	12	GF	S	54	64	64	-	-	-	60	56	56	56
2 Hayes Street	1	12	F 1	S	55	64	64	-	-	-	61	56	56	56
2 Hayes Street	1	12	F 2	S	55	65	65	-	-	-	61	57	56	57
2 Hayes Street	1	12	F 3	S	55	65	65	-	-	-	61	57	57	57
200 Kurraba Road	1	46	GF	W	49	59	59	-	-	-	54	51	51	51
200 Kurraba Road	1	46	F 1	W	49	59	60	-	-	-	54	51	51	51
200 Kurraba Road	1	46	F 2	W	50	59	60	-	-	-	55	52	52	51
5 Wallaringa Avenue	1	25	GF	SW	54	62	63	-	-	-	58	56	55	55
5 Wallaringa Avenue	1	25	F 1	SW	54	62	63	-	-	-	58	56	56	56
5 Wallaringa Avenue	1	25	F 2	SW	54	63	63	-	-	-	58	56	56	56
5 Wallaringa Avenue	1	25	F 3	SW	55	63	63	-	-	-	59	56	56	56
7 Lower Wycombe Lane	1	16	GF	S	54	62	63	-	-	-	58	55	54	55
7 Lower Wycombe Lane	1	16	F 1	S	54	62	63	-	-	-	59	55	54	55
7 Lower Wycombe Lane	1	16	F 2	S	54	62	63	-	-	-	59	55	55	55
7 Lower Wycombe Lane	1	16	F 3	S	54	63	63	-	-	-	59	55	55	55
7 Wallaringa Avenue	1	26	GF	SW	54	62	63	-	-	-	58	55	55	56
7 Wallaringa Avenue	1	26	F 1	SW	54	62	63	-	-	-	58	55	55	56
7 Wallaringa Avenue	1	26	F 2	SW	54	63	63	-	-	-	58	55	55	56
7 Wallaringa Avenue	1	26	F 3	SW	55	63	63	-	-	-	58	56	55	56
7a Hayes Street	1	13	GF	S	54	64	64	-	-	-	59	56	56	57

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable (> 55dB(A))														
Clearly audible (>65 dB(A))														
Moderately intrusive (> 75 dB(A))														
Highly intrusive / Highly noise affected (>75 dB(A))														
7a Hayes Street	1	13	F 1	S	55	64	64	-	-	-	59	56	56	57
7a Hayes Street	1	13	F 2	S	55	64	65	-	-	-	60	56	56	57
7a Hayes Street	1	13	F 3	S	56	64	65	-	-	-	60	57	56	58
9 Hayes Street	1	15	GF	S	54	62	63	-	-	-	58	55	54	55
9 Hayes Street	1	15	F 1	S	54	62	63	-	-	-	58	55	55	55
9 Hayes Street	1	15	F 2	S	54	63	63	-	-	-	59	55	55	55
9 Hayes Street	1	15	F 3	S	54	63	63	-	-	-	59	55	55	55
9 Lower Wycombe Lane	1	17	GF	S	54	62	63	-	-	-	58	55	54	55
9 Lower Wycombe Lane	1	17	F 1	S	54	62	63	-	-	-	58	55	54	55
9 Lower Wycombe Lane	1	17	F 2	S	54	62	63	-	-	-	58	55	54	55
9 Lower Wycombe Lane	1	17	F 3	S	54	62	63	-	-	-	58	55	55	55
9 Wallaringa Avenue	1	27	GF	SW	54	62	62	-	-	-	58	55	54	55
9 Wallaringa Avenue	1	27	F 1	SW	54	62	63	-	-	-	58	55	55	55
9 Wallaringa Avenue	1	27	F 2	SW	54	62	63	-	-	-	58	55	55	56
9 Wallaringa Avenue	1	27	F 3	SW	54	63	63	-	-	-	58	55	55	56
99 Kurraba Road	1	29	GF	SW	54	64	64	-	-	-	60	57	57	56
99 Kurraba Road	1	29	F 1	SW	54	64	65	-	-	-	60	57	57	57
99 Kurraba Road	1	29	F 2	SW	54	65	65	-	-	-	60	58	57	57
1 Elamang Street	2	82	GF	NW	54	64	67	-	-	-	59	57	57	55
1 Elamang Street	2	82	F 1	NW	55	64	67	-	-	-	60	57	57	55
1 Elamang Street	2	82	F 2	NW	55	64	67	-	-	-	60	57	57	55
118 High Street	2	81	GF	S	58	66	68	-	-	-	58	52	58	59
118 High Street	2	81	F 1	S	58	67	68	-	-	-	59	53	58	59
13 Elamang Street	2	63	GF	NE	57	68	68	-	-	-	62	59	60	56
13 Elamang Street	2	63	F 1	NE	57	68	68	-	-	-	62	59	60	56
13 Elamang Street	2	63	F 2	NE	57	68	68	-	-	-	62	59	61	57
140 High Street	2	80	GF	S	50	59	63	-	-	-	56	52	52	56
140 High Street	2	80	F 1	S	50	59	64	-	-	-	57	52	53	58
140 High Street	2	80	F 2	S	50	59	64	-	-	-	58	52	53	58
140 High Street	2	80	F 3	S	51	59	65	-	-	-	58	53	53	59
141 High Street	2	79	GF	NE	57	68	66	-	-	-	60	57	60	59
141 High Street	2	79	F 1	NE	58	68	68	-	-	-	62	57	60	60
141 High Street	2	79	F 2	NE	58	68	68	-	-	-	63	58	61	61
142 High Street	2	9	GF	S	63	65	67	-	-	-	65	61	56	66
142 High Street	2	9	F 1	S	64	65	67	-	-	-	65	61	56	67
142 High Street	2	9	F 2	S	64	66	68	-	-	-	66	62	56	67
142 High Street	2	9	F 3	S	65	66	68	-	-	-	67	62	57	68
143 High Street	2	78	GF	NE	58	68	67	-	-	-	61	57	61	61

Receiver	NCA	Obj.-No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable (> 55dB(A))														
Clearly audible (>65 dB(A))														
Moderately intrusive (> 75 dB(A))														
Highly intrusive / Highly noise affected (>75 dB(A))														
143 High Street	2	78	F 1	NE	59	69	69	-	-	-	63	58	61	61
143 High Street	2	78	F 2	NE	59	69	69	-	-	-	63	58	61	62
144 High Street	2	8	GF	SE	54	62	63	-	-	-	58	55	54	57
144 High Street	2	8	F 1	SE	55	63	63	-	-	-	58	55	55	57
144 High Street	2	8	F 2	SE	55	63	64	-	-	-	59	56	56	58
144 High Street	2	8	F 3	SE	57	66	66	-	-	-	61	58	58	59
144 High Street	2	8	F 4	SE	61	72	72	-	-	-	66	64	65	64
144 High Street	2	8	F 5	SE	66	77	77	-	-	-	71	69	70	68
145 High Street	2	77	GF	NE	61	72	70	-	-	-	64	59	63	63
145 High Street	2	77	F 1	NE	62	72	71	-	-	-	65	59	64	64
145 High Street	2	77	F 2	NE	62	73	71	-	-	-	66	60	64	64
146 High Street	2	3	GF	SE	78	85	85	-	-	-	80	75	76	79
146 High Street	2	3	F 1	SE	78	86	86	-	-	-	81	75	77	79
146 High Street	2	3	F 2	SE	78	86	86	-	-	-	81	76	77	79
146 High Street	2	3	F 3	SE	78	86	86	-	-	-	81	76	77	79
147 High Street	2	76	GF	NE	60	70	69	-	-	-	65	59	62	63
147 High Street	2	76	F 1	NE	60	71	71	-	-	-	65	60	63	64
147 High Street	2	76	F 2	NE	61	71	71	-	-	-	66	60	63	64
149 High Street	2	75	GF	NE	61	71	71	-	-	-	66	60	63	64
149 High Street	2	75	F 1	NE	62	72	71	-	-	-	67	61	64	65
149 High Street	2	75	F 2	NE	62	72	72	-	-	-	67	61	64	65
15 Elamang Street	2	62	GF	NE	57	66	68	-	-	-	61	58	59	57
15 Elamang Street	2	62	F 1	NE	57	67	68	-	-	-	62	58	59	57
15 Elamang Street	2	62	F 2	NE	57	67	68	-	-	-	62	59	59	57
161 High Street	2	74	GF	NE	62	72	74	-	-	-	67	61	64	64
161 High Street	2	74	F 1	NE	63	73	74	-	-	-	67	61	65	65
161 High Street	2	74	F 2	NE	64	73	75	-	-	-	68	62	65	65
165 High Street	2	10	GF	SE	66	74	73	-	-	-	69	65	66	68
165 High Street	2	10	F 1	SE	67	74	74	-	-	-	70	65	66	68
165 High Street	2	10	F 2	SE	67	75	74	-	-	-	70	66	67	69
169 High Street	2	11	GF	NE	50	60	61	-	-	-	55	52	53	52
169 High Street	2	11	F 1	NE	51	62	61	-	-	-	56	54	55	53
169 High Street	2	11	F 2	NE	60	70	67	-	-	-	62	60	61	63
17 Elamang Street	2	61	GF	NE	57	67	68	-	-	-	62	59	59	57
17 Elamang Street	2	61	F 1	NE	57	67	68	-	-	-	62	59	59	57
17 Elamang Street	2	61	F 2	NE	57	67	68	-	-	-	62	59	59	57
171 High Street	2	7	GF	NE	59	63	65	-	-	-	64	62	52	61
171 High Street	2	7	F 1	NE	64	70	69	-	-	-	66	64	60	65

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable (> 55dB(A))														
Clearly audible (>65 dB(A))														
Moderately intrusive (> 75 dB(A))														
Highly intrusive / Highly noise affected (>75 dB(A))														
171 High Street	2	7	F 2	NE	66	73	73	-	-	-	70	66	65	68
173 High Street	2	6	GF	NE	68	73	74	-	-	-	70	67	66	70
173 High Street	2	6	F 1	NE	69	76	76	-	-	-	72	67	68	72
173 High Street	2	6	F 2	NE	70	76	76	-	-	-	73	68	68	73
179 High Street	2	5	GF	NE	73	80	82	-	-	-	75	70	72	76
179 High Street	2	5	F 1	NE	74	81	83	-	-	-	76	71	73	78
179 High Street	2	5	F 2	NE	75	82	84	-	-	-	77	71	74	78
181 High Street	2	4	GF	NE	75	82	84	-	-	-	78	72	75	81
181 High Street	2	4	F 1	NE	77	84	85	-	-	-	79	73	76	81
181 High Street	2	4	F 2	NE	77	85	85	-	-	-	80	74	76	81
183 High Street	2	2	GF	SE	80	86	93	-	-	-	80	75	78	75
183 High Street	2	2	F 1	SE	80	87	92	-	-	-	82	75	79	76
183 High Street	2	2	F 2	SE	79	87	92	-	-	-	83	76	79	76
183 High Street	2	1	GF	NE	77	87	92	-	-	-	82	75	79	85
183 High Street	2	1	F 1	NE	77	88	92	-	-	-	84	76	80	84
183 High Street	2	1	F 2	NE	77	88	91	-	-	-	84	76	80	84
19 Elamang Street	2	60	GF	NE	57	67	68	-	-	-	62	59	59	57
19 Elamang Street	2	60	F 1	NE	58	67	69	-	-	-	62	59	60	57
19 Elamang Street	2	60	F 2	NE	58	68	69	-	-	-	62	59	60	57
21 Elamang Street	2	59	GF	NE	58	68	69	-	-	-	63	60	60	58
21 Elamang Street	2	59	F 1	NE	59	68	70	-	-	-	63	60	61	58
21 Elamang Street	2	59	F 2	NE	59	68	70	-	-	-	63	60	61	58
23 Elamang Street	2	58	GF	NE	58	68	69	-	-	-	63	60	60	58
23 Elamang Street	2	58	F 1	NE	59	68	70	-	-	-	63	60	60	58
23 Elamang Street	2	58	F 2	NE	59	68	70	-	-	-	63	60	61	58
24 Elamang Street	2	67	GF	NE	55	64	67	-	-	-	60	57	57	56
24 Elamang Street	2	67	F 1	NE	55	65	67	-	-	-	60	57	57	57
24 Elamang Street	2	67	F 2	NE	55	65	67	-	-	-	60	57	57	57
25 Elamang Street	2	57	GF	NE	57	68	70	-	-	-	63	60	61	58
25 Elamang Street	2	57	F 1	NE	57	69	70	-	-	-	63	60	61	58
25 Elamang Street	2	57	F 2	NE	57	69	70	-	-	-	63	60	61	59
27 Elamang Street	2	56	GF	NE	56	68	70	-	-	-	63	60	60	58
27 Elamang Street	2	56	F 1	NE	56	68	70	-	-	-	63	60	61	58
27 Elamang Street	2	56	F 2	NE	56	69	70	-	-	-	63	60	61	59
27a Elamang Street	2	55	GF	NE	55	68	69	-	-	-	63	60	60	58
27a Elamang Street	2	55	F 1	NE	55	68	69	-	-	-	63	60	61	58
27a Elamang Street	2	55	F 2	NE	56	69	70	-	-	-	63	60	61	58
27b Elamang Street	2	54	GF	N	55	68	69	-	-	-	60	59	60	56

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable (> 55dB(A))														
Clearly audible (>65 dB(A))														
Moderately intrusive (> 75 dB(A))														
Highly intrusive / Highly noise affected (>75 dB(A))														
27b Elamang Street	2	54	F 1	N	55	68	69	-	-	-	60	60	60	57
27b Elamang Street	2	54	F 2	N	55	68	69	-	-	-	61	60	61	57
29 Elamang Street	2	53	GF	N	54	67	68	-	-	-	59	59	60	57
29 Elamang Street	2	53	F 1	N	54	67	68	-	-	-	60	59	60	57
29 Elamang Street	2	53	F 2	N	55	68	69	-	-	-	60	59	60	58
33 Peel Street	2	68	GF	N	54	64	66	-	-	-	59	56	56	56
33 Peel Street	2	68	F 1	N	54	64	66	-	-	-	59	56	56	56
33 Peel Street	2	68	F 2	N	54	64	66	-	-	-	60	56	56	56
39a Elamang Street	2	50	GF	NE	43	54	65	-	-	-	47	53	53	44
39a Elamang Street	2	50	F 1	NE	44	54	66	-	-	-	47	53	53	44
39a Elamang Street	2	50	F 2	NE	44	55	66	-	-	-	47	53	54	45
39b Elamang Street	2	51	GF	N	46	57	66	-	-	-	47	54	55	44
39b Elamang Street	2	51	F 1	N	46	58	67	-	-	-	48	54	55	45
39b Elamang Street	2	51	F 2	N	48	59	67	-	-	-	48	55	56	46
39c Elamang Street	2	52	GF	NE	52	66	68	-	-	-	55	56	58	54
39c Elamang Street	2	52	F 1	NE	52	67	68	-	-	-	56	56	58	57
39c Elamang Street	2	52	F 2	NE	53	67	68	-	-	-	56	58	59	57
41-43 Elamang Street	2	49	GF	N	43	53	62	-	-	-	48	53	53	44
41-43 Elamang Street	2	49	F 1	N	44	54	63	-	-	-	48	53	53	45
41-43 Elamang Street	2	49	F 2	N	44	55	63	-	-	-	48	53	53	45
47 Elamang Street	2	48	GF	E	43	52	59	-	-	-	46	46	46	44
47 Elamang Street	2	48	F 1	E	43	53	59	-	-	-	46	46	46	45
47 Elamang Street	2	48	F 2	E	44	53	60	-	-	-	47	47	47	45
5 Elamang Street	2	66	GF	NE	55	65	67	-	-	-	60	57	57	57
5 Elamang Street	2	66	F 1	NE	55	65	67	-	-	-	60	57	58	57
5 Elamang Street	2	66	F 2	NE	55	65	68	-	-	-	60	58	58	57
7 Elamang Street	2	65	GF	NE	57	67	69	-	-	-	62	60	60	58
7 Elamang Street	2	65	F 1	NE	58	67	69	-	-	-	63	60	60	58
7 Elamang Street	2	65	F 2	NE	55	65	68	-	-	-	60	57	58	56
9 Elamang Street	2	64	GF	NE	56	65	68	-	-	-	61	58	58	56
9 Elamang Street	2	64	F 1	NE	56	66	68	-	-	-	61	58	58	56
9 Elamang Street	2	64	F 2	NE	56	66	69	-	-	-	61	58	58	56
Loreto A Kirribilli	2	69	GF	NE	52	64	64	-	-	-	57	56	56	55
Loreto A Kirribilli	2	69	F 1	NE	52	64	64	-	-	-	57	56	56	55
Loreto A Kirribilli	2	69	F 2	NE	52	64	65	-	-	-	57	56	56	55
Loreto B Kirribilli	2	70	GF	N	52	65	65	-	-	-	59	56	57	55
Loreto B Kirribilli	2	70	F 1	N	52	65	65	-	-	-	59	56	57	55
Loreto B Kirribilli	2	70	F 2	N	52	65	65	-	-	-	59	57	57	55

Receiver	NCA	Obj.- No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable (> 55dB(A))														
Clearly audible (>65 dB(A))														
Moderately intrusive (> 75 dB(A))														
Highly intrusive / Highly noise affected (>75 dB(A))														
Loreto C Kirribilli	2	72	GF	NE	44	54	55	-	-	-	50	47	47	45
Loreto C Kirribilli	2	72	F 1	NE	50	59	60	-	-	-	55	52	52	50
Loreto C Kirribilli	2	72	F 2	NE	53	63	64	-	-	-	58	55	55	53
Loreto D Kirribilli	2	71	GF	N	53	65	66	-	-	-	60	57	57	55
Loreto D Kirribilli	2	71	F 1	N	54	65	66	-	-	-	61	57	57	55
Loreto D Kirribilli	2	71	F 2	N	54	65	66	-	-	-	61	57	58	55
Loreto E Kirribilli	2	73	GF	NE	54	63	64	-	-	-	59	55	56	54
Loreto E Kirribilli	2	73	F 1	NE	54	64	65	-	-	-	59	56	56	54
Loreto E Kirribilli	2	73	F 2	NE	54	64	65	-	-	-	59	56	56	54

Table C2 Predicted construction LAeq noise levels compared to RMS worst case evening (OOH1) noise impact categories, dB(A). – NCA 1

Receiver	NCA	Obj.- No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 42 to 52 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 52 to 62 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 62 to 72 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >72 dB(A)														
1 Baden Road	1	47	GF	W	-	-	-	58	56	55	-	-	-	-
1 Baden Road	1	47	F 1	W	-	-	-	58	56	55	-	-	-	-
1 Baden Road	1	47	F 2	W	-	-	-	58	57	55	-	-	-	-
1 Wallaringa Avenue	1	28	GF	W	-	-	-	61	59	58	-	-	-	-
1 Wallaringa Avenue	1	28	F 1	W	-	-	-	62	60	58	-	-	-	-
1 Wallaringa Avenue	1	28	F 2	W	-	-	-	62	60	58	-	-	-	-
1 Wallaringa Avenue	1	28	F 3	W	-	-	-	62	60	58	-	-	-	-
1 Wallaringa Avenue	1	28	F 4	W	-	-	-	62	60	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 5	W	-	-	-	62	60	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 6	W	-	-	-	62	60	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 7	W	-	-	-	62	60	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 8	W	-	-	-	62	61	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 9	W	-	-	-	63	61	59	-	-	-	-
107 Kurraba Road	1	30	GF	W	-	-	-	61	59	58	-	-	-	-
107 Kurraba Road	1	30	F 1	W	-	-	-	61	60	58	-	-	-	-
107 Kurraba Road	1	30	F 2	W	-	-	-	62	60	58	-	-	-	-
109 Kurraba Road	1	31	GF	W	-	-	-	62	60	58	-	-	-	-
109 Kurraba Road	1	31	F 1	W	-	-	-	62	60	58	-	-	-	-
109 Kurraba Road	1	31	F 2	W	-	-	-	62	60	58	-	-	-	-
11 Lower Wycombe Lane	1	18	GF	S	-	-	-	62	59	58	-	-	-	-
11 Lower Wycombe Lane	1	18	F 1	S	-	-	-	62	59	58	-	-	-	-
11 Lower Wycombe Lane	1	18	F 2	S	-	-	-	62	59	58	-	-	-	-
11 Lower Wycombe Lane	1	18	F 3	S	-	-	-	63	60	58	-	-	-	-
119 Kurraba Road	1	32	GF	W	-	-	-	62	60	58	-	-	-	-
119 Kurraba Road	1	32	F 1	W	-	-	-	62	60	59	-	-	-	-
119 Kurraba Road	1	32	F 2	W	-	-	-	62	60	59	-	-	-	-
121 Kurraba Road	1	33	GF	W	-	-	-	64	62	60	-	-	-	-
121 Kurraba Road	1	33	F 1	W	-	-	-	64	62	60	-	-	-	-
121 Kurraba Road	1	33	F 2	W	-	-	-	64	62	61	-	-	-	-
125 Kurraba Road	1	34	GF	W	-	-	-	61	59	58	-	-	-	-
125 Kurraba Road	1	34	F 1	W	-	-	-	61	60	58	-	-	-	-
125 Kurraba Road	1	34	F 2	W	-	-	-	62	60	58	-	-	-	-
13 Lower Wycombe Lane	1	19	GF	S	-	-	-	61	59	58	-	-	-	-
13 Lower Wycombe Lane	1	19	F 1	S	-	-	-	61	59	58	-	-	-	-
13 Lower Wycombe Lane	1	19	F 2	S	-	-	-	61	59	58	-	-	-	-
13 Lower Wycombe Lane	1	19	F 3	S	-	-	-	62	60	58	-	-	-	-
133 Kurraba Road	1	35	GF	W	-	-	-	61	59	58	-	-	-	-

Receiver	NCA	Obj.- No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 42 to 52 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 52 to 62 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 62 to 72 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >72 dB(A)														
133 Kurraba Road	1	35	F 1	W	-	-	-	61	60	58	-	-	-	-
133 Kurraba Road	1	35	F 2	W	-	-	-	62	60	58	-	-	-	-
135 Kurraba Road	1	36	GF	W	-	-	-	61	59	58	-	-	-	-
135 Kurraba Road	1	36	F 1	W	-	-	-	61	60	58	-	-	-	-
135 Kurraba Road	1	36	F 2	W	-	-	-	62	60	58	-	-	-	-
141 Kurraba Road	1	37	GF	W	-	-	-	60	58	56	-	-	-	-
141 Kurraba Road	1	37	F 1	W	-	-	-	60	58	57	-	-	-	-
141 Kurraba Road	1	37	F 2	W	-	-	-	60	58	57	-	-	-	-
143 Kurraba Road	1	38	GF	W	-	-	-	60	58	57	-	-	-	-
143 Kurraba Road	1	38	F 1	W	-	-	-	60	58	57	-	-	-	-
143 Kurraba Road	1	38	F 2	W	-	-	-	60	58	57	-	-	-	-
145 Kurraba Road	1	39	GF	W	-	-	-	59	57	55	-	-	-	-
145 Kurraba Road	1	39	F 1	W	-	-	-	60	58	56	-	-	-	-
145 Kurraba Road	1	39	F 2	W	-	-	-	60	58	56	-	-	-	-
147 Kurraba Road	1	40	GF	W	-	-	-	61	59	58	-	-	-	-
147 Kurraba Road	1	40	F 1	W	-	-	-	62	60	59	-	-	-	-
147 Kurraba Road	1	40	F 2	W	-	-	-	62	60	59	-	-	-	-
15 Lower Wycombe Lane	1	21	GF	S	-	-	-	61	59	58	-	-	-	-
15 Lower Wycombe Lane	1	21	F 1	S	-	-	-	61	59	58	-	-	-	-
15 Lower Wycombe Lane	1	21	F 2	S	-	-	-	61	59	58	-	-	-	-
15 Lower Wycombe Lane	1	21	F 3	S	-	-	-	61	59	58	-	-	-	-
153 Kurraba Road	1	41	GF	W	-	-	-	60	58	57	-	-	-	-
153 Kurraba Road	1	41	F 1	W	-	-	-	60	58	57	-	-	-	-
153 Kurraba Road	1	41	F 2	W	-	-	-	60	59	57	-	-	-	-
15a Lower Wycombe Lane	1	20	GF	S	-	-	-	61	59	58	-	-	-	-
15a Lower Wycombe Lane	1	20	F 1	S	-	-	-	61	59	58	-	-	-	-
15a Lower Wycombe Lane	1	20	F 2	S	-	-	-	61	59	58	-	-	-	-
15a Lower Wycombe Lane	1	20	F 3	S	-	-	-	61	59	58	-	-	-	-
192b Kurraba Road	1	42	GF	SW	-	-	-	47	46	44	-	-	-	-
192b Kurraba Road	1	42	F 1	SW	-	-	-	50	48	47	-	-	-	-
192b Kurraba Road	1	42	F 2	SW	-	-	-	53	52	50	-	-	-	-
194 Kurraba Road	1	43	GF	W	-	-	-	55	53	51	-	-	-	-
194 Kurraba Road	1	43	F 1	W	-	-	-	57	56	54	-	-	-	-
194 Kurraba Road	1	43	F 2	W	-	-	-	57	56	54	-	-	-	-
196 Kurraba Road	1	44	GF	W	-	-	-	51	49	47	-	-	-	-
196 Kurraba Road	1	44	F 1	W	-	-	-	56	54	53	-	-	-	-
196 Kurraba Road	1	44	F 2	W	-	-	-	57	56	54	-	-	-	-
198 Kurraba Road	1	45	GF	W	-	-	-	52	50	48	-	-	-	-

Receiver	NCA	Obj.- No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 42 to 52 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 52 to 62 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 62 to 72 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >72 dB(A)														
198 Kurraba Road	1	45	F 1	W	-	-	-	56	55	53	-	-	-	-
198 Kurraba Road	1	45	F 2	W	-	-	-	57	56	54	-	-	-	-
19a Wallaringa Avenue	1	24	GF	SW	-	-	-	64	62	60	-	-	-	-
19a Wallaringa Avenue	1	24	F 1	SW	-	-	-	64	62	61	-	-	-	-
19a Wallaringa Avenue	1	24	F 2	SW	-	-	-	64	62	61	-	-	-	-
19a Wallaringa Avenue	1	24	F 3	SW	-	-	-	62	60	59	-	-	-	-
19c Wallaringa Avenue	1	23	GF	SW	-	-	-	63	61	60	-	-	-	-
19c Wallaringa Avenue	1	23	F 1	SW	-	-	-	63	61	60	-	-	-	-
19c Wallaringa Avenue	1	23	F 2	SW	-	-	-	63	62	60	-	-	-	-
19c Wallaringa Avenue	1	23	F 3	SW	-	-	-	64	62	60	-	-	-	-
19d Wallaringa Avenue	1	22	GF	S	-	-	-	61	59	57	-	-	-	-
19d Wallaringa Avenue	1	22	F 1	S	-	-	-	61	59	58	-	-	-	-
19d Wallaringa Avenue	1	22	F 2	S	-	-	-	61	59	58	-	-	-	-
19d Wallaringa Avenue	1	22	F 3	S	-	-	-	62	60	58	-	-	-	-
1a Hayes Street	1	14	GF	S	-	-	-	53	51	50	-	-	-	-
1a Hayes Street	1	14	F 1	S	-	-	-	57	55	54	-	-	-	-
1a Hayes Street	1	14	F 2	S	-	-	-	61	59	58	-	-	-	-
1a Hayes Street	1	14	F 3	S	-	-	-	61	60	58	-	-	-	-
2 Hayes Street	1	12	GF	S	-	-	-	63	61	60	-	-	-	-
2 Hayes Street	1	12	F 1	S	-	-	-	63	61	60	-	-	-	-
2 Hayes Street	1	12	F 2	S	-	-	-	64	62	61	-	-	-	-
2 Hayes Street	1	12	F 3	S	-	-	-	64	62	61	-	-	-	-
200 Kurraba Road	1	46	GF	W	-	-	-	58	56	54	-	-	-	-
200 Kurraba Road	1	46	F 1	W	-	-	-	58	56	54	-	-	-	-
200 Kurraba Road	1	46	F 2	W	-	-	-	58	56	55	-	-	-	-
5 Wallaringa Avenue	1	25	GF	SW	-	-	-	62	60	58	-	-	-	-
5 Wallaringa Avenue	1	25	F 1	SW	-	-	-	62	60	58	-	-	-	-
5 Wallaringa Avenue	1	25	F 2	SW	-	-	-	62	60	59	-	-	-	-
5 Wallaringa Avenue	1	25	F 3	SW	-	-	-	62	60	59	-	-	-	-
7 Lower Wycombe Lane	1	16	GF	S	-	-	-	62	60	59	-	-	-	-
7 Lower Wycombe Lane	1	16	F 1	S	-	-	-	62	60	59	-	-	-	-
7 Lower Wycombe Lane	1	16	F 2	S	-	-	-	62	60	59	-	-	-	-
7 Lower Wycombe Lane	1	16	F 3	S	-	-	-	62	60	59	-	-	-	-
7 Wallaringa Avenue	1	26	GF	SW	-	-	-	62	60	58	-	-	-	-
7 Wallaringa Avenue	1	26	F 1	SW	-	-	-	62	60	58	-	-	-	-
7 Wallaringa Avenue	1	26	F 2	SW	-	-	-	62	60	59	-	-	-	-
7 Wallaringa Avenue	1	26	F 3	SW	-	-	-	62	60	59	-	-	-	-
7a Hayes Street	1	13	GF	S	-	-	-	63	61	60	-	-	-	-

Receiver	NCA	Obj.- No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 42 to 52 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 52 to 62 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 62 to 72 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >72 dB(A)														
7a Hayes Street	1	13	F 1	S	-	-	-	63	61	60	-	-	-	-
7a Hayes Street	1	13	F 2	S	-	-	-	63	62	60	-	-	-	-
7a Hayes Street	1	13	F 3	S	-	-	-	64	62	61	-	-	-	-
9 Hayes Street	1	15	GF	S	-	-	-	62	60	59	-	-	-	-
9 Hayes Street	1	15	F 1	S	-	-	-	62	60	59	-	-	-	-
9 Hayes Street	1	15	F 2	S	-	-	-	62	60	59	-	-	-	-
9 Hayes Street	1	15	F 3	S	-	-	-	62	60	59	-	-	-	-
9 Lower Wycombe Lane	1	17	GF	S	-	-	-	61	59	58	-	-	-	-
9 Lower Wycombe Lane	1	17	F 1	S	-	-	-	61	60	58	-	-	-	-
9 Lower Wycombe Lane	1	17	F 2	S	-	-	-	62	60	58	-	-	-	-
9 Lower Wycombe Lane	1	17	F 3	S	-	-	-	62	60	59	-	-	-	-
9 Wallaringa Avenue	1	27	GF	SW	-	-	-	61	59	58	-	-	-	-
9 Wallaringa Avenue	1	27	F 1	SW	-	-	-	61	60	58	-	-	-	-
9 Wallaringa Avenue	1	27	F 2	SW	-	-	-	62	60	58	-	-	-	-
9 Wallaringa Avenue	1	27	F 3	SW	-	-	-	62	60	58	-	-	-	-
99 Kurraba Road	1	29	GF	SW	-	-	-	62	62	59	-	-	-	-
99 Kurraba Road	1	29	F 1	SW	-	-	-	62	62	59	-	-	-	-

Table C3 Predicted construction LAeq noise levels compared to RMS worst case evening (OOH1) noise impact categories, dB(A). – NCA 2

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 40 to 50 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 50 to 60 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 60 to 70 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >70 dB(A)														
99 Kurraba Road	1	29	F 2	SW	-	-	-	62	62	59	-	-	-	-
1 Elamang Street	2	82	GF	NW	-	-	-	63	61	59	-	-	-	-
1 Elamang Street	2	82	F 1	NW	-	-	-	63	61	59	-	-	-	-
1 Elamang Street	2	82	F 2	NW	-	-	-	63	61	60	-	-	-	-
118 High Street	2	81	GF	S	-	-	-	59	59	58	-	-	-	-
118 High Street	2	81	F 1	S	-	-	-	59	59	58	-	-	-	-
13 Elamang Street	2	63	GF	NE	-	-	-	64	63	61	-	-	-	-
13 Elamang Street	2	63	F 1	NE	-	-	-	65	63	61	-	-	-	-
13 Elamang Street	2	63	F 2	NE	-	-	-	65	63	61	-	-	-	-
140 High Street	2	80	GF	S	-	-	-	58	56	56	-	-	-	-
140 High Street	2	80	F 1	S	-	-	-	59	58	57	-	-	-	-
140 High Street	2	80	F 2	S	-	-	-	60	59	58	-	-	-	-
140 High Street	2	80	F 3	S	-	-	-	60	59	59	-	-	-	-
141 High Street	2	79	GF	NE	-	-	-	58	58	58	-	-	-	-
141 High Street	2	79	F 1	NE	-	-	-	60	60	59	-	-	-	-
141 High Street	2	79	F 2	NE	-	-	-	60	60	60	-	-	-	-
142 High Street	2	9	GF	S	-	-	-	63	68	63	-	-	-	-
142 High Street	2	9	F 1	S	-	-	-	64	68	64	-	-	-	-
142 High Street	2	9	F 2	S	-	-	-	65	69	64	-	-	-	-
142 High Street	2	9	F 3	S	-	-	-	65	69	65	-	-	-	-
143 High Street	2	78	GF	NE	-	-	-	59	58	58	-	-	-	-
143 High Street	2	78	F 1	NE	-	-	-	60	60	60	-	-	-	-
143 High Street	2	78	F 2	NE	-	-	-	60	60	60	-	-	-	-
144 High Street	2	8	GF	SE	-	-	-	62	60	58	-	-	-	-
144 High Street	2	8	F 1	SE	-	-	-	63	60	60	-	-	-	-
144 High Street	2	8	F 2	SE	-	-	-	64	61	61	-	-	-	-
144 High Street	2	8	F 3	SE	-	-	-	65	63	62	-	-	-	-
144 High Street	2	8	F 4	SE	-	-	-	69	67	66	-	-	-	-
144 High Street	2	8	F 5	SE	-	-	-	73	72	71	-	-	-	-
145 High Street	2	77	GF	NE	-	-	-	62	62	62	-	-	-	-
145 High Street	2	77	F 1	NE	-	-	-	63	63	63	-	-	-	-
145 High Street	2	77	F 2	NE	-	-	-	63	63	63	-	-	-	-
146 High Street	2	3	GF	SE	-	-	-	83	81	80	-	-	-	-
146 High Street	2	3	F 1	SE	-	-	-	85	82	81	-	-	-	-
146 High Street	2	3	F 2	SE	-	-	-	84	82	81	-	-	-	-
146 High Street	2	3	F 3	SE	-	-	-	84	82	81	-	-	-	-
147 High Street	2	76	GF	NE	-	-	-	62	62	62	-	-	-	-

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 40 to 50 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 50 to 60 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 60 to 70 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >70 dB(A)														
147 High Street	2	76	F 1	NE	-	-	-	63	63	63	-	-	-	-
147 High Street	2	76	F 2	NE	-	-	-	64	65	64	-	-	-	-
149 High Street	2	75	GF	NE	-	-	-	64	64	64	-	-	-	-
149 High Street	2	75	F 1	NE	-	-	-	65	65	65	-	-	-	-
149 High Street	2	75	F 2	NE	-	-	-	67	66	65	-	-	-	-
15 Elamang Street	2	62	GF	NE	-	-	-	64	62	61	-	-	-	-
15 Elamang Street	2	62	F 1	NE	-	-	-	64	62	61	-	-	-	-
15 Elamang Street	2	62	F 2	NE	-	-	-	65	63	61	-	-	-	-
161 High Street	2	74	GF	NE	-	-	-	65	65	64	-	-	-	-
161 High Street	2	74	F 1	NE	-	-	-	66	66	65	-	-	-	-
161 High Street	2	74	F 2	NE	-	-	-	68	67	65	-	-	-	-
165 High Street	2	10	GF	SE	-	-	-	73	70	70	-	-	-	-
165 High Street	2	10	F 1	SE	-	-	-	74	71	70	-	-	-	-
165 High Street	2	10	F 2	SE	-	-	-	74	71	71	-	-	-	-
169 High Street	2	11	GF	NE	-	-	-	58	56	55	-	-	-	-
169 High Street	2	11	F 1	NE	-	-	-	59	56	55	-	-	-	-
169 High Street	2	11	F 2	NE	-	-	-	65	63	63	-	-	-	-
17 Elamang Street	2	61	GF	NE	-	-	-	65	63	61	-	-	-	-
17 Elamang Street	2	61	F 1	NE	-	-	-	65	63	61	-	-	-	-
17 Elamang Street	2	61	F 2	NE	-	-	-	65	63	61	-	-	-	-
171 High Street	2	7	GF	NE	-	-	-	72	69	66	-	-	-	-
171 High Street	2	7	F 1	NE	-	-	-	73	70	68	-	-	-	-
171 High Street	2	7	F 2	NE	-	-	-	74	72	70	-	-	-	-
173 High Street	2	6	GF	NE	-	-	-	74	71	70	-	-	-	-
173 High Street	2	6	F 1	NE	-	-	-	75	73	71	-	-	-	-
173 High Street	2	6	F 2	NE	-	-	-	76	74	72	-	-	-	-
179 High Street	2	5	GF	NE	-	-	-	78	76	75	-	-	-	-
179 High Street	2	5	F 1	NE	-	-	-	79	77	76	-	-	-	-
179 High Street	2	5	F 2	NE	-	-	-	80	78	77	-	-	-	-
181 High Street	2	4	GF	NE	-	-	-	80	78	77	-	-	-	-
181 High Street	2	4	F 1	NE	-	-	-	81	80	79	-	-	-	-
181 High Street	2	4	F 2	NE	-	-	-	82	80	80	-	-	-	-
183 High Street	2	2	GF	SE	-	-	-	81	80	79	-	-	-	-
183 High Street	2	2	F 1	SE	-	-	-	83	82	82	-	-	-	-
183 High Street	2	2	F 2	SE	-	-	-	84	82	82	-	-	-	-
183 High Street	2	1	GF	NE	-	-	-	84	83	82	-	-	-	-
183 High Street	2	1	F 1	NE	-	-	-	85	84	83	-	-	-	-
183 High Street	2	1	F 2	NE	-	-	-	85	84	83	-	-	-	-

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 40 to 50 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 50 to 60 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 60 to 70 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >70 dB(A)														
19 Elamang Street	2	60	GF	NE	-	-	-	65	63	62	-	-	-	-
19 Elamang Street	2	60	F 1	NE	-	-	-	65	63	62	-	-	-	-
19 Elamang Street	2	60	F 2	NE	-	-	-	65	63	62	-	-	-	-
21 Elamang Street	2	59	GF	NE	-	-	-	66	64	62	-	-	-	-
21 Elamang Street	2	59	F 1	NE	-	-	-	66	64	62	-	-	-	-
21 Elamang Street	2	59	F 2	NE	-	-	-	66	64	63	-	-	-	-
23 Elamang Street	2	58	GF	NE	-	-	-	66	64	62	-	-	-	-
23 Elamang Street	2	58	F 1	NE	-	-	-	66	64	62	-	-	-	-
23 Elamang Street	2	58	F 2	NE	-	-	-	66	64	63	-	-	-	-
24 Elamang Street	2	67	GF	NE	-	-	-	63	61	60	-	-	-	-
24 Elamang Street	2	67	F 1	NE	-	-	-	63	61	60	-	-	-	-
24 Elamang Street	2	67	F 2	NE	-	-	-	63	61	60	-	-	-	-
25 Elamang Street	2	57	GF	NE	-	-	-	66	64	63	-	-	-	-
25 Elamang Street	2	57	F 1	NE	-	-	-	66	64	63	-	-	-	-
25 Elamang Street	2	57	F 2	NE	-	-	-	66	64	63	-	-	-	-
27 Elamang Street	2	56	GF	NE	-	-	-	66	64	63	-	-	-	-
27 Elamang Street	2	56	F 1	NE	-	-	-	66	64	63	-	-	-	-
27 Elamang Street	2	56	F 2	NE	-	-	-	66	64	63	-	-	-	-
27a Elamang Street	2	55	GF	NE	-	-	-	66	64	62	-	-	-	-
27a Elamang Street	2	55	F 1	NE	-	-	-	66	64	63	-	-	-	-
27a Elamang Street	2	55	F 2	NE	-	-	-	66	64	63	-	-	-	-
27b Elamang Street	2	54	GF	N	-	-	-	57	62	55	-	-	-	-
27b Elamang Street	2	54	F 1	N	-	-	-	57	62	56	-	-	-	-
27b Elamang Street	2	54	F 2	N	-	-	-	57	62	56	-	-	-	-
29 Elamang Street	2	53	GF	N	-	-	-	55	61	54	-	-	-	-
29 Elamang Street	2	53	F 1	N	-	-	-	55	62	55	-	-	-	-
29 Elamang Street	2	53	F 2	N	-	-	-	56	62	55	-	-	-	-
33 Peel Street	2	68	GF	N	-	-	-	62	60	59	-	-	-	-
33 Peel Street	2	68	F 1	N	-	-	-	62	61	59	-	-	-	-
33 Peel Street	2	68	F 2	N	-	-	-	63	61	59	-	-	-	-
39a Elamang Street	2	50	GF	NE	-	-	-	49	48	47	-	-	-	-
39a Elamang Street	2	50	F 1	NE	-	-	-	50	48	47	-	-	-	-
39a Elamang Street	2	50	F 2	NE	-	-	-	50	48	48	-	-	-	-
39b Elamang Street	2	51	GF	N	-	-	-	52	48	49	-	-	-	-
39b Elamang Street	2	51	F 1	N	-	-	-	52	49	50	-	-	-	-
39b Elamang Street	2	51	F 2	N	-	-	-	52	49	50	-	-	-	-
39c Elamang Street	2	52	GF	NE	-	-	-	51	50	49	-	-	-	-
39c Elamang Street	2	52	F 1	NE	-	-	-	51	50	49	-	-	-	-

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6	
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 40 to 50 dB(A)															
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 50 to 60 dB(A)															
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 60 to 70 dB(A)															
Highly Intrusive: >NML + 25 dB(A) - >70 dB(A)															
39c Elamang Street	2	52	F 2	NE	-	-	-	52	51	49	-	-	-	-	
41-43 Elamang Street	2	49	GF	N	-	-	-	51	49	48	-	-	-	-	
41-43 Elamang Street	2	49	F 1	N	-	-	-	51	49	48	-	-	-	-	
41-43 Elamang Street	2	49	F 2	N	-	-	-	51	50	49	-	-	-	-	
47 Elamang Street	2	48	GF	E	-	-	-	50	48	46	-	-	-	-	
47 Elamang Street	2	48	F 1	E	-	-	-	50	48	47	-	-	-	-	
47 Elamang Street	2	48	F 2	E	-	-	-	51	49	47	-	-	-	-	
5 Elamang Street	2	66	GF	NE	-	-	-	63	61	60	-	-	-	-	
5 Elamang Street	2	66	F 1	NE	-	-	-	63	61	60	-	-	-	-	
5 Elamang Street	2	66	F 2	NE	-	-	-	63	62	60	-	-	-	-	
7 Elamang Street	2	65	GF	NE	-	-	-	65	64	62	-	-	-	-	
7 Elamang Street	2	65	F 1	NE	-	-	-	66	64	62	-	-	-	-	
7 Elamang Street	2	65	F 2	NE	-	-	-	63	61	60	-	-	-	-	
9 Elamang Street	2	64	GF	NE	-	-	-	64	62	60	-	-	-	-	
9 Elamang Street	2	64	F 1	NE	-	-	-	64	62	60	-	-	-	-	
9 Elamang Street	2	64	F 2	NE	-	-	-	64	62	61	-	-	-	-	
Loreto A Kirribilli	2	69	GF	NE	-	-	-	57	59	54	-	-	-	-	
Loreto A Kirribilli	2	69	F 1	NE	-	-	-	57	59	54	-	-	-	-	
Loreto A Kirribilli	2	69	F 2	NE	-	-	-	57	59	54	-	-	-	-	
Loreto B Kirribilli	2	70	GF	N	-	-	-	62	60	58	-	-	-	-	
Loreto B Kirribilli	2	70	F 1	N	-	-	-	63	60	58	-	-	-	-	
Loreto B Kirribilli	2	70	F 2	N	-	-	-	63	60	59	-	-	-	-	
Loreto C Kirribilli	2	72	GF	NE	-	-	-	53	51	50	-	-	-	-	
Loreto C Kirribilli	2	72	F 1	NE	-	-	-	58	56	55	-	-	-	-	
Loreto C Kirribilli	2	72	F 2	NE	-	-	-	62	60	58	-	-	-	-	
Loreto D Kirribilli	2	71	GF	N	-	-	-	63	62	60	-	-	-	-	
Loreto D Kirribilli	2	71	F 1	N	-	-	-	64	62	60	-	-	-	-	
Loreto D Kirribilli	2	71	F 2	N	-	-	-	64	62	60	-	-	-	-	
Loreto E Kirribilli	2	73	GF	NE	-	-	-	62	60	59	-	-	-	-	
Loreto E Kirribilli	2	73	F 1	NE	-	-	-	62	60	59	-	-	-	-	
Loreto E Kirribilli	2	73	F 2	NE	-	-	-	62	60	59	-	-	-	-	

Table C4 Predicted construction LAeq noise levels compared to RMS night-time (OOH2) worst case noise impact categories, dB(A). – NCA 1

Receiver	NCA	Obj. - No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 38 to 48 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 48 to 58 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 58 to 68 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >68 dB(A)														
1 Baden Road	1	47	GF	W	-	-	-	58	56	55	-	-	-	-
1 Baden Road	1	47	F 1	W	-	-	-	58	56	55	-	-	-	-
1 Baden Road	1	47	F 2	W	-	-	-	58	57	55	-	-	-	-
1 Wallaringa Avenue	1	28	GF	W	-	-	-	61	59	58	-	-	-	-
1 Wallaringa Avenue	1	28	F 1	W	-	-	-	62	60	58	-	-	-	-
1 Wallaringa Avenue	1	28	F 2	W	-	-	-	62	60	58	-	-	-	-
1 Wallaringa Avenue	1	28	F 3	W	-	-	-	62	60	58	-	-	-	-
1 Wallaringa Avenue	1	28	F 4	W	-	-	-	62	60	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 5	W	-	-	-	62	60	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 6	W	-	-	-	62	60	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 7	W	-	-	-	62	60	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 8	W	-	-	-	62	61	59	-	-	-	-
1 Wallaringa Avenue	1	28	F 9	W	-	-	-	63	61	59	-	-	-	-
107 Kurraba Road	1	30	GF	W	-	-	-	61	59	58	-	-	-	-
107 Kurraba Road	1	30	F 1	W	-	-	-	61	60	58	-	-	-	-
107 Kurraba Road	1	30	F 2	W	-	-	-	62	60	58	-	-	-	-
109 Kurraba Road	1	31	GF	W	-	-	-	62	60	58	-	-	-	-
109 Kurraba Road	1	31	F 1	W	-	-	-	62	60	58	-	-	-	-
109 Kurraba Road	1	31	F 2	W	-	-	-	62	60	58	-	-	-	-
11 Lower Wycombe Lane	1	18	GF	S	-	-	-	62	59	58	-	-	-	-
11 Lower Wycombe Lane	1	18	F 1	S	-	-	-	62	59	58	-	-	-	-
11 Lower Wycombe Lane	1	18	F 2	S	-	-	-	62	59	58	-	-	-	-
11 Lower Wycombe Lane	1	18	F 3	S	-	-	-	63	60	58	-	-	-	-
119 Kurraba Road	1	32	GF	W	-	-	-	62	60	58	-	-	-	-
119 Kurraba Road	1	32	F 1	W	-	-	-	62	60	59	-	-	-	-
119 Kurraba Road	1	32	F 2	W	-	-	-	62	60	59	-	-	-	-
121 Kurraba Road	1	33	GF	W	-	-	-	64	62	60	-	-	-	-
121 Kurraba Road	1	33	F 1	W	-	-	-	64	62	60	-	-	-	-
121 Kurraba Road	1	33	F 2	W	-	-	-	64	62	61	-	-	-	-
125 Kurraba Road	1	34	GF	W	-	-	-	61	59	58	-	-	-	-
125 Kurraba Road	1	34	F 1	W	-	-	-	61	60	58	-	-	-	-
125 Kurraba Road	1	34	F 2	W	-	-	-	62	60	58	-	-	-	-

Receiver	NCA	Obj. - No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 38 to 48 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 48 to 58 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 58 to 68 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >68 dB(A)														
13 Lower Wycombe Lane	1	19	GF	S	-	-	-	61	59	58	-	-	-	-
13 Lower Wycombe Lane	1	19	F 1	S	-	-	-	61	59	58	-	-	-	-
13 Lower Wycombe Lane	1	19	F 2	S	-	-	-	61	59	58	-	-	-	-
13 Lower Wycombe Lane	1	19	F 3	S	-	-	-	62	60	58	-	-	-	-
133 Kurraba Road	1	35	GF	W	-	-	-	61	59	58	-	-	-	-
133 Kurraba Road	1	35	F 1	W	-	-	-	61	60	58	-	-	-	-
133 Kurraba Road	1	35	F 2	W	-	-	-	62	60	58	-	-	-	-
135 Kurraba Road	1	36	GF	W	-	-	-	61	59	58	-	-	-	-
135 Kurraba Road	1	36	F 1	W	-	-	-	61	60	58	-	-	-	-
135 Kurraba Road	1	36	F 2	W	-	-	-	62	60	58	-	-	-	-
141 Kurraba Road	1	37	GF	W	-	-	-	60	58	56	-	-	-	-
141 Kurraba Road	1	37	F 1	W	-	-	-	60	58	57	-	-	-	-
141 Kurraba Road	1	37	F 2	W	-	-	-	60	58	57	-	-	-	-
143 Kurraba Road	1	38	GF	W	-	-	-	60	58	57	-	-	-	-
143 Kurraba Road	1	38	F 1	W	-	-	-	60	58	57	-	-	-	-
143 Kurraba Road	1	38	F 2	W	-	-	-	60	58	57	-	-	-	-
145 Kurraba Road	1	39	GF	W	-	-	-	59	57	55	-	-	-	-
145 Kurraba Road	1	39	F 1	W	-	-	-	60	58	56	-	-	-	-
145 Kurraba Road	1	39	F 2	W	-	-	-	60	58	56	-	-	-	-
147 Kurraba Road	1	40	GF	W	-	-	-	61	59	58	-	-	-	-
147 Kurraba Road	1	40	F 1	W	-	-	-	62	60	59	-	-	-	-
147 Kurraba Road	1	40	F 2	W	-	-	-	62	60	59	-	-	-	-
15 Lower Wycombe Lane	1	21	GF	S	-	-	-	61	59	58	-	-	-	-
15 Lower Wycombe Lane	1	21	F 1	S	-	-	-	61	59	58	-	-	-	-
15 Lower Wycombe Lane	1	21	F 2	S	-	-	-	61	59	58	-	-	-	-
15 Lower Wycombe Lane	1	21	F 3	S	-	-	-	61	59	58	-	-	-	-
153 Kurraba Road	1	41	GF	W	-	-	-	60	58	57	-	-	-	-
153 Kurraba Road	1	41	F 1	W	-	-	-	60	58	57	-	-	-	-
153 Kurraba Road	1	41	F 2	W	-	-	-	60	59	57	-	-	-	-

Receiver	NCA	Obj. - No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 38 to 48 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 48 to 58 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 58 to 68 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >68 dB(A)														
15a Lower Wycombe Ln.	1	20	GF	S	-	-	-	61	59	58	-	-	-	-
15a Lower Wycombe Ln.	1	20	F 1	S	-	-	-	61	59	58	-	-	-	-
15a Lower Wycombe Ln.	1	20	F 2	S	-	-	-	61	59	58	-	-	-	-
15a Lower Wycombe Ln.	1	20	F 3	S	-	-	-	61	59	58	-	-	-	-
192b Kurraba Road	1	42	GF	SW	-	-	-	47	46	44	-	-	-	-
192b Kurraba Road	1	42	F 1	SW	-	-	-	50	48	47	-	-	-	-
192b Kurraba Road	1	42	F 2	SW	-	-	-	53	52	50	-	-	-	-
194 Kurraba Road	1	43	GF	W	-	-	-	55	53	51	-	-	-	-
194 Kurraba Road	1	43	F 1	W	-	-	-	57	56	54	-	-	-	-
194 Kurraba Road	1	43	F 2	W	-	-	-	57	56	54	-	-	-	-
196 Kurraba Road	1	44	GF	W	-	-	-	51	49	47	-	-	-	-
196 Kurraba Road	1	44	F 1	W	-	-	-	56	54	53	-	-	-	-
196 Kurraba Road	1	44	F 2	W	-	-	-	57	56	54	-	-	-	-
198 Kurraba Road	1	45	GF	W	-	-	-	52	50	48	-	-	-	-
198 Kurraba Road	1	45	F 1	W	-	-	-	56	55	53	-	-	-	-
198 Kurraba Road	1	45	F 2	W	-	-	-	57	56	54	-	-	-	-
19a Wallaringa Avenue	1	24	GF	SW	-	-	-	64	62	60	-	-	-	-
19a Wallaringa Avenue	1	24	F 1	SW	-	-	-	64	62	61	-	-	-	-
19a Wallaringa Avenue	1	24	F 2	SW	-	-	-	64	62	61	-	-	-	-
19a Wallaringa Avenue	1	24	F 3	SW	-	-	-	62	60	59	-	-	-	-
19c Wallaringa Avenue	1	23	GF	SW	-	-	-	63	61	60	-	-	-	-
19c Wallaringa Avenue	1	23	F 1	SW	-	-	-	63	61	60	-	-	-	-
19c Wallaringa Avenue	1	23	F 2	SW	-	-	-	63	62	60	-	-	-	-
19c Wallaringa Avenue	1	23	F 3	SW	-	-	-	64	62	60	-	-	-	-
19d Wallaringa Avenue	1	22	GF	S	-	-	-	61	59	57	-	-	-	-
19d Wallaringa Avenue	1	22	F 1	S	-	-	-	61	59	58	-	-	-	-
19d Wallaringa Avenue	1	22	F 2	S	-	-	-	61	59	58	-	-	-	-
19d Wallaringa Avenue	1	22	F 3	S	-	-	-	62	60	58	-	-	-	-
1a Hayes Street	1	14	GF	S	-	-	-	53	51	50	-	-	-	-
1a Hayes Street	1	14	F 1	S	-	-	-	57	55	54	-	-	-	-
1a Hayes Street	1	14	F 2	S	-	-	-	61	59	58	-	-	-	-
1a Hayes Street	1	14	F 3	S	-	-	-	61	60	58	-	-	-	-
2 Hayes Street	1	12	GF	S	-	-	-	63	61	60	-	-	-	-
2 Hayes Street	1	12	F 1	S	-	-	-	63	61	60	-	-	-	-

Receiver	NCA	Obj. - No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 38 to 48 dB(A)														
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 48 to 58 dB(A)														
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 58 to 68 dB(A)														
Highly Intrusive: >NML + 25 dB(A) - >68 dB(A)														
2 Hayes Street	1	12	F 2	S	-	-	-	64	62	61	-	-	-	-
2 Hayes Street	1	12	F 3	S	-	-	-	64	62	61	-	-	-	-
200 Kurraba Road	1	46	GF	W	-	-	-	58	56	54	-	-	-	-
200 Kurraba Road	1	46	F 1	W	-	-	-	58	56	54	-	-	-	-
200 Kurraba Road	1	46	F 2	W	-	-	-	58	56	55	-	-	-	-
5 Wallaringa Avenue	1	25	GF	SW	-	-	-	62	60	58	-	-	-	-
5 Wallaringa Avenue	1	25	F 1	SW	-	-	-	62	60	58	-	-	-	-
5 Wallaringa Avenue	1	25	F 2	SW	-	-	-	62	60	59	-	-	-	-
5 Wallaringa Avenue	1	25	F 3	SW	-	-	-	62	60	59	-	-	-	-
7 Lower Wycombe Lane	1	16	GF	S	-	-	-	62	60	59	-	-	-	-
7 Lower Wycombe Lane	1	16	F 1	S	-	-	-	62	60	59	-	-	-	-
7 Lower Wycombe Lane	1	16	F 2	S	-	-	-	62	60	59	-	-	-	-
7 Lower Wycombe Lane	1	16	F 3	S	-	-	-	62	60	59	-	-	-	-
7 Wallaringa Avenue	1	26	GF	SW	-	-	-	62	60	58	-	-	-	-
7 Wallaringa Avenue	1	26	F 1	SW	-	-	-	62	60	58	-	-	-	-
7 Wallaringa Avenue	1	26	F 2	SW	-	-	-	62	60	59	-	-	-	-
7 Wallaringa Avenue	1	26	F 3	SW	-	-	-	62	60	59	-	-	-	-
7a Hayes Street	1	13	GF	S	-	-	-	63	61	60	-	-	-	-
7a Hayes Street	1	13	F 1	S	-	-	-	63	61	60	-	-	-	-
7a Hayes Street	1	13	F 2	S	-	-	-	63	62	60	-	-	-	-
7a Hayes Street	1	13	F 3	S	-	-	-	64	62	61	-	-	-	-
9 Hayes Street	1	15	GF	S	-	-	-	62	60	59	-	-	-	-
9 Hayes Street	1	15	F 1	S	-	-	-	62	60	59	-	-	-	-
9 Hayes Street	1	15	F 2	S	-	-	-	62	60	59	-	-	-	-
9 Hayes Street	1	15	F 3	S	-	-	-	62	60	59	-	-	-	-
9 Lower Wycombe Lane	1	17	GF	S	-	-	-	61	59	58	-	-	-	-
9 Lower Wycombe Lane	1	17	F 1	S	-	-	-	61	60	58	-	-	-	-
9 Lower Wycombe Lane	1	17	F 2	S	-	-	-	62	60	58	-	-	-	-
9 Lower Wycombe Lane	1	17	F 3	S	-	-	-	62	60	59	-	-	-	-
9 Wallaringa Avenue	1	27	GF	SW	-	-	-	61	59	58	-	-	-	-

Receiver	NCA	Obj. - No.	FI	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6	
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 38 to 48 dB(A)															
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 48 to 58 dB(A)															
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 58 to 68 dB(A)															
Highly Intrusive: >NML + 25 dB(A) - >68 dB(A)															
9 Wallaringa Avenue	1	27	F 1	SW	-	-	-	61	60	58	-	-	-	-	
9 Wallaringa Avenue	1	27	F 2	SW	-	-	-	62	60	58	-	-	-	-	
9 Wallaringa Avenue	1	27	F 3	SW	-	-	-	62	60	58	-	-	-	-	
99 Kurraba Road	1	29	GF	SW	-	-	-	62	62	59	-	-	-	-	
99 Kurraba Road	1	29	F 1	SW	-	-	-	62	62	59	-	-	-	-	

Table C5 Predicted construction LAeq noise levels (Stage 1) compared to RMS night (OOH2) worst case noise impact categories, dB(A). – NCA 2

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6	
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 34 to 44 dB(A)															
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 44 to 54 dB(A)															
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 54 to 64 dB(A)															
Highly Intrusive: >NML + 25 dB(A) - >64 dB(A)															
99 Kurraba Road	1	29	F 2	SW	-	-	-	62	62	59	-	-	-	-	
1 Elamang Street	2	82	GF	NW	-	-	-	63	61	59	-	-	-	-	
1 Elamang Street	2	82	F 1	NW	-	-	-	63	61	59	-	-	-	-	
1 Elamang Street	2	82	F 2	NW	-	-	-	63	61	60	-	-	-	-	
118 High Street	2	81	GF	S	-	-	-	59	59	58	-	-	-	-	
118 High Street	2	81	F 1	S	-	-	-	59	59	58	-	-	-	-	
13 Elamang Street	2	63	GF	NE	-	-	-	64	63	61	-	-	-	-	
13 Elamang Street	2	63	F 1	NE	-	-	-	65	63	61	-	-	-	-	
13 Elamang Street	2	63	F 2	NE	-	-	-	65	63	61	-	-	-	-	
140 High Street	2	80	GF	S	-	-	-	58	56	56	-	-	-	-	
140 High Street	2	80	F 1	S	-	-	-	59	58	57	-	-	-	-	
140 High Street	2	80	F 2	S	-	-	-	60	59	58	-	-	-	-	
140 High Street	2	80	F 3	S	-	-	-	60	59	59	-	-	-	-	
141 High Street	2	79	GF	NE	-	-	-	58	58	58	-	-	-	-	
141 High Street	2	79	F 1	NE	-	-	-	60	60	59	-	-	-	-	
141 High Street	2	79	F 2	NE	-	-	-	60	60	60	-	-	-	-	
142 High Street	2	9	GF	S	-	-	-	63	68	63	-	-	-	-	
142 High Street	2	9	F 1	S	-	-	-	64	68	64	-	-	-	-	
142 High Street	2	9	F 2	S	-	-	-	65	69	64	-	-	-	-	
142 High Street	2	9	F 3	S	-	-	-	65	69	65	-	-	-	-	
143 High Street	2	78	GF	NE	-	-	-	59	58	58	-	-	-	-	
143 High Street	2	78	F 1	NE	-	-	-	60	60	60	-	-	-	-	
143 High Street	2	78	F 2	NE	-	-	-	60	60	60	-	-	-	-	
144 High Street	2	8	GF	SE	-	-	-	62	60	58	-	-	-	-	
144 High Street	2	8	F 1	SE	-	-	-	63	60	60	-	-	-	-	
144 High Street	2	8	F 2	SE	-	-	-	64	61	61	-	-	-	-	
144 High Street	2	8	F 3	SE	-	-	-	65	63	62	-	-	-	-	
144 High Street	2	8	F 4	SE	-	-	-	69	67	66	-	-	-	-	
144 High Street	2	8	F 5	SE	-	-	-	73	72	71	-	-	-	-	
145 High Street	2	77	GF	NE	-	-	-	62	62	62	-	-	-	-	
145 High Street	2	77	F 1	NE	-	-	-	63	63	63	-	-	-	-	
145 High Street	2	77	F 2	NE	-	-	-	63	63	63	-	-	-	-	
146 High Street	2	3	GF	SE	-	-	-	83	81	80	-	-	-	-	
146 High Street	2	3	F 1	SE	-	-	-	85	82	81	-	-	-	-	
146 High Street	2	3	F 2	SE	-	-	-	84	82	81	-	-	-	-	
146 High Street	2	3	F 3	SE	-	-	-	84	82	81	-	-	-	-	

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6	
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 34 to 44 dB(A)															
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 44 to 54 dB(A)															
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 54 to 64 dB(A)															
Highly Intrusive: >NML + 25 dB(A) - >64 dB(A)															
147 High Street	2	76	GF	NE	-	-	-	62	62	62	-	-	-	-	
147 High Street	2	76	F 1	NE	-	-	-	63	63	63	-	-	-	-	
147 High Street	2	76	F 2	NE	-	-	-	64	65	64	-	-	-	-	
149 High Street	2	75	GF	NE	-	-	-	64	64	64	-	-	-	-	
149 High Street	2	75	F 1	NE	-	-	-	65	65	65	-	-	-	-	
149 High Street	2	75	F 2	NE	-	-	-	67	66	65	-	-	-	-	
15 Elamang Street	2	62	GF	NE	-	-	-	64	62	61	-	-	-	-	
15 Elamang Street	2	62	F 1	NE	-	-	-	64	62	61	-	-	-	-	
15 Elamang Street	2	62	F 2	NE	-	-	-	65	63	61	-	-	-	-	
161 High Street	2	74	GF	NE	-	-	-	65	65	64	-	-	-	-	
161 High Street	2	74	F 1	NE	-	-	-	66	66	65	-	-	-	-	
161 High Street	2	74	F 2	NE	-	-	-	68	67	65	-	-	-	-	
165 High Street	2	10	GF	SE	-	-	-	73	70	70	-	-	-	-	
165 High Street	2	10	F 1	SE	-	-	-	74	71	70	-	-	-	-	
165 High Street	2	10	F 2	SE	-	-	-	74	71	71	-	-	-	-	
169 High Street	2	11	GF	NE	-	-	-	58	56	55	-	-	-	-	
169 High Street	2	11	F 1	NE	-	-	-	59	56	55	-	-	-	-	
169 High Street	2	11	F 2	NE	-	-	-	65	63	63	-	-	-	-	
17 Elamang Street	2	61	GF	NE	-	-	-	65	63	61	-	-	-	-	
17 Elamang Street	2	61	F 1	NE	-	-	-	65	63	61	-	-	-	-	
17 Elamang Street	2	61	F 2	NE	-	-	-	65	63	61	-	-	-	-	
171 High Street	2	7	GF	NE	-	-	-	72	69	66	-	-	-	-	
171 High Street	2	7	F 1	NE	-	-	-	73	70	68	-	-	-	-	
171 High Street	2	7	F 2	NE	-	-	-	74	72	70	-	-	-	-	
173 High Street	2	6	GF	NE	-	-	-	74	71	70	-	-	-	-	
173 High Street	2	6	F 1	NE	-	-	-	75	73	71	-	-	-	-	
173 High Street	2	6	F 2	NE	-	-	-	76	74	72	-	-	-	-	
179 High Street	2	5	GF	NE	-	-	-	78	76	75	-	-	-	-	
179 High Street	2	5	F 1	NE	-	-	-	79	77	76	-	-	-	-	
179 High Street	2	5	F 2	NE	-	-	-	80	78	77	-	-	-	-	
181 High Street	2	4	GF	NE	-	-	-	80	78	77	-	-	-	-	
181 High Street	2	4	F 1	NE	-	-	-	81	80	79	-	-	-	-	
181 High Street	2	4	F 2	NE	-	-	-	82	80	80	-	-	-	-	
183 High Street	2	2	GF	SE	-	-	-	81	80	79	-	-	-	-	
183 High Street	2	2	F 1	SE	-	-	-	83	82	82	-	-	-	-	
183 High Street	2	2	F 2	SE	-	-	-	84	82	82	-	-	-	-	
183 High Street	2	1	GF	NE	-	-	-	84	83	82	-	-	-	-	

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6	
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 34 to 44 dB(A)															
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 44 to 54 dB(A)															
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 54 to 64 dB(A)															
Highly Intrusive: >NML + 25 dB(A) - >64 dB(A)															
183 High Street	2	1	F 1	NE	-	-	-	85	84	83	-	-	-	-	
183 High Street	2	1	F 2	NE	-	-	-	85	84	83	-	-	-	-	
19 Elamang Street	2	60	GF	NE	-	-	-	65	63	62	-	-	-	-	
19 Elamang Street	2	60	F 1	NE	-	-	-	65	63	62	-	-	-	-	
19 Elamang Street	2	60	F 2	NE	-	-	-	65	63	62	-	-	-	-	
21 Elamang Street	2	59	GF	NE	-	-	-	66	64	62	-	-	-	-	
21 Elamang Street	2	59	F 1	NE	-	-	-	66	64	62	-	-	-	-	
21 Elamang Street	2	59	F 2	NE	-	-	-	66	64	63	-	-	-	-	
23 Elamang Street	2	58	GF	NE	-	-	-	66	64	62	-	-	-	-	
23 Elamang Street	2	58	F 1	NE	-	-	-	66	64	62	-	-	-	-	
23 Elamang Street	2	58	F 2	NE	-	-	-	66	64	63	-	-	-	-	
24 Elamang Street	2	67	GF	NE	-	-	-	63	61	60	-	-	-	-	
24 Elamang Street	2	67	F 1	NE	-	-	-	63	61	60	-	-	-	-	
24 Elamang Street	2	67	F 2	NE	-	-	-	63	61	60	-	-	-	-	
25 Elamang Street	2	57	GF	NE	-	-	-	66	64	63	-	-	-	-	
25 Elamang Street	2	57	F 1	NE	-	-	-	66	64	63	-	-	-	-	
25 Elamang Street	2	57	F 2	NE	-	-	-	66	64	63	-	-	-	-	
27 Elamang Street	2	56	GF	NE	-	-	-	66	64	63	-	-	-	-	
27 Elamang Street	2	56	F 1	NE	-	-	-	66	64	63	-	-	-	-	
27 Elamang Street	2	56	F 2	NE	-	-	-	66	64	63	-	-	-	-	
27a Elamang Street	2	55	GF	NE	-	-	-	66	64	62	-	-	-	-	
27a Elamang Street	2	55	F 1	NE	-	-	-	66	64	63	-	-	-	-	
27a Elamang Street	2	55	F 2	NE	-	-	-	66	64	63	-	-	-	-	
27b Elamang Street	2	54	GF	N	-	-	-	57	62	55	-	-	-	-	
27b Elamang Street	2	54	F 1	N	-	-	-	57	62	56	-	-	-	-	
27b Elamang Street	2	54	F 2	N	-	-	-	57	62	56	-	-	-	-	
29 Elamang Street	2	53	GF	N	-	-	-	55	61	54	-	-	-	-	
29 Elamang Street	2	53	F 1	N	-	-	-	55	62	55	-	-	-	-	
29 Elamang Street	2	53	F 2	N	-	-	-	56	62	55	-	-	-	-	
33 Peel Street	2	68	GF	N	-	-	-	62	60	59	-	-	-	-	
33 Peel Street	2	68	F 1	N	-	-	-	62	61	59	-	-	-	-	
33 Peel Street	2	68	F 2	N	-	-	-	63	61	59	-	-	-	-	
39a Elamang Street	2	50	GF	NE	-	-	-	49	48	47	-	-	-	-	
39a Elamang Street	2	50	F 1	NE	-	-	-	50	48	47	-	-	-	-	
39a Elamang Street	2	50	F 2	NE	-	-	-	50	48	48	-	-	-	-	
39b Elamang Street	2	51	GF	N	-	-	-	52	48	49	-	-	-	-	
39b Elamang Street	2	51	F 1	N	-	-	-	52	49	50	-	-	-	-	

Receiver	NCA	Obj.- No.	Fl	Dir	Scenario 1	Scenario 1a	Scenario 2	Scenario 3a	Scenario 3b	Scenario 3c	Scenario 3d	Scenario 4	Scenario 5	Scenario 6	
Noticeable: NML – 5dB(A) to NML + 5 dB(A) - 34 to 44 dB(A)															
Clearly audible: NML +5 dB(A) to NML + 15 dB(A) – 44 to 54 dB(A)															
Moderately intrusive: NML +15 dB(A) to NML + 25 dB(A) – 54 to 64 dB(A)															
Highly Intrusive: >NML + 25 dB(A) - >64 dB(A)															
39b Elamang Street	2	51	F 2	N	-	-	-	52	49	50	-	-	-	-	
39c Elamang Street	2	52	GF	NE	-	-	-	51	50	49	-	-	-	-	
39c Elamang Street	2	52	F 1	NE	-	-	-	51	50	49	-	-	-	-	
39c Elamang Street	2	52	F 2	NE	-	-	-	52	51	49	-	-	-	-	
41-43 Elamang Street	2	49	GF	N	-	-	-	51	49	48	-	-	-	-	
41-43 Elamang Street	2	49	F 1	N	-	-	-	51	49	48	-	-	-	-	
41-43 Elamang Street	2	49	F 2	N	-	-	-	51	50	49	-	-	-	-	
47 Elamang Street	2	48	GF	E	-	-	-	50	48	46	-	-	-	-	
47 Elamang Street	2	48	F 1	E	-	-	-	50	48	47	-	-	-	-	
47 Elamang Street	2	48	F 2	E	-	-	-	51	49	47	-	-	-	-	
5 Elamang Street	2	66	GF	NE	-	-	-	63	61	60	-	-	-	-	
5 Elamang Street	2	66	F 1	NE	-	-	-	63	61	60	-	-	-	-	
5 Elamang Street	2	66	F 2	NE	-	-	-	63	62	60	-	-	-	-	
7 Elamang Street	2	65	GF	NE	-	-	-	65	64	62	-	-	-	-	
7 Elamang Street	2	65	F 1	NE	-	-	-	66	64	62	-	-	-	-	
7 Elamang Street	2	65	F 2	NE	-	-	-	63	61	60	-	-	-	-	
9 Elamang Street	2	64	GF	NE	-	-	-	64	62	60	-	-	-	-	
9 Elamang Street	2	64	F 1	NE	-	-	-	64	62	60	-	-	-	-	
9 Elamang Street	2	64	F 2	NE	-	-	-	64	62	61	-	-	-	-	
Loreto A Kirribilli	2	69	GF	NE	-	-	-	57	59	54	-	-	-	-	
Loreto A Kirribilli	2	69	F 1	NE	-	-	-	57	59	54	-	-	-	-	
Loreto A Kirribilli	2	69	F 2	NE	-	-	-	57	59	54	-	-	-	-	
Loreto B Kirribilli	2	70	GF	N	-	-	-	62	60	58	-	-	-	-	
Loreto B Kirribilli	2	70	F 1	N	-	-	-	63	60	58	-	-	-	-	
Loreto B Kirribilli	2	70	F 2	N	-	-	-	63	60	59	-	-	-	-	
Loreto C Kirribilli	2	72	GF	NE	-	-	-	53	51	50	-	-	-	-	
Loreto C Kirribilli	2	72	F 1	NE	-	-	-	58	56	55	-	-	-	-	
Loreto C Kirribilli	2	72	F 2	NE	-	-	-	62	60	58	-	-	-	-	
Loreto D Kirribilli	2	71	GF	N	-	-	-	63	62	60	-	-	-	-	
Loreto D Kirribilli	2	71	F 1	N	-	-	-	64	62	60	-	-	-	-	
Loreto D Kirribilli	2	71	F 2	N	-	-	-	64	62	60	-	-	-	-	
Loreto E Kirribilli	2	73	GF	NE	-	-	-	62	60	59	-	-	-	-	
Loreto E Kirribilli	2	73	F 1	NE	-	-	-	62	60	59	-	-	-	-	
Loreto E Kirribilli	2	73	F 2	NE	-	-	-	62	60	59	-	-	-	-	

North Sydney
Wharf Upgrade

APPENDIX D
PREDICTED
CONSTRUCTION
NOISE IMPACTS –
NOISE CONTOUR
MAPS



Figure D1 Predicted construction noise scenario 1 – site establishment, ground Level – standard hours

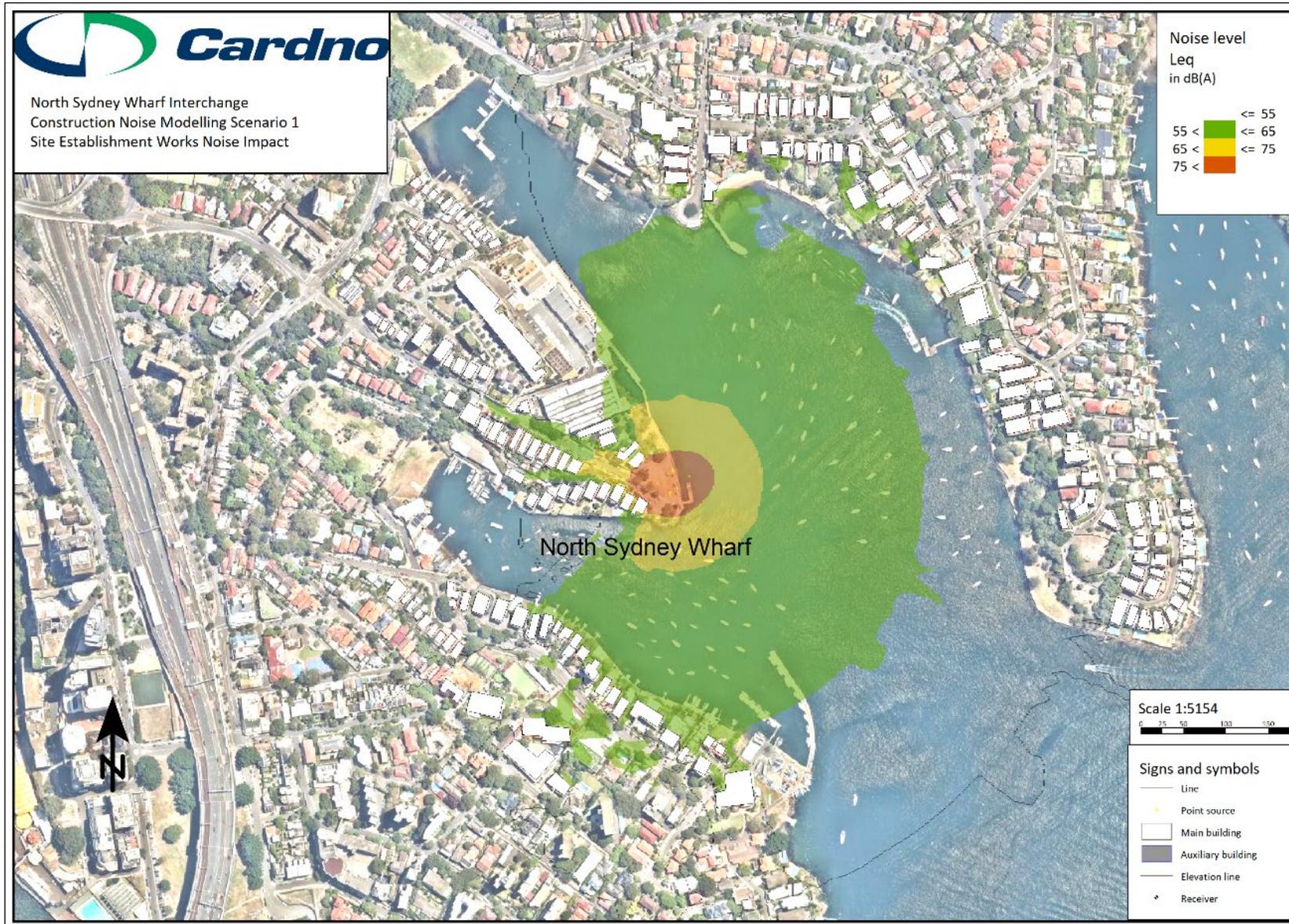


Figure D2 Predicted construction noise scenario 1A – site demolition, ground level – standard hours

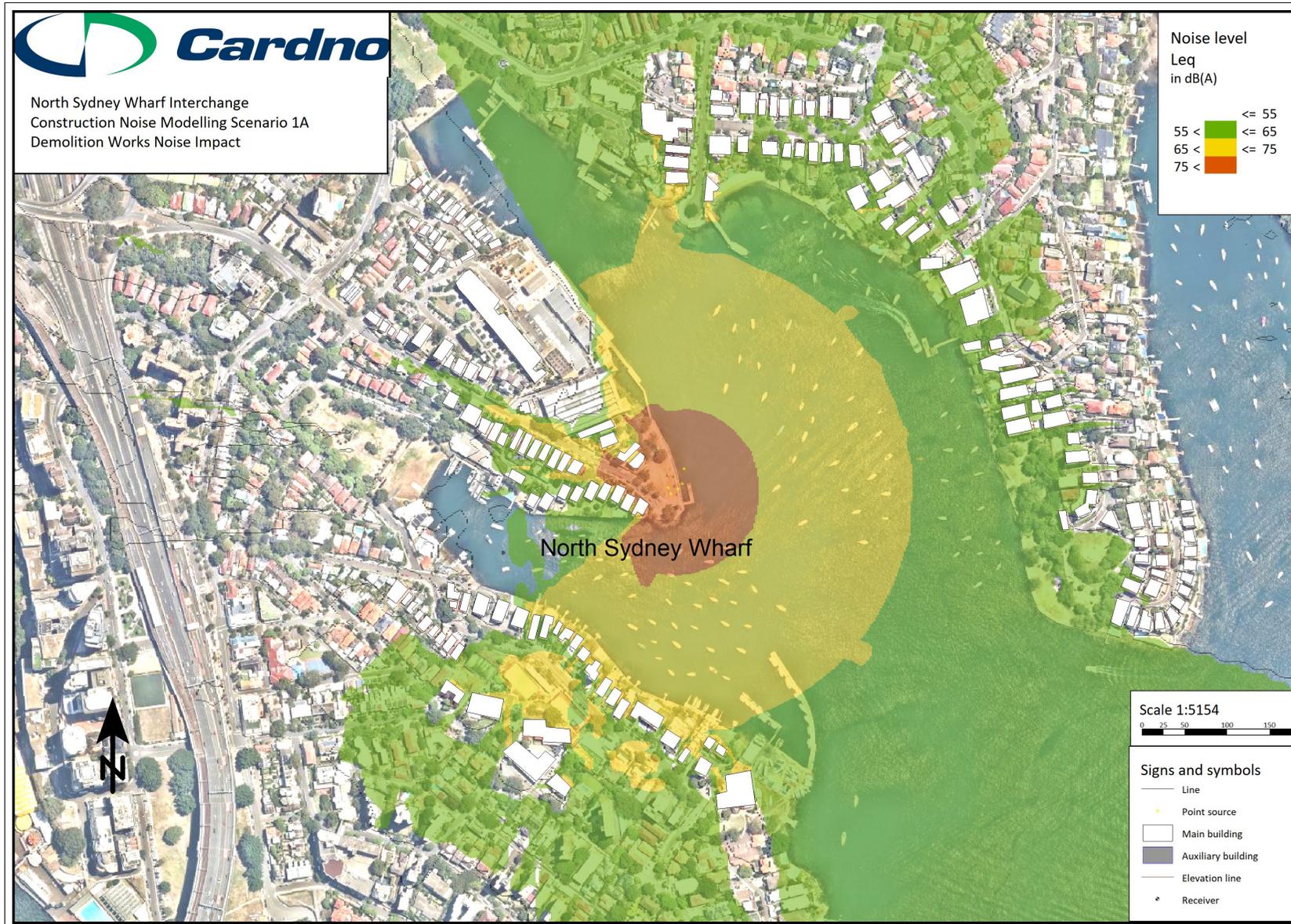


Figure D3 Predicted construction noise scenario 2 – land side works, ground level – standard hours

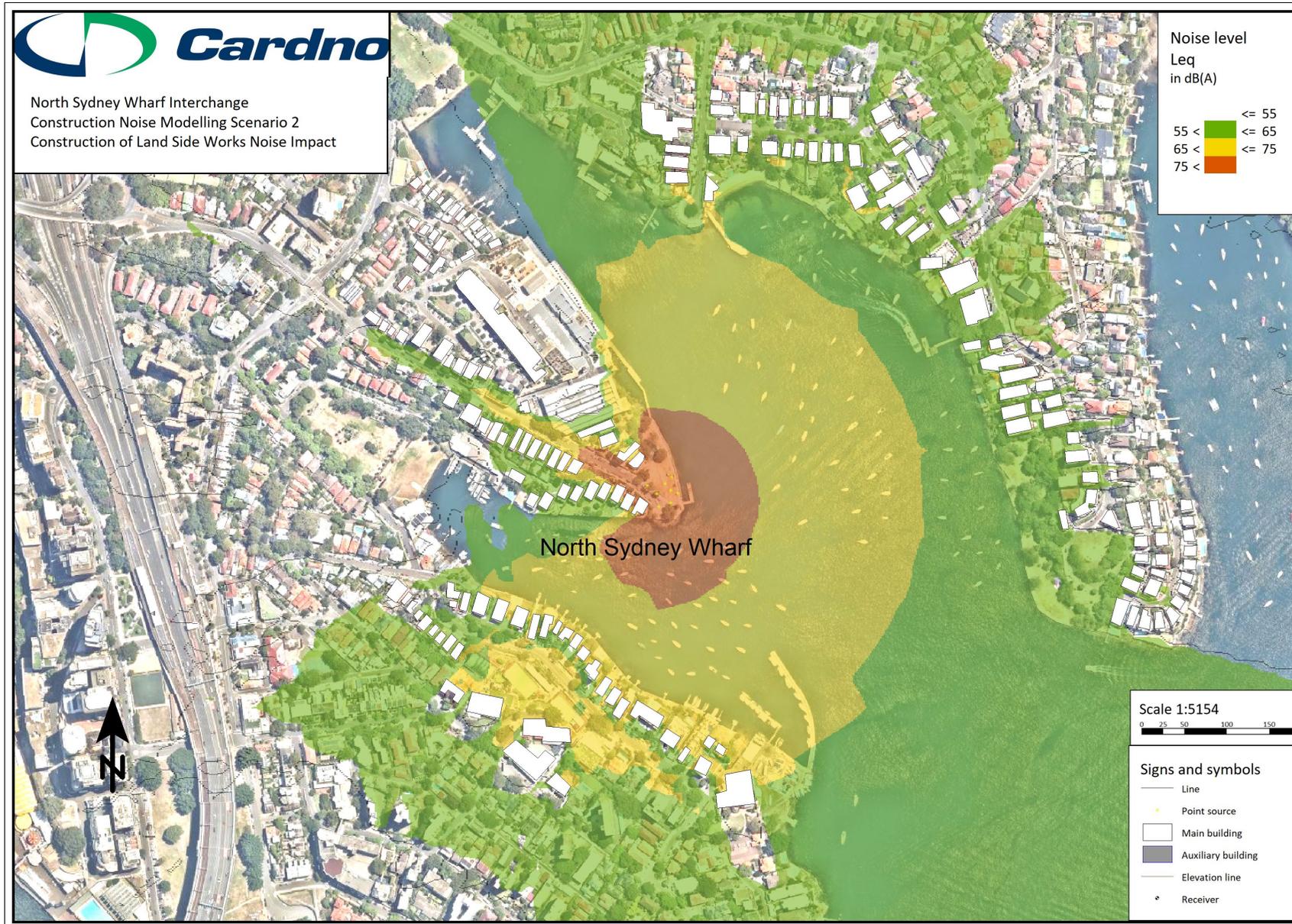


Figure D4 Predicted construction noise scenario 3A, ground level – drilling works, ground level – non-standard hours (OOH2)

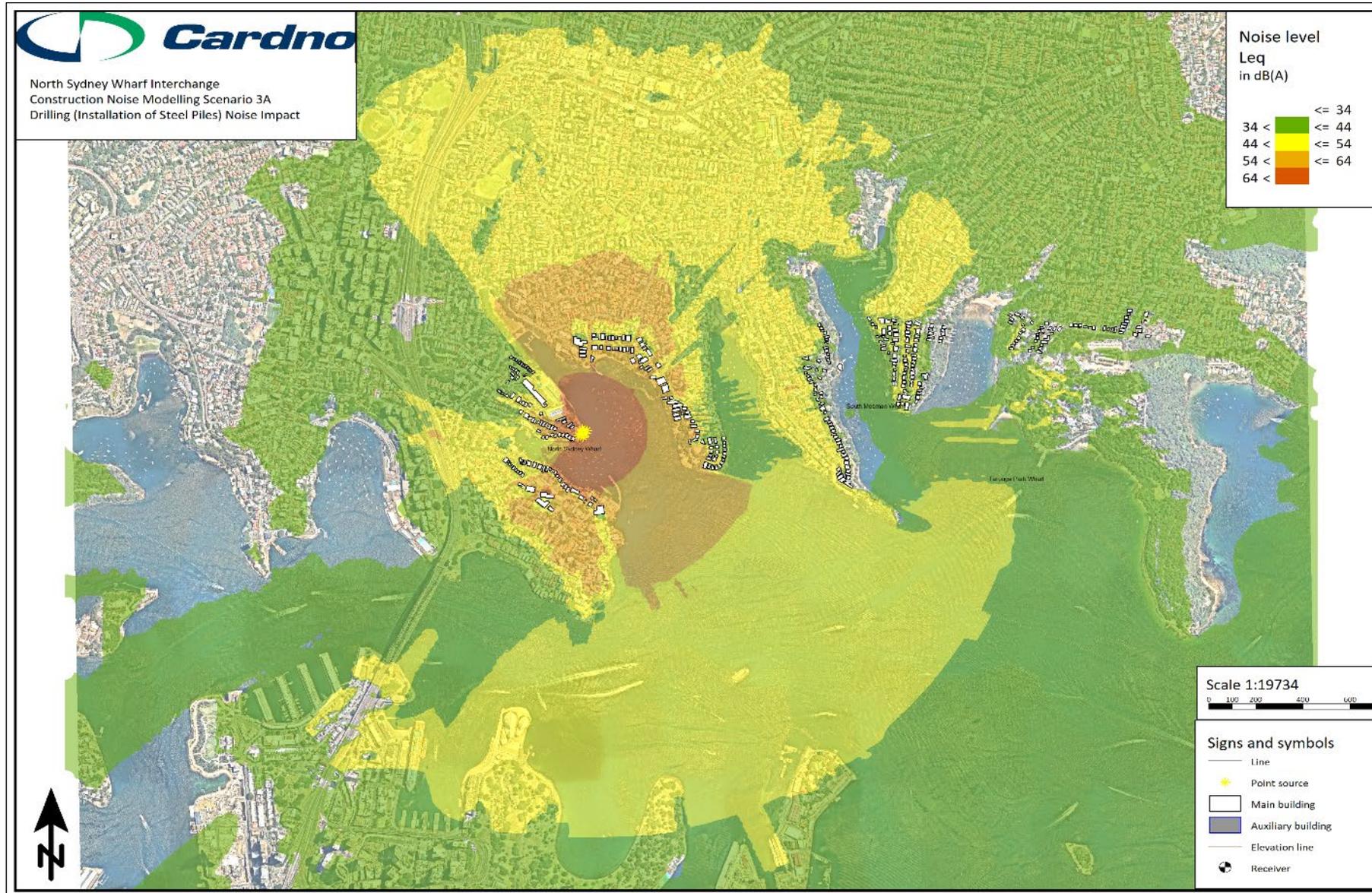


Figure D5 Predicted construction noise scenario 3B, ground level – hammering works, ground level – non standard hours (OOH2)

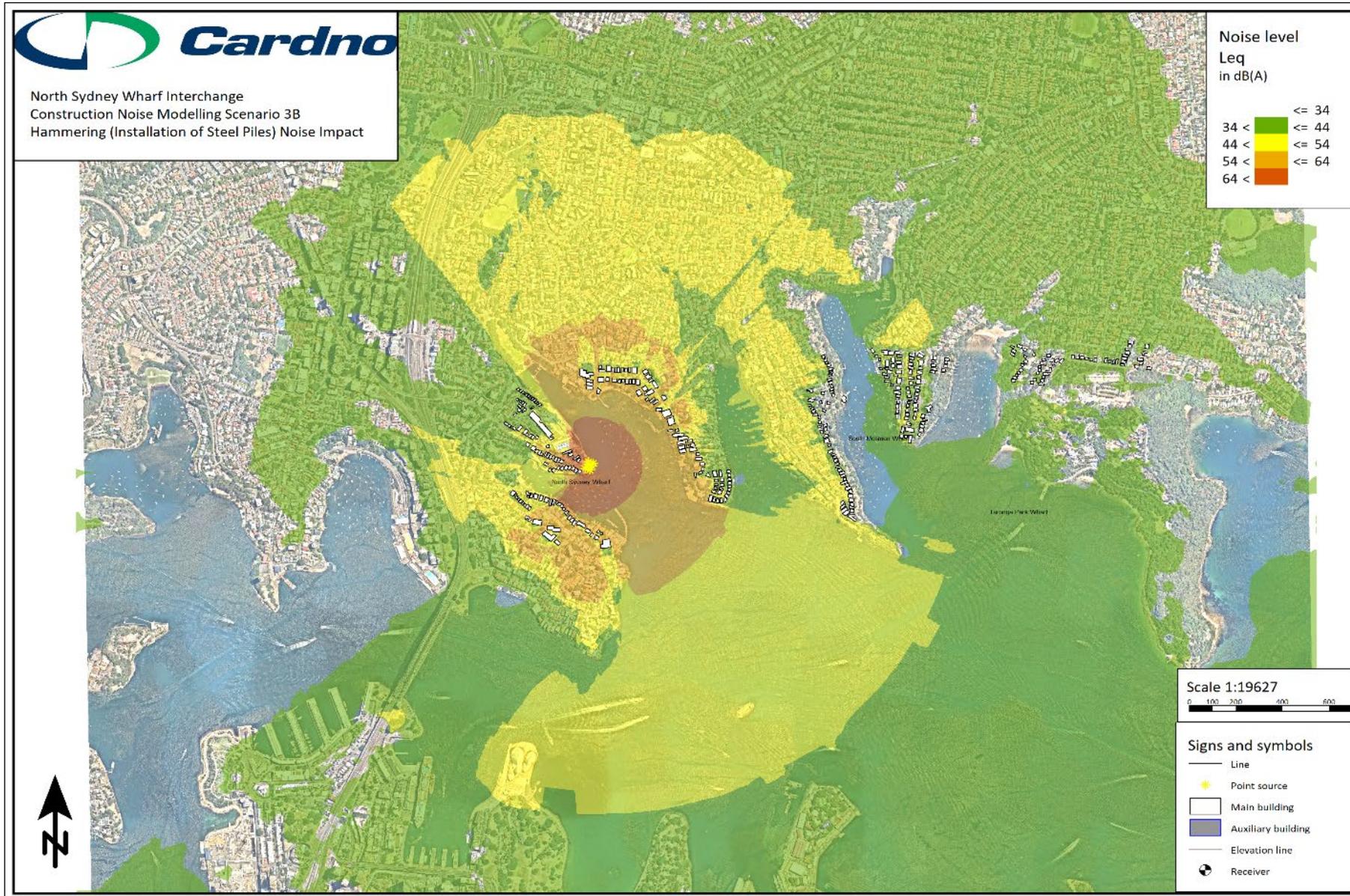


Figure D6 Predicted construction noise scenario 3C, ground level – piling works, ground level – non standard hours (OOH2)

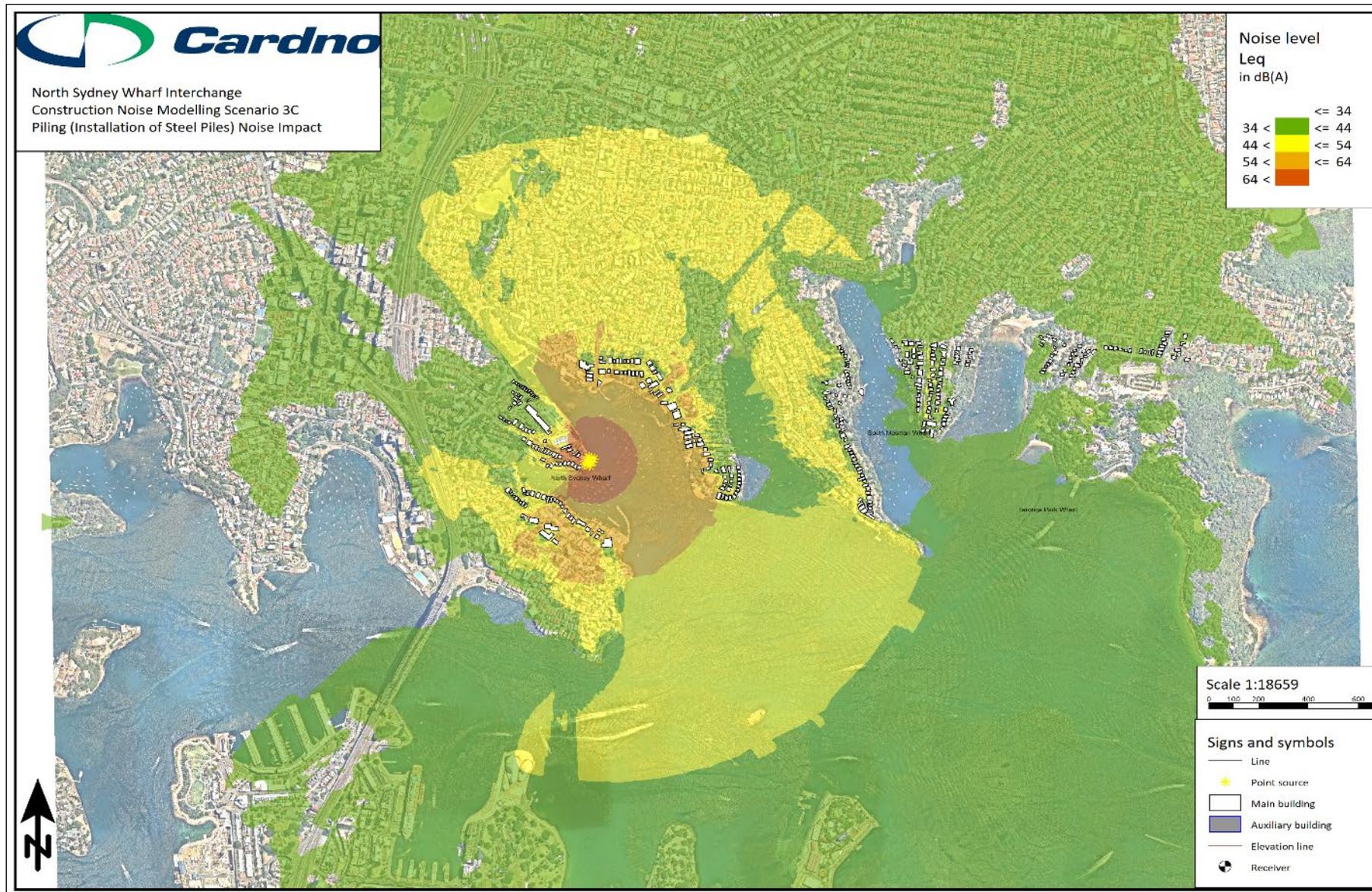


Figure D7 Predicted construction noise scenario 4, ground level – piling day works, ground level – standard hours



Figure D8 Predicted construction noise scenario 5, ground level – installation of improved and new facilities works, ground level – standard hours



Figure D9 Predicted construction noise scenario 6, ground level – site clean up works, ground level – standard hours



Appendix F

Landscape character and visual impact assessment

Landscape Character and Visual Impact Assessment

North Sydney Wharf Upgrade

AWE200198



Prepared for
Transport for NSW

9 October 2020

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

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1 Introduction

Transport for NSW (TfNSW) has engaged Cardno to undertake an environmental assessment to upgrade the North Sydney Wharf. Cardno has been asked to prepare a preliminary Landscape Character and Visual Impact Assessment (LCVIA) to inform the wharf's design and environmental assessment. The LCVIA has been prepared in accordance with the following TfNSW Guidelines:

- > *'Beyond the Pavement: urban design approach and procedures for road and maritime infrastructure planning, design and construction'* (RMS, 2020)
- > *Guideline for Landscape Character and Visual Impact Assessment - Environmental Impact Assessment Practice Note EIA-NO4* (RMS, 2018).

1.1 Study Area

Figure 1-1 identifies the Study Area of the LCVIA.

1.2 Purpose and Scope of this Report

The LCVIA has been prepared for TfNSW as part of the Review of Environmental Factors (REFs) for the North Sydney Wharf upgrade. The purposes of this report are:

- > To inform the design of the wharf so the proposal can avoid and minimise impacts on the surrounding areas and properties
- > To undertake a view analysis to and from the site from adjoining properties, key vantage points and streetscape location, including photomontages or perspectives of the proposed development
- > To provide a visual impact assessment to identify the visual changes and impacts on the site and its surrounding when viewed from key vantage points
- > To recommend management and mitigation measures to be implemented if the proposal was approved.

1.3 Urban Design Policy and Guidelines

The LCVIA has been prepared in accordance with the guidelines outlined in the *Environmental Impact Assessment Practice Note EIA-NO4 – Guideline for landscape character and visual assessment* (RMS, 2018). The guideline establishes the assessment tasks for a landscape character and visual assessment which are outlined below:

- > Analyse existing landscape character
- > Identify landscape character zones
- > Determine the magnitude of landscape character impacts
- > Assess landscape character impact
- > Identify the extent of the visibility of the proposal
- > Identify existing viewpoints
- > Determine the magnitude of change from each viewpoint
- > Assess the visual impact
- > Refine concept design to avoid and minimise the impact
- > Develop a strategy to manage landscape character and visual impact.



Figure 1-1 Study Area (defined by the construction footprint)

2 Urban and Landscape Design Concept

2.1 Objectives

The objective of the LCVIA for the North Sydney Wharf is to facilitate a development outcome that:

- > Ensures the proposal is compatible with the existing built, natural and community environments
- > Contributes to the character of the area
- > Protects key elements and features of the locality
- > Safeguards key and significant viewpoints to and from the site
- > Enhances the overall quality of the public domain for the community and park users
- > Upgrades facilities to meet current standards and improve amenity.

2.2 The Proposal

2.2.1 Waterside Design

The water based features of the proposal would include:

- > Installation of a new 3.3-metre by 3.3-metre concrete jetty, supported by three new piles, including minor modifications to the top of the seawall
- > Installation of a new 12-metre by 27-metre pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with pivot piles (to assist vessel berthing) provided at either end of the pontoon
- > Installation of a new 18-metre uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- > Installation of two protection piles on the northern side of the gangway
- > Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- > Safety and security features on the pontoon including an emergency help point, lighting, closed circuit television (CCTV), ladders to the water and a life buoy and tactile indicators where required.

2.2.2 Landside Design

The land based features of the proposal would include:

- > One accessible parking space at the cul-de-sac end of High Street
- > One kiss-and-ride space or zone at the cul-de-sac end of High Street
- > Three new bicycle parking hoops
- > Footpath regrading to produce a *Disability Standards for Accessible Public Transport 2002* (DSAPT) compliant grade
- > Installation of a new accessible ramp between the existing footpath and the new gangway
- > One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- > Installation of new wayfinding signage, information boards, and opal card readers
- > Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter
- > Removal and replacement of up to four trees to construct the accessible pathway.

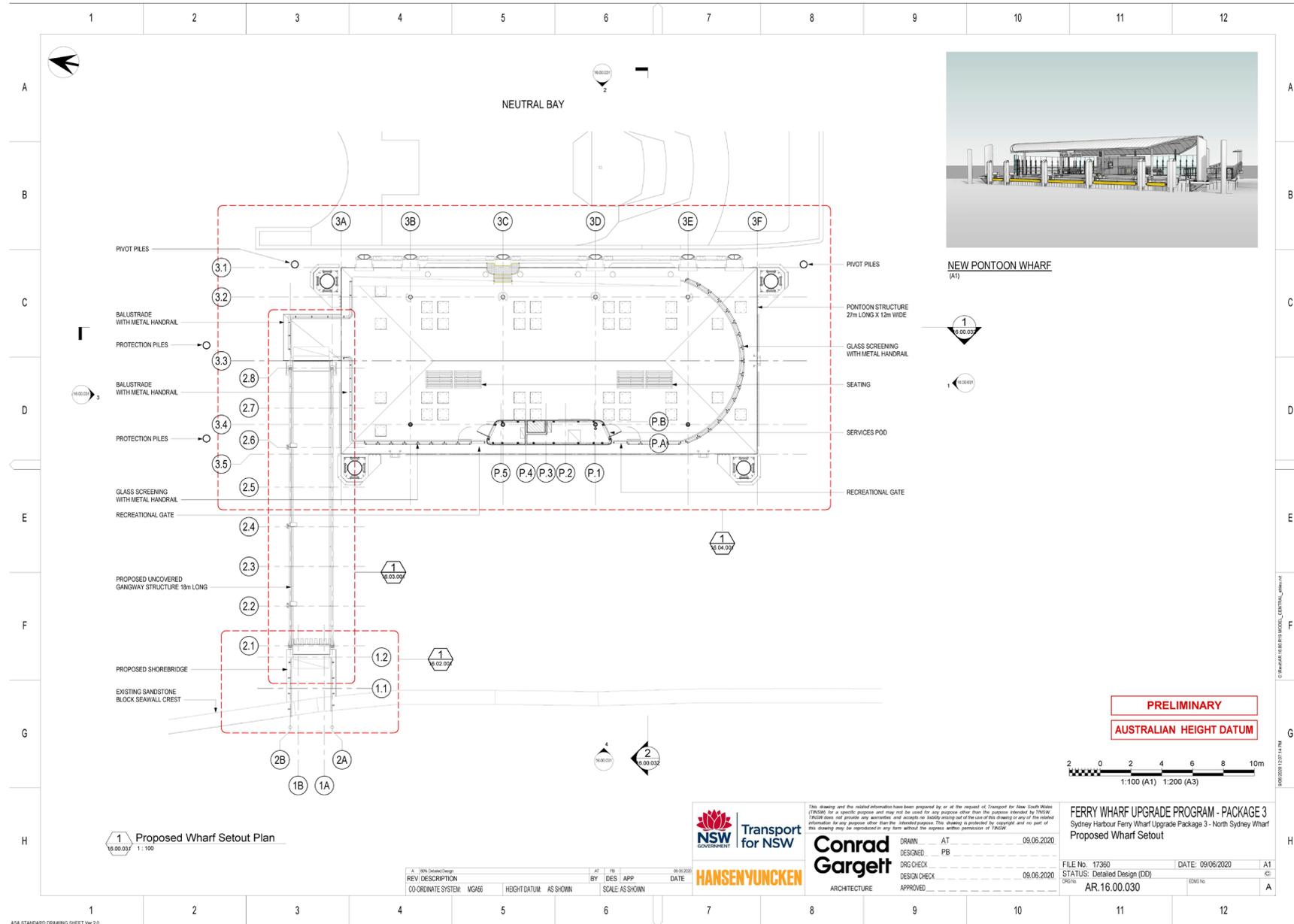


Figure 2-1 Proposed Wharf Layout (Source: Hansen Yuncken and Conrad Gargett)

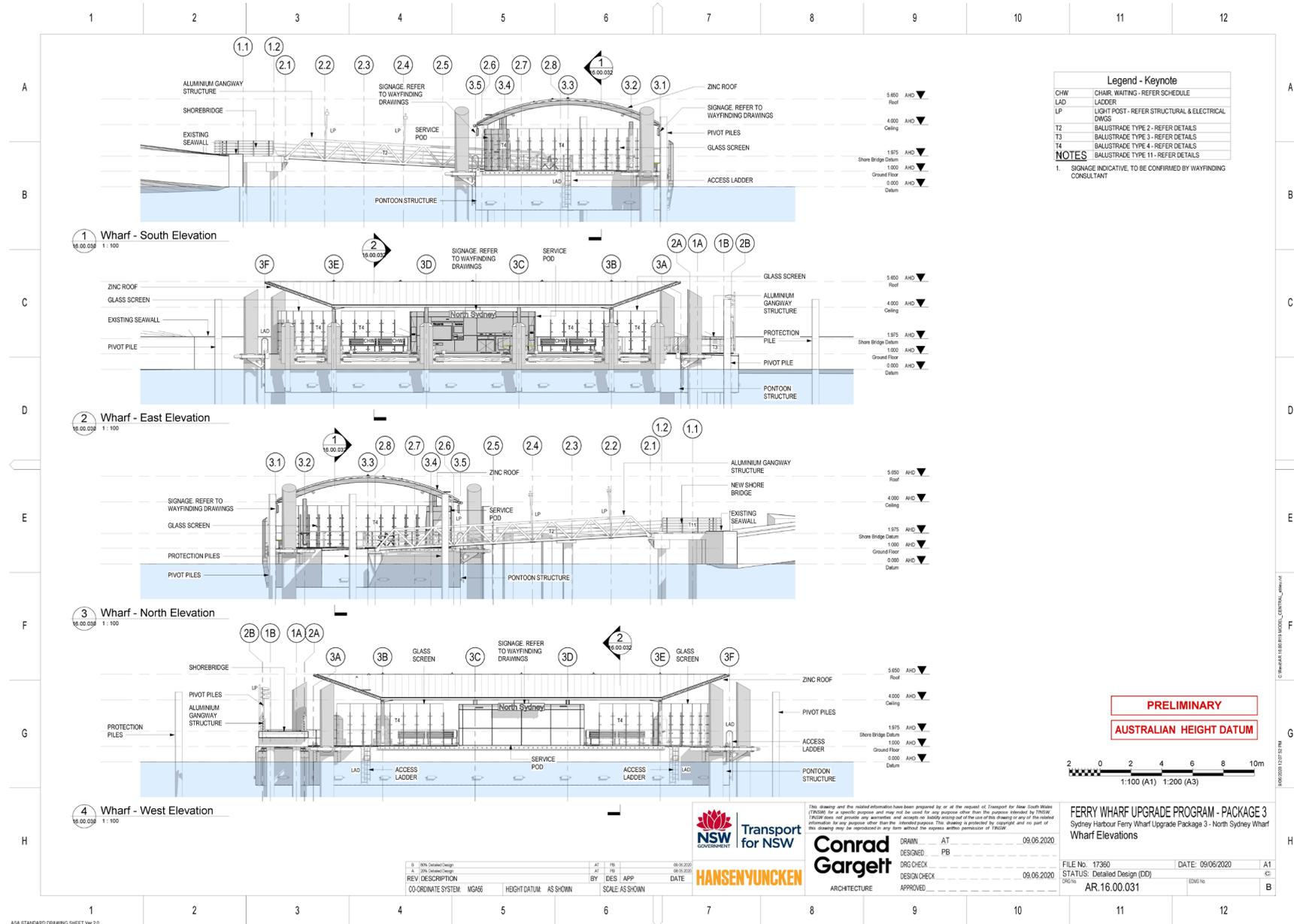


Figure 2-2 Architectural Elevations (Source: Hansen Yuncken and Congrad Gargett)

3 Planning Context

3.1.1 Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

Consideration is given to the *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005* (Sydney Harbour SREP) as the existing and proposed wharf is located on water zoned as W1 Maritime Waters. The objectives of the W1 zone are:

- > To give preference to and protect waters required for the effective and efficient movement of commercial shipping, public water transport and maritime industrial operations generally
- > To allow development only where it is demonstrated that it is compatible with, and will not adversely affect the effective and efficient movement of commercial shipping, public water transport and maritime industry operations
- > To promote equitable use of the waterway, including use by passive recreation craft.

Additionally, the Study Area is located within the Foreshores and Waterways Area and Wetland Protection Areas.

3.1.2 Sydney Harbour Foreshore Area Development Control Plan

The Sydney Harbour Foreshore Area Development Control Plan (SHFA DCP) is developed to support the Sydney Harbour SREP. The DCP provides detailed design guidelines for development and criteria for natural resource protection for the area identified as Foreshores and Waterways.

Section 3 of the DCP outlines the provision requiring a consent authority to consider the visual impact of development from the waterway and foreshores. To assist in reviewing the landscape characteristics where a development is proposed, the area has been divided into several different landscape character types. The North Sydney Wharf is identified as Landscape Character Type 8 and the Statement of Character and Intent are as follow:

These areas have a high level of built form with waterside commercial, industrial and residential uses. The commercial and industrial uses play an important role in terms of tourism and maritime services which support water-based activities. There are special features in these areas that contribute to the visual character of the area that should be maintained.

An assessment of the performance criteria is provided in **Table 3-1**.

Table 3-1 Landscape Character Assessment (Source: RMS, 2018)

Performance Criteria	Comments
Vegetation is integrated with land-based development to minimise the contrast between natural and built elements.	Shrubs are proposed along the existing foreshore footpath and proposed access ramp to screen and soften the proposed wharf and provide contrast between the natural and built elements.
Design and mitigation measures are provided to minimise noise and amenity impacts between incompatible land uses.	The proposed wharf is not incompatible with the surrounding land uses as it replaces the existing wharf located approximately 40m south of the proposed wharf.
The maritime uses on the Harbour are preserved. Pressure for these uses to relocate is minimised. New developments adjoining maritime uses are designed and sited to maintain compatibility with existing maritime uses.	The new North Sydney wharf would preserve the maritime uses on the Harbour.
Remaining natural features that are significant along the foreshore are preserved and views of these features are maintained.	Natural features along foreshores would not be impacted by the proposed wharf.

3.1.3 North Sydney Local Environmental Plan 2013

The wharf is located within the North Sydney local government area (LGA). Therefore, consideration of the *North Sydney Local Environmental Plan 2013* (NSLEP).

A significant proportion of the Study Area is zoned as RE1 – Public Recreation under NSLEP 2013. The objectives of the RE1 zone are as follow:

- > 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 ensure sufficient public recreation areas are available for the benefit and use of residents of, and visitors to, North Sydney.

3.1.4 North Sydney Development Control Plan 2013

North Sydney Development Control Plan (NSDCP) 2013 applies to land identified in the Land Application Map to NSLEP 2013.

Part C of the NSDCP 2013 provides Area Character Statements for each of the neighbourhood within the Local Government Area. The Study Area is located within Part 7 Neutral Bay Planning Area – Neutral Bay Neighbourhood.

The significant elements associated with North Sydney Wharf are:

Natural Features

- > *Remnant natural shoreline areas in Neutral Bay, Anderson Park and Kesterton Park.*

Views

- > *The views and vistas are to be preserved and where possible enhanced: views from streets and reserves to Sydney Harbour and beyond.*

Public Transport

- > *Development is to take advantage of high levels of accessibility to high frequency public bus services along Military Road.*

The desired built form for development along foreshore is:

- > *Development on sites on or near the foreshore should be carefully designed to not restrict water views from neighbouring property or from public areas*
- > *Development adjacent to the foreshore is small in scale and does not dominate the foreshore frontage*
- > *Development associated with marinas and boating activity is kept to a minimum and is compatible with the surrounding land uses*
- > *Development adjoining foreshore areas uses muted colours and non-reflective materials, such as brick and timber to ensure the scenic and environmental qualities are enhanced.*

4 Existing Context

4.1 Location

The wharf is positioned in Neutral Bay and at the tip of the peninsula. It is located adjacent to Kesterton Park, to the east of Warringah Freeway and High Street. The bay itself is enclosed by the Kirribilli Peninsula to the south and Kurraba Point to the east. North Sydney Wharf is one of three wharves within Neutral Bay, the others being Neutral Bay and Kurraba Point wharves. The location of the North Sydney Wharf is shown in **Figure 4-1**.

The wharf is situated 1.1 kilometres from North Sydney and 2.5 kilometres (by water) and five kilometres (by road) from the Sydney CBD.

The wharf is located at the south eastern tip of a small peninsula extending into Neutral Bay. The topography of the peninsula falls from north west to south east.

The wharf is situated on the F5 Sydney Ferry Network Loop, which provides connections to Circular Quay and other northern harbour locations.

4.2 Landscape and Urban Context

The existing North Sydney Wharf is a concrete wharf incorporating a jetty with single berthing and no canopy cover. The wharf is situated at the eastern edge of Kesterton Park and is accessed through High Street via Kesterton Park. Kesterton Park is an open space public foreshore area which consists of mainly native vegetation, a large grassed area, children's playground, public toilets and seats and picnic tables. The park offers panoramic views of the Sydney Harbour, Kurraba Point and Neutral Bay.

A sandstone seawall is constructed along the edge of the peninsula around two metres above the mean high-water mark. A cul-de-sac is located at the end of High Street and is separated from the water by a turf mound and a series of sandstone retaining walls.

The surrounding area predominantly comprises residential development, including three to six storey residential flat buildings and single to two storey detached dwellings.

Sub Base Platypus site (formerly HMAS Platypus) is located approximately 160 metres north of North Sydney Wharf. This site is being redeveloped by the Sydney Harbour Federation Trust and comprises public open space/domain and commercial premises. A new access path has been constructed connecting Kesterton Park and the Sub Base Platypus.

4.3 Aboriginal and European Heritage

According to the NSLEP 2013, the following local heritage items are located within the vicinity of the site:

- > Kesterton Park, High Street (Item No: I0858)
- > North Sydney Bus Shelter - West of the wharf (Item No: I0407)
- > Rockcliff Mansions, 144 High Street (Item No: I0853).

The western side of High Street is also identified as Careening Cove Heritage Conservation Area. The locations of the heritage items and conservation area are shown on **Figure 4-3**.

An Aboriginal Heritage Information System (AHIMS) Web Services review was conducted on 19 June 2020 and no known Aboriginal heritage sites are recorded or declared in or near the wharf.

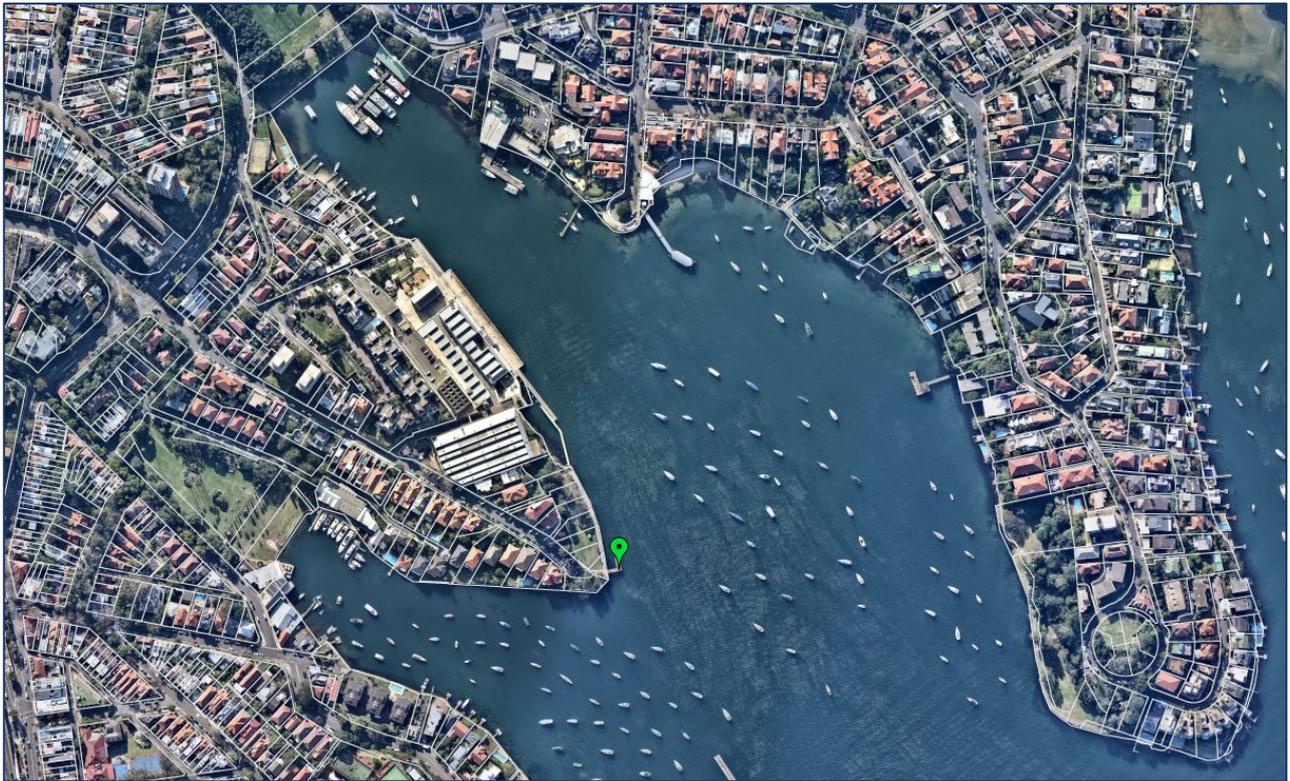


Figure 4-1 Location of North Sydney Wharf (Source: NearMap)



Figure 4-2 Perspective View of North Sydney Wharf (Source: Google Map)

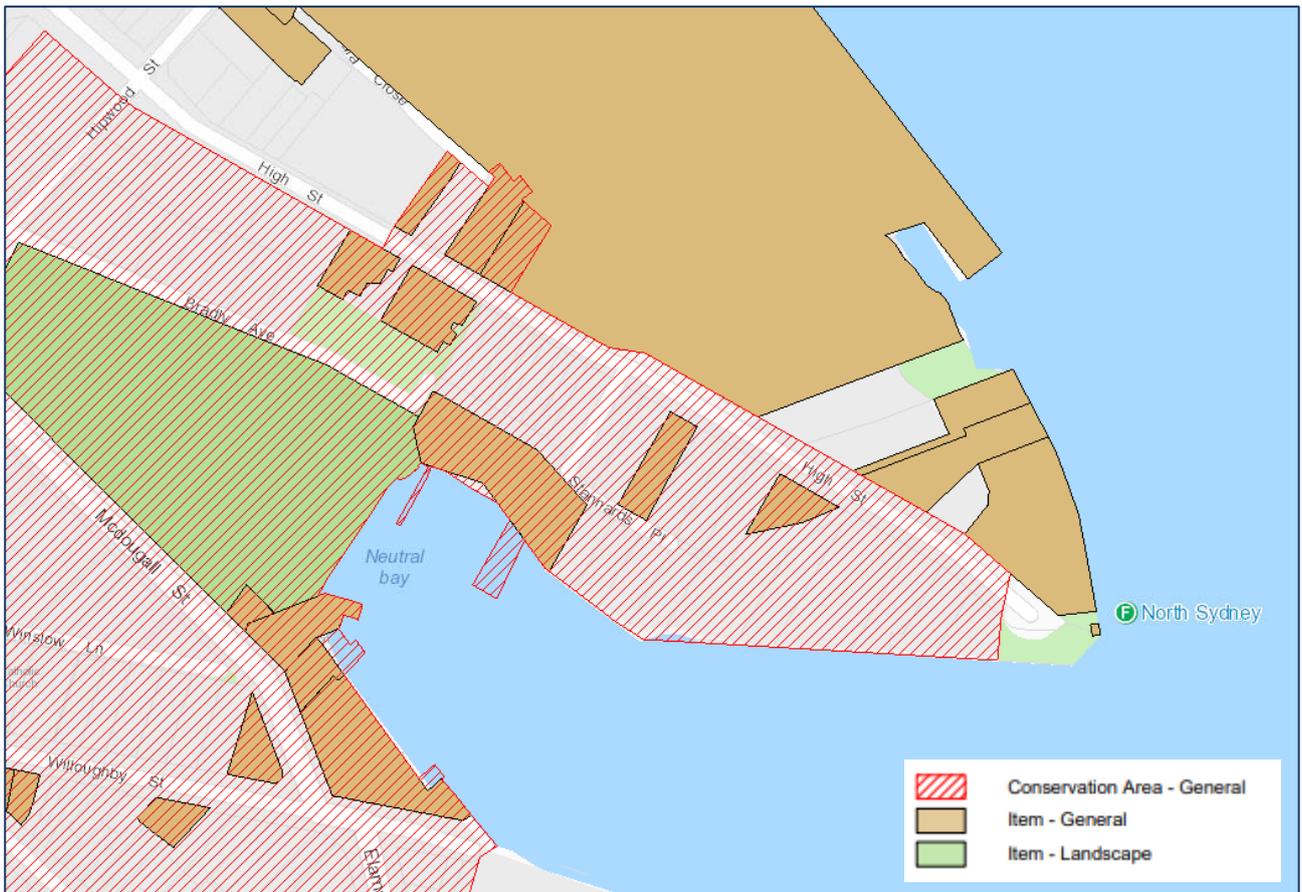


Figure 4-3 Heritage Items within the Vicinity of the Site (Source: NSW Government)

5 Landscape Character Assessment

5.1 Landscape Character

The *Guideline for Landscape Character and Visual Impact Assessment* (prepared by the former Road and Maritime Services) defines landscape character as follows:

- > **Landscape character** refers to the aggregate of an area’s built, natural and cultural character.

The landscape character assessment evaluates the overall impact of the proposed wharf on the surrounding character and sense of place.

5.2 Assessment Methodology

The potential impact of the North Sydney Wharf on the existing landscape character is a combination of the sensitivity of its landscape and magnitude of the proposed works/structures. The *Guideline for Landscape Character and Visual Impact Assessment* defines sensitivity and magnitude as:

- > **Sensitivity** refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed nature of change. For example, a pristine natural environment is likely to be more sensitive to a change of the nature of a four lane motorway than a built up industrial area. The design quality of the proposed development does not make the area less sensitive to change but instead affects the magnitude of the impact as described following.
- > **Magnitude** refers to the physical scale of the project, how distant it is and the contrast it presents to the existing condition. For example, a large interchange would have a very different impact on landscape character than a localised road widening in the same area. A more distant bridge would have a lesser magnitude than one nearer to residents. A vegetated embankment facing a parkland would have less contrast than a retaining wall in the same location. Magnitude will also need to consider cumulative impact, which is a consideration of the result of the incremental impact of the proposal when added to other past, current and known likely future activity.

The assessment intends to identify the overall impact of the proposed works/structures on each of the Landscape Character Zones (LCZ) through predicting the sensitivity of the LCZ to changes as a result of the proposed works/structures followed by identifying the anticipated magnitude change that would result from implementation of the proposed works/structures within each LCZ.

Based on the measures of sensitivity and magnitude, a rating of the landscape character impact for the North Sydney Wharf can be formulated, as shown in **Table 5-1**.

Table 5-1 Landscape Character Rating Matrix (Source: RMS, 2018)

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

5.2.1 Landscape Character Impact Assessment

For this assessment, the magnitude rating for the landscape character impact is categorised in **Table 5-2**.

Table 5-2 Magnitude Rating for Landscape Character

Magnitude Rating	
High	The proposed works/structures would be the dominant feature in the landscape. It would significantly affect and alter the current character of the area.
Moderate	The proposed works/structures would be visible and constitute a new feature and alter the area's existing character.
Low	The proposed works/structures would constitute a minor feature, resulting in small changes to the existing landscape character.
Negligible	Only a small proportion of the proposed works/structures would be discernible, or the changes to the landscape character would be barely noticeable due to the separation distance.
None	The existing landscape character would not be altered as the proposed works/structures would not be noticeable.

5.3 Sub-Precincts and Character Statements

To determine the North Sydney Wharf impact, the study area has been divided into five LCZ as shown in **Figure 5-1**. The sensitivity of each LCZ was assessed and a summary of the impact is provided in **Table 5-3**.

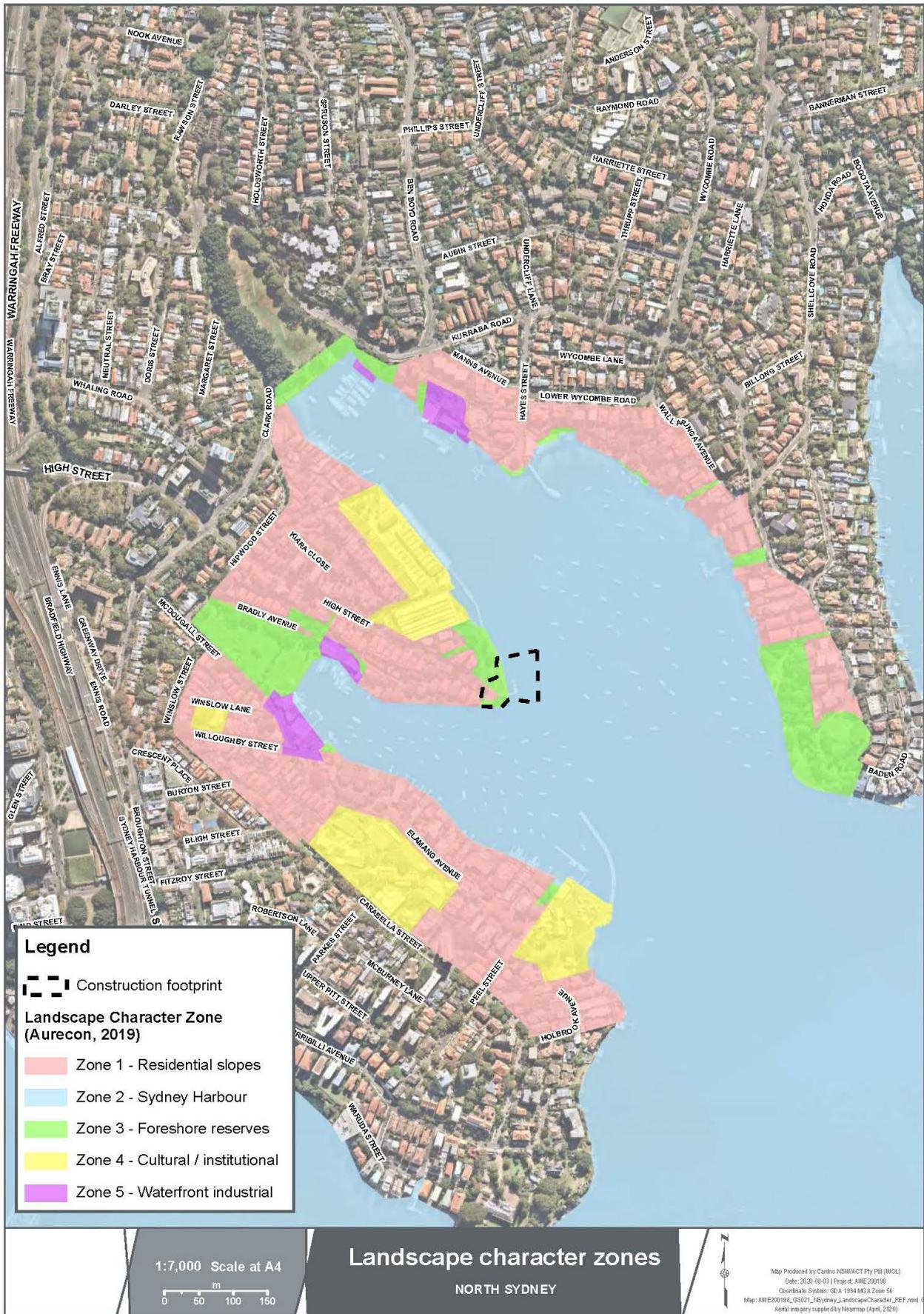


Figure 5-1 Landscape Character Zone

Table 5-3 Landscape Character Assessment

Landscape Character Precinct	Description	Sensitivity	Magnitude	Landscape Character Impact
Residential	<p>The residential precinct is characterised by a mix of two to three storey residential dwellings and three to 15 storey medium/high rise residential flat buildings.</p> <p>The precinct consists of a variety of architectural styles and building forms from large federation dwellings to ‘tower’ form residential flat buildings.</p> <p>Residential development on the Neutral Bay peninsula generally falls to the south east down to the foreshores of Sydney Harbour.</p> <p>Mature trees and vegetation are visible along the street frontage, which forms a significant part of the precinct's appearance.</p> <p>Yachts moored close to the shoreline form part of the visual character of the residential slopes.</p>	High-Moderate	Moderate-Low	<p>Moderate</p> <p>The proposed wharf would have visual connections with the surrounding private dwellings located to the north and east of the subject site.</p> <p>This residential zone is capable of absorbing moderate change without altering its character for the following reasons:</p> <ul style="list-style-type: none"> > The proposal only consists of replacing the existing wharf, which is in a relatively poor state of repair > The design of the new wharf responds to existing visual cues on the harbour, particularly the colour, materials, and vertical elements of nearby yachts > The design of the wharf is consistent with the Neutral Bay Wharf located to the north-east of the subject site > The wharf would not dominate the view from the nearest residence at Kurraba Point (approximately 350m east of the subject site) > Apartments at 144-146 High Street would have direct views towards the new wharf but the wharf would present as a foreground element at the lower edge of these views. The lower apartments in this building are at a level approximately six metres above the adjoining Kesterton Park.
Sydney Harbour	<p>Sydney Harbour is a large body of water.</p> <p>The landform around the harbour comprises of peninsulas with steep slopes rising to ridgelines.</p>	High-Moderate	Low	<p>Moderate</p> <p>The wharf is situated on the F5 Sydney Ferry Network Loop, which provides connections to Circular Quay and other northern harbour locations.</p>

Landscape Character Precinct	Description	Sensitivity	Magnitude	Landscape Character Impact
	<p>Natural sandstone outcrops and man made sandstone walls are visible from parts of the Harbour foreshore.</p> <p>The foreshore of Sydney Harbour mainly consists of vegetated public recreational areas and private dwellings. The harbour also includes moored yachts flanking the foreshores, and jetties and pontoons.</p> <p>The existing wharf is enclosed and protected by Kurraba Point to the east and Kirribilli Point to the west.</p>			<p>The scale of the wharf is in keeping with other wharfs located within the vicinity, such as Neutral Bay and Kirribilli Marina and Australian Border Force College.</p> <p>The proposed wharf would result in a positive landscape character change within the vicinity of the site as the existing wharf is in a poor state of repair and would ensure a consistent design with other existing wharves in the board locality such as Neutral Bay Wharf, Mosman Bay, McMahons Point, Milsons Point and Cremorne Point Wharf.</p> <p>Considering the scale and location of the wharf, it is unlikely that the wharf would be highly visible and that it would adversely impact on views from Sydney Harbour.</p>
Foreshore Reserves	<p>Several public reserves are located within the foreshore of the harbour such as Kesterton Park, Milson Park, Anderson Park and Kurraba Point. These reserves generally consist of grassed areas with mature trees and children's' playgrounds.</p> <p>Located at the foreshore, the reserves slope down from the ridges to the waters of Sydney Harbour.</p> <p>The reserves also provide relief to the built forms located along the foreshore areas.</p> <p>As discussed previously, the North Sydney wharf is located</p>	High-Moderate	Moderate	<p>High-Moderate</p> <p>The new wharf would impact on some open water views toward Kurraba Point as it is situated along the eastern boundary of Kesterton Park. However, ample water views are available in the north east and south east section of the park. No significant aspect would be impacted by the proposal.</p> <p>The wharf would be well integrated with the surrounding environment as lightweight materials, simple lines and colours which will blend with the surrounding maritime uses and minimise any potential visual impact.</p>

Landscape Character Precinct	Description	Sensitivity	Magnitude	Landscape Character Impact
	at the south eastern tip of Kesterton Park.			
Cultural/institutional	<p>Several cultural and institutional facilities are located within the foreshores of Sydney Harbour, such as Sub Base Platypus, Ensemble Theatre, Australian Border Force and Royal Sydney Yacht Squadron College (RSYS).</p> <p>Typically, the cultural institutions comprise relatively large building footprints and built form, which would be more visually dominant when compared to the adjacent private dwellings.</p> <p>The architectural style varies significantly for these buildings.</p>	Medium-Low	Low	<p>Medium-Low</p> <p>Cultural and institutional are unlikely to be impacted by the proposed wharf. These institutions are mostly dispersed within Neutral Bay and consist of large building footprint and form, which would partially dominate views and vistas.</p> <p>The closest cultural/institutional is the Sub Base Platypus, which is located approximately 160 metres north of the North Sydney wharf. The Sub Base Platypus mainly consists of bulky repurposed navy buildings with a boardwalk (i.e. former wharf of the Sub Base) along the water edge. The backdrop of Sub Base Platypus comprises a 10-15 metres sandstone cliff. A 5-7 storey residential complex is located on top of the sandstone cliff. Considering the scale and context of Sub Base Platypus, it is unlikely the wharf upgrade would have an adverse impact on this substantial site.</p> <p>The wharf would be partially visible from the RSYS. Due to the distance and the existing wharf structure at RSYS, any visual impact generated by the wharf is considered insignificant.</p> <p>The wharf will not be visible from the Ensemble Theatre.</p> <p>The impact is considered to be moderate-low.</p>
Waterfront Industrial	<p>A small pocket of waterfront industrial uses/zones are located at Careening Cove, adjacent to Anderson Park.</p> <p>The industrial uses provide a contrasting character to the adjoining land uses.</p>	Low	Negligible	<p>Negligible</p> <p>The industrial uses/zones are located at Careening Cove. Considering the topography of the area, it is unlikely the proposed wharf will be visible from Careening Cove.</p> <p>Furthermore, the waterfront industrial zone generally consists of larger buildings and structures, which would have a more detrimental visual impact than the proposed ferry wharf.</p> <p>Considering the above factors, any change to the landscape character of the zone generated by the proposed wharf is considered negligible.</p>

5.4 Sensitivity – High to Moderate

The proposal would introduce a new foreshore-built element into the existing landscape character, which mainly consists of residential uses and Kesterton Park. The sensitivity of the existing landscape character is considered high to moderate as the proposed wharf is located within the vicinity of a conservation area and a number of heritage items with medium visitation from both locals and tourists. However, the visual impact generated by the proposed wharf is considered minor as the wharf will constitute a small element in most views within a broad landscape that incorporates a wide variety of development typologies. Furthermore, the foreshore of Neutral Bay and Sydney Harbour comprises a range of uses (i.e. industrial, residential, recreational area and institutional uses) and waterfront structures (i.e. jetties, pontoons and wharfs).

5.5 Magnitude - Moderate to low

The proposal intends to upgrade the existing North Sydney wharf. The wharf's design has incorporated simple lines and a coordinated palette of materials and colours to respond to the maritime and surrounding character.

It is considered the magnitude of change to views that would result from installation of the new wharf is moderate to low as the nearest residential uses (i.e. 144-146 High Street) are set back from the foreshore by Kesterton Park and located approximately 6m above the proposed wharf. It is also noted that several similar structures are located within the vicinity of the North Sydney wharf. Therefore, the proposed wharf would not significantly impact on the foreshore or surrounding environment.

Landside works comprise an accessible parking space, a kiss-and-ride space, bicycle parking hoops, regrading of footpath including an accessible ramp, installation of new wayfinding signages and new microwave aerial. These new elements are considered to be of a scale comparable to the surrounding environment.

5.6 Overall Landscape Character Impact - Moderate

It is considered that the proposed North Sydney Wharf would have a moderate impact on the surrounding character zones. The landscape character within the proximity of North Sydney Wharf generally consists of recreation/foreshore area adjoining residential uses and Sydney Harbour.

The proposal would introduce a larger structure with curvilinear roofing to the Neutral Bay foreshore. The proposed structure would be located approximately 40 metres north of the existing wharf and extend approximately 30 metres from the foreshore.

The proposal would introduce a new visual element to the existing landscape character of the area. However, any potential impact would be mitigated by:

- > Similar visual structures (such as jetties, pontoons and wharfs) are located within Neutral Bay, Neutral Harbour and Careening Cove
- > The design of the wharf is consistent with the Neutral Bay Wharf situated to the north-east and other wharfs within Sydney Harbour
- > A coordinated palette of materials and colours is proposed to respond to the existing maritime and foreshore character
- > Low-scale landside and waterside works to improve accessibility, wayfinding and services.

6 Visual Impact Assessment

6.1 Visual Impact

The *Guideline for Landscape Character and Visual Impact Assessment* (prepared by the former RMS) defines visual impact as follows:

- > **Visual Impact** refers to impact on the views from residences, workplaces and public places.

6.2 Assessment Methodology

To determine the potential visual impact of the North Sydney Wharf, the assessment would combine the viewers' sensitivity to the proposed works/structures with the magnitude of the proposed works/structure within the existing views.

6.2.1 Visual Sensitivity

According to the *Guideline for Landscape Character and Visual Impact Assessment*, visual sensitivity is defined as follows:

- > **Visual sensitivity** refers to the quality of the existing view and how sensitive the view is to the proposed change.

To determine the visual sensitivity, the following factors should be taken into consideration:

- > Distance between the proposed works/structures and the viewer
- > The category of viewer (resident, worker and open space user)
- > The element of the proposal that would be visible
- > The importance of the view.

6.2.2 Magnitude

Magnitude refers to the “*form – scale, size, character – of the project and its proximity to the viewer*” (RMS, 2018). Magnitude assessment should also consider the distance of the proposed works/structures from the viewer should also be taken into consideration. Other factors that should be considered include:

- > The scale of the change within the view as a result of the proposed works/structures
- > The integration of the proposed works/structures (i.e. form, scale and mass) within the landscape
- > The nature and extent of the view
- > The location of the proposed works/structure in relation to the region
- > the scale of the change within the view with respect to the addition (or loss) of elements taken up by the proposed development.

For this assessment, the magnitude rating is categorised in **Table 6-1**.

Table 6-1 Visual Impact Magnitude Rating

Magnitude Rating	
High	The proposed works/structures would result in the total loss of key elements/features/characteristics of the existing landscape and/or introduction of elements inconsistent with the aspect of the current landscape character.
Moderate	The proposed works/structures would result in the partial loss or alteration to key elements/features/characteristics of the existing landscape. The new elements would be prominent but not considered to be significantly uncharacteristic of the existing landscape.

Magnitude Rating	
Low	The proposed works/structures would result in a minor loss or alters the key elements/features/characteristics of the existing landscape. However, the new elements are generally consistent with the existing landscape.
Negligible	The proposed works/structures would result in a minor alteration to the essential elements/features/characteristics. The introduction of the new elements would have no to minimal impact on the existing landscape.

6.2.3 Visual Impact Assessment

Based on the measures of sensitivity and magnitude, a rating can be assigned to the North Sydney Wharf's visual impact, as shown in **Table 6-2**.

Table 6-2 Visual Impact Rating Matrix (Source: RMS, 2018)

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

For this assessment, the magnitude rating for the visual impact is categorised in **Table 6-3**.

Table 6-3 Visual Impact Rating Matrix

Magnitude Rating	
High	The proposed works/structures would be highly visible and form a significant element within the current views, which would alter the overall character positively or negatively.
Moderate	The proposed works/structures would be visible and recognisable as a new element within the existing view and maybe readily noticeable by a viewer.
Low	The proposed works/structures would result in minor changes to the existing view and unlikely to be recognisable by a casual observer. The new elements would not have much impact on the overall quality of the view and visual sensitivity is likely to be low.
Negligible	A small proportion of the proposed works/structures would be discernible and/or the new elements would be located at a significant distance from the viewpoint that it would hardly be visible.

6.2.4 Key View Points

In consultation with TfNSW, viewpoints within a reasonable distance and visual catchment of the North Sydney Wharf have been identified (**Figure 6-1**). The diagram outlines the position and direction of the key viewpoints that are likely to be impacted by the proposed works/structures.



Figure 6-1 Visibility Analysis and Key Viewpoints

6.2.5 Distance Zones

The following distance zones have been established to assist in the assessment on key views within the vicinity of the site. The zones are categorised as follow:

- > Foreground zone (FZ): 0 – 250m from the viewer
- > Middle ground zone (MZ): 250 – 500m from the viewer
- > Background zone (BZ): 500m or greater from the viewer.

6.2.6 Photomontages

Photomontages have been developed to illustrate proposed changes and to determine the likely visual impact generated by the proposed North Sydney Wharf. Photomontages for the Study Area have been prepared from the following five viewpoints.

- > Viewpoint A – Kesterton Park, adjacent to the existing cul-de-sac at High Street, looking north-east
- > Viewpoint B – Kesterton Park (near the existing playground) looking south-east
- > Viewpoint C – Sydney Harbour looking north-west
- > Viewpoint D – Kurraba Reserve looking west
- > Viewpoint E – Neutral Bay Wharf looking south.

Figure 6-2 to **Figure 6-11** have been selected to identify the different aspects of the proposal and determine the magnitude of the proposed works/structures from critical viewpoints in the proximity of the study area.

6.2.7 Viewpoint assessment

6.2.7.1 Viewpoint A – Kesterton Park, adjacent to the existing cul-de-sac at High Street, looking north-east.



Figure 6-2 Viewpoint A – Existing View (Source: TfNSW)



Figure 6-3 Viewpoint A – Photomontage (Source: TfNSW)

6.2.7.1.2 Viewpoint A - Description

Viewpoint A is located at the western edge of Kesterton Park, adjacent to the cul-de-sac at High Street, looking east. It is located approximately 30 metres from the existing and proposed North Sydney Wharf. Viewpoint A is orientated toward Kurraba Point. Residential development at Kurraba Point is visible from this viewpoint.

6.2.7.1.3 Viewpoint A – Visual Impact Assessment

Visible Elements	Sensitivity	Magnitude	Distance Zone	Overall Rating	Comment
Platform roof, gangway roof, landside works	High - Moderate	High	FZ	High-Moderate	<p>The sensitivity of Viewpoint A is considered high-moderate due to following reasons:</p> <ul style="list-style-type: none"> > Close proximity to the North Sydney Wharf > The proposed wharf and associated works would be highly visible from this viewpoint > Kesterton Park is a public recreation area that offers prominent views to Sydney Harbour. <p>As shown in Figure 6-3, part of the proposed wharf would be located below the sandstone retaining wall along the Neutral Bay foreshore. The visibility of the proposed wharf would also vary subject to tidal fluctuation.</p> <p>Due to the size and height of the proposed wharf, the visual impact from this viewpoint would be greater when compared to the existing wharf. However, the impact is limited to the water view towards Kurraba Point.</p> <p>Views to Sydney Harbour, from Kesterton Park, are still available from the foreshore footpath and Wurrabirri Point. Therefore, the reduction of water view to Kurraba Point is not considered to be as significant.</p> <p>As illustrated in Figure 6-3, a uniform palette of materials has been selected to respond to the maritime and surrounding character. New paving and furniture for the landside works have been chosen to complement and integrated into the existing environment,</p> <p>Considering the above reasoning, the potential visual impact is deemed to be high-moderate.</p>

6.2.7.2 Viewpoint B – Kesterton Park (adjacent to existing footpath) looking south-east.



Figure 6-4 Viewpoint B – Existing View (Source: TfNSW)



Figure 6-5 Viewpoint B – Photomontage (Source: TfNSW)

6.2.7.2.2 Viewpoint B - Description

Viewpoint B is located at the eastern edge of Kesterton Park, adjacent to the existing footpath between Kesterton Park and the Neutral Bay foreshore. The viewpoint is approximately 30 metres from the existing North Sydney Wharf and is orientated toward Sydney Harbour.

6.2.7.2.3 Viewpoint B – Visual Impact Assessment

Visible Elements	Sensitivity	Magnitude	Distance Zone	Overall Rating	Comment
Platform roof, gangway roof, landside works	High-Moderate	High-Moderate	FZ	High-Moderate	<p>The sensitivity of Viewpoint B is considered high-moderate due to following reasons:</p> <ul style="list-style-type: none"> > Close proximity to the North Sydney Wharf > Kesterton Park is a public recreation area that offers prominent views to Sydney Harbour. <p>As shown in Figure 6-5, the proposed wharf would be highly visible and reduce the view to</p>

Visible Elements	Sensitivity	Magnitude	Distance Zone	Overall Rating	Comment
					<p>Sydney Harbour. However, the impact is considered minor for the following reasons:</p> <ul style="list-style-type: none"> > Unrestricted views to Sydney Harbour are available approximately 40 metres south of Viewpoint B and Wurrabirri Point > The use of transparent material would maintain some visibility to Sydney Harbour through the proposed wharf > Uniform palette of materials would be used to respond to the maritime and surrounding character. <p>Pedestrians' view, utilising the footpath along the foreshore, would be impacted. However, the visual impact is likely to be temporary and other vantage points of the Sydney Harbour are available near the existing North Sydney Wharf.</p> <p>As Kesterton Park falls from west to east, Viewpoint B is taken from the lowest point within Kesterton Park. Hence, Figure 6-5 illustrates the worst case scenario and impacts would likely be reduced from other parts of Kesterton Park.</p>

It is notable that this viewpoint is directly to the north east of the existing residential apartments on the boundary of Kesterton Park at 144-146 High Street. These apartments would experience similar views of the new ferry wharf. However, views from the apartments would be elevated so that the wharf would appear in the lower portion of the view. With movement up the apartment block, elevation would increase and the wharf would constitute a lesser portion of the view.

Views from the apartments located are unlikely to be impacted for the following reasons:

- > The apartment complex is located approximately 6 metres above the proposed wharf
- > The proposed wharf would not impede Standing and sitting views to Sydney Harbour
- > The windows and balconies are primarily orientated toward the Sydney Harbour and not Kurraba Point.

Our opinion is that the impact of the proposed new wharf on views from the nearby apartments would be acceptable.

6.2.7.3 Viewpoint C – Sydney Harbour looking north-west.



Figure 6-6 Viewpoint C – Existing View (Source: TfNSW)



Figure 6-7 Viewpoint C – Photomontage (Source: TfNSW)

6.2.7.3.2 Viewpoint C - Description

Viewpoint C is from Sydney Harbour, looking north at a distance of approximately 60 metres from the existing North Sydney Wharf.

6.2.7.3.3 Viewpoint C – Visual Impact Assessment

Visible Elements	Sensitivity	Magnitude	Distance Zone	Overall Rating	Comment
Platform and roof	Moderate	High-Moderate	FZ	Moderate	Viewpoint C is captured from the Harbour City Ferry route from Kirribilli Wharf to North Sydney Wharf. The prominent elements of Viewpoint C are the existing wharf and residential

Visible Elements	Sensitivity	Magnitude	Distance Zone	Overall Rating	Comment
					<p>building located at 144-146 High Street.</p> <p>The proposed wharf would introduce a new element into the harbour and would be highly visible from this viewpoint, notwithstanding that the existing ferry wharf is a significant component of the current view.</p> <p>Most people would be travelling to and from this viewpoint. Therefore, the duration of view of the proposed wharf is likely to be short and temporary.</p> <p>The design of the North Sydney Wharf reflects the practical use of the foreshore area and harbour as a ferry wharf. The proposed design is considered an improvement to the existing wharf and generally consistent with other wharf upgrades located within the Sydney Harbour. Therefore, the magnitude of the proposed design is deemed to be high-moderate.</p>

6.2.7.4 Viewpoint D– Kurraba Reserve looking west



Figure 6-8 Viewpoint D – Existing View (Source: TfNSW)



Figure 6-9 Viewpoint D – Photomontage (Source: TfNSW)



Figure 6-10 Viewpoint D – Photomontage – zoomed in image (Source: TfNSW)

6.2.7.4.2 Viewpoint D - Description

Viewpoint D is located within Kurraba Reserve looking west at a distance of approximately 400 metres from the existing North Sydney Wharf. Viewpoint D is dominated by buildings situated along Kirribilli’s foreshore, Sub Base Platypus to the north-east and tall commercial/residential buildings located at North Sydney and Milsons Point. As illustrated in **Figure 6-9**, the existing North Sydney Wharf would be visible from this location as a small component of a broad view that incorporates the foreshore, the North Sydney skyline and moored yachts in Neutral Bay.

Kurraba Reserve is a popular recreational area with prominent views of the Sydney Harbour and Garden Island.

6.2.7.4.3 Viewpoint D - Visual Impact Assessment

Visible Elements	Sensitivity	Magnitude	Distance Zone	Overall Rating	Comment
Platform and roof	Moderate-Low	Moderate-Low	MZ	Moderate-Low	<p>The sensitivity of Viewpoint D is considered moderate to low as the North Sydney Wharf is located approximately 400 metres from Viewpoint D.</p> <p>The North Sydney Wharf is visible from Viewpoint D.</p> <p>As illustrated from Figure 6-9, the foreground of Viewpoint D is dominated by boats/yachts anchored within Neutral Bay, the former industrial buildings at Sub Base Platypus and tall commercial/residential buildings located within background. Due to the minor scale of the proposed North Sydney Wharf would not be the dominant element within Viewpoint D.</p> <p>The existing landscaping at Kesterton Park and along High Street</p>

Visible Elements	Sensitivity	Magnitude	Distance Zone	Overall Rating	Comment
					<p>would soften the proposed structures and reduce potential visual impacts.</p> <p>Viewpoint D offers a view to Sydney Harbour and Garden Island. Therefore, views toward Kesterton Park from Viewpoint B would not be the main focus for visitors or commuters.</p>

6.2.7.5 Viewpoint E – Neutral Bay Wharf looking south



Figure 6-11 Viewpoint E – Existing View (Source: TfNSW)



Figure 6-12 Viewpoint E – Photomontage (Source: TfNSW)



Figure 6-13 Viewpoint E – Photomontage - zoomed in image (Source: TfNSW)

6.2.7.5.2 Viewpoint E - Description

Viewpoint E is located at Neutral Bay Wharf, looking southwest. It is located approximately 350 metres from the existing North Sydney Wharf. Viewpoint E is dominated by the industrial buildings at Sub Base Platypus; Iora Apartment located at 1 Kiara Close, North Sydney and yachts anchored within Neutral Bay. As indicated in **Figures 6-12 and 6-13**, the existing North Sydney Wharf is a small element within Viewpoint E.

Neutral Bay Wharf offers views to Sydney Harbour and Garden Island.

6.2.7.5.3 Viewpoint E - Visual Impact Assessment

Visible Elements	Sensitivity	Magnitude	Distance Zone	Overall Rating	Comment
Platform and roof and gangway	Moderate-Low	Moderate-Low	MZ	Moderate-Low	<p>The sensitivity of Viewpoint E is considered moderate to low as the North Sydney Wharf is located approximately 300 metres from Viewpoint E.</p> <p>The platform, roof and gangway are visible from Viewpoint E.</p> <p>The key attractor of this viewpoint is the existing industrial buildings located at the Sub Base Platypus and three residential buildings located above the sandstone wall at Sub Base Platypus.</p> <p>The new wharf is a larger structure when compared to the existing wharf. However, the proposed structure is sitting low in the middle ground and partially blends into taller buildings located within the background. Therefore, the magnitude of the new wharf is considered moderate-low.</p> <p>Views to Sydney Harbour and Garden Island would not be impacted by Viewpoint E.</p>

6.3 Overall Visual Impact Assessment - Moderate

The new North Sydney wharf would be visible from a number of viewpoints within the vicinity of the site. The visual impact generated by the proposed wharf varies from viewpoint to viewpoint.

The North Sydney wharf is directly overlooked from the Kesterton Park and the existing footpath along the foreshore. This is a highly sensitive area as Kesterton Park is identified as a local heritage item and moderately utilised by the public.

Visual impact from Kesterton Park is considered high-moderate as the impact is limited to the water view towards Kurraba Point. Furthermore, views to Sydney Harbour are still available from the foreshore footpath and Wurrabirri Point.

Views from the footpath at the foreshore (i.e. Viewpoint B) would include the new wharf as a new built element. However, views of the Sydney Harbour are available from all other points along the footpath and Kesterton Park. Therefore, the visual impact in this area would be high-moderate.

Visual impacts from Sydney Harbour (i.e. captured from the Harbour City Ferry route) are considered moderate. Most people will be travelling to and from this Viewpoint. Therefore, the duration of view of the proposed wharf is likely to be short and temporary. No significant aspect would be impacted.

Kurraba Point and Neutral Bay Wharf are considered moderate-low sensitivity viewpoints. Due to the distance from North Sydney Wharf, the new structure would be minor in scale when compared to nearby industrial and residential buildings. It is not identified as the dominant element within these viewpoints. Additionally, the proposed structure would not result in any view loss.

Overall the impact is considered moderate with the proposal forming part of a broader harbour context with minimal impact on existing views.

7 Summary of Urban Design Concept and Mitigation Strategy

7.1 Summary of Urban Design Concept and Mitigation Strategy

The proposed new North Sydney ferry wharf has been designed in a form that is consistent with contemporary urban design practices. It incorporates use of lightweight materials and maximises transparency within the confines of the requirement to provide safety and weather protection for ferry users. The approaches to and surrounds of the wharf have been designed to maximise amenity and are in keeping with the existing urban and landscape environment. Landscape treatment of the approaches to the wharf is appropriate and complimentary to the existing landscape of Kesterton Park.

We consider that the wharf design and associated landscape treatment is sufficient to mitigate the potential impacts of the proposal on the local visual and landscape environment. No additional mitigation measures are considered necessary.

7.2 Conclusion

The assessment of the impacts of the proposed new North Sydney ferry wharf on local landscape and visual quality has been carried out in accordance with the following TfNSW Guidelines:

- > *'Beyond the Pavement: urban design approach and procedures for road and maritime infrastructure planning, design and construction'* (RMS, 2020)
- > *Guideline for Landscape Character and Visual Impact Assessment - Environmental Impact Assessment Practice Note EIA-NO4* (RMS, 2018).

The assessment has found that the proposal would have an acceptable impact on landscape and visual quality when viewed from Sydney Harbour and from its foreshore. It is considered that with regard to visual and landscape impacts the proposal is worthy of support.

Appendix G

Statement of heritage impact

Ferry Wharf Upgrade Program 3, Seven Wharves: North Sydney Wharf

Statement of Heritage Impact

Report to Cardno

September 2020



 artefact

Artefact Heritage

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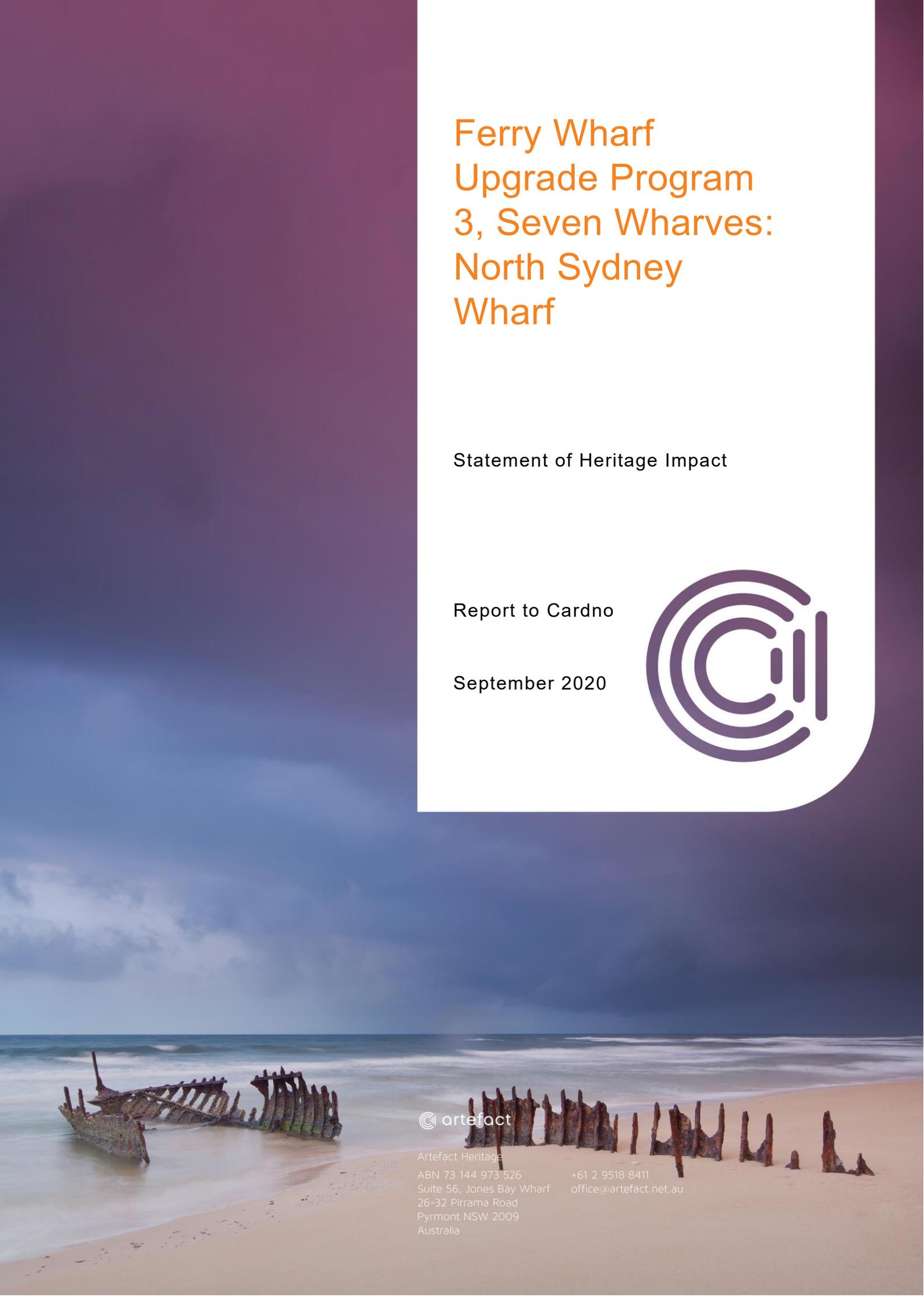
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EXECUTIVE SUMMARY

Transport for New South Wales (Transport for NSW - formerly Roads and Maritime Services) is proposing to upgrade North Sydney Wharf as part of Ferry Wharf Upgrade Program 3 (FWUP3). FWUP3 aims to upgrade seven ferry wharves in Sydney Harbour as part of the Transport Access Program (TAP), which is aimed at providing a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure. FWUP3 focusses on wharf interchanges which do not currently provide equitable access to ferry services and as such do not meet the *Disability Standards for Accessible Public Transport 2002* (DSAPT) or *Disability Discrimination Act 1992* (DDA) requirements. As part of FWUP3, Cardno, on behalf of Transport for NSW, is preparing a Review of Environmental Factors (REF) for each wharf upgrade.

Artefact Heritage have been engaged by Cardno, on behalf of Transport for NSW, to prepare a Statement of Heritage Impact (SoHI) to assess the potential impacts to listed heritage items and potential archaeological remains as a result of the proposed FWUP3 works at North Sydney Wharf. This report identifies listed heritage items present within and in the vicinity of the proposal, provides a preliminary assessment of archaeological potential, assesses impacts to heritage items and potential archaeological remains, and provides recommendations, management strategies and mitigation measures.

Conclusions

This SoHI has determined the following:

- The construction footprint is located within the curtilages of two heritage items listed on the North Sydney Local Environmental Plan (LEP) 2013:
 - Kesterton Park (LEP no. I0858)
 - North Sydney Bus Shelter (LEP no. I0407)
- The construction footprint is located adjacent to two heritage items listed on the North Sydney LEP 2013:
 - Careening Cove Conservation Area (LEP no. CA10)
 - Rockcliff Mansions (LEP no. I0853)
- The visual buffer zone for the construction footprint also includes:
 - The visual buffer zone of one heritage item listed on the World Heritage List (WHL):
 - Sydney Opera House (buffer zone) [WHL 166rev]
 - One heritage item listed on the Commonwealth Heritage List (CHL):
 - Customs Marine Centre (CHL ID 105249)
 - Two heritage items listed on the State Heritage Register (SHR):
 - Hastings (SHR no. 00567)
 - Nutcote (SHR no. 00505)
 - Nineteen heritage items listed on the North Sydney LEP 2013 and Sydney LEP 2012
- A preliminary archaeological assessment has determined that the construction footprint has nil to low potential to contain locally significant archaeological remains associated with Phase 1 (1788-1870 Informal use and whaling allotments), and low to moderate potential to contain locally significant archaeological remains associated with Phase 2 (1870-1941 Industrial use), including

evidence of former nineteenth century wharves and a weigh bridge. The construction footprint also has moderate to high potential to contain non-significant reclamation fills associated with Phase 2. The archaeological remains would likely be limited to evidence of former 'works' and the construction footprint is unlikely to contain significant 'relics' as defined by the *NSW Heritage Act 1977* (Heritage Act)

- The impacts on the identified heritage items resulting from the proposed works are summarised in the table below, and include:
 - Minor to moderate direct and indirect and negligible potential direct impacts to Kesterton Park (LEP no. I0858)
 - Negligible indirect and neutral direct and potential direct impacts to North Sydney Bus Shelter (LEP no. I0407)
 - Neutral direct and negligible indirect and potential direct impacts to Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853)
 - Neutral direct, indirect and potential direct impacts to Sydney Opera House (WHL 166rev)
 - Negligible indirect and neutral direct and indirect impacts to Customs Marine Centre (CHL ID 105249)
 - Negligible indirect and neutral direct and indirect impacts to Hastings (SHR no. 00567) and Nutcote (SHR no. 00505)
 - Negligible indirect and neutral direct and indirect impacts to the remaining LEP heritage items
- Based on the preliminary archaeological assessment, excavations associated with the proposal would result in negligible impacts to potential archaeological remains of local significance. However, the proposed excavations are unlikely to impact significant 'relics'
- The proposed works would not impact the overall significance of the heritage items within and adjacent to the construction footprint, or the heritage items within the visual buffer zone
- The impacts associated with the proposed works are necessary to make North Sydney Wharf compliant with the requirements of the DDA.

Heritage item	Direct	Indirect	Potential direct	Archaeological
Kesterton Park	Minor to moderate	Minor to moderate	Negligible	Negligible
North Sydney Bus Shelter	Neutral	Negligible	Negligible	Neutral
Careening Cove Conservation Area	Neutral	Negligible	Negligible	Neutral
Rockcliff Mansions	Neutral	Negligible	Negligible	Neutral
Sydney Opera House (buffer zone)	Neutral	Neutral	Neutral	Neutral
Customs Marine Centre	Neutral	Negligible	Neutral	Neutral
Hastings	Neutral	Negligible	Neutral	Neutral

Heritage item	Direct	Indirect	Potential direct	Archaeological
Nutcote	Neutral	Negligible	Neutral	Neutral
Remaining LEP items in the visual buffer zone	Neutral	Negligible	Neutral	Neutral

Mitigation measures and recommendations

The following mitigation measures should be enacted to minimise heritage impacts:

- As the proposed works would not impact upon the Commonwealth heritage values of Customs Marine Centre (CHL ID 105249), or the World heritage values of the Sydney Opera House (WHL 166rev), a referral to the Commonwealth in accordance with the EPBC Act would not be required
- The proposed works would result in impacts to Kesterton Park (LEP no. I0858), which is listed on the North Sydney LEP 2013, that are more than minor in nature. As a result, the proposal is not consistent with the general requirements for exempt development under Section 20 of the ISEPP. Therefore, consultation is required with North Sydney Council prior to any impacts occurring
- A copy of this report must be submitted to North Sydney Council for their records to inform them of the impacts to Kesterton Park (LEP no. I0858). The proposal must take into consideration any response to the impact assessment that is received from North Sydney Council within 21 days after the notice is given
- The preliminary archaeological assessment has identified low to moderate potential for archaeological remains of local significance to be present within the construction footprint, including evidence of a former nineteenth century weigh bridge. However, due to the shallow nature of the proposed excavations there is limited risk of archaeological impacts and therefore impacts to the identified archaeological resources would be negligible. Furthermore, the preliminary archaeological assessment has found that the potential archaeological remains would likely be limited to 'works'. As a result, an exception under Section 139 (4) of the Heritage Act would not be required for the proposed works and the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be implemented should any archaeological remains be encountered during works
- If unexpected 'relics' are encountered during excavation, a s146 relics notification would be forwarded to Heritage NSW, DPC. 'Relics' cannot be impacted without appropriate approvals under the Heritage Act
- If any design changes would result in additional excavations and impacts to potential archaeological remains of the former weigh bridge, further archaeological assessment and management would be required. This may include a program of archaeological test excavation
- If significant archaeological remains are encountered during works, design options for avoiding impacts to the significant archaeological remains should be considered where practicable and opportunities should be investigated for the implementation of heritage interpretation

- A heritage induction would be provided to workers prior to construction, informing them of the location and significance of known heritage items and the implementation of the Unexpected Heritage Item Procedure 2015 if unanticipated heritage items or depositions are located during construction. The heritage induction would include management of expected non-significant archaeological remains, such as minor artefactual material associated with Phase 2 reclamation fills
- A structural engineer should assess whether the vibrations associated with the proposed landscaping and piling for the wharf piles, would potentially result in direct impacts to the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) and to Rockcliff Mansions (LEP no. I0853)
- During the construction works, regular inspections of the construction activities and work areas should be undertaken by structural engineers and any other required specialist to monitor and review the construction methodology and confirm the integrity of the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853). Assessment and monitoring of vibration impacts should adhere to:
 - British Standard BS 7385: *Part 2: Evaluation and Measurement for Vibrations in Buildings – Part 2 Guide to Damage Levels from Ground-Borne Vibration*
 - German Standard DIN 4150, *Part 3: Structural Vibration in Buildings: Effects on Structures*
- If vibration monitors are attached to the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) or Rockcliff Mansions (LEP no. I0853), they must not be attached with permanent fixings. They should be removable without causing damage. Bees wax may be a suitable attachment method
- If it is identified that levels of vibration are causing damage to heritage fabric, works must cease, and the construction methodology reviewed by the project engineers in consultation with a Heritage Consultant in order to mitigate further impacts. A temporary protection plan to outline protection measures required for significant fabric during activities causing potential vibration impacts would be prepared prior to commencement of works
- Care must be taken during the removal of the non-significant elements from the North Sydney Bus Shelter (LEP no. I0407) to ensure that significant fabric is not damaged in the process. A work method statement should be prepared to guide the removal of elements from the bus shelter to minimise the risk of inadvertent impacts
- Works within Kesterton Park (LEP no. I0858) must be kept to a minimum where possible and be undertaken with care to minimise impacts to the local heritage item and minimise the loss of public green space and vegetation
- A work method statement should be prepared to guide the modification of the seawall within Kesterton Park (LEP no. I0858) for the new gangway abutment and pavement finish

- Any trees or vegetation required to be removed, including the four small trees along the existing footpath, should be reinstated following the completion of the works to minimise impacts to the visual characteristics of Kesterton Park (LEP no. I0858)
- All impacted areas and ground surfaces must be reinstated as near as possible to their original state following the completion of works within Kesterton Park (LEP no. I0858)
- A Photographic Archival Recording should be undertaken of Kesterton Park (LEP no. I0858) to document its current visual setting prior to any impacts and modifications
- If underwater excavations are proposed in the location of the current wharf, then a maritime archaeological assessment should be undertaken to assess the potential for impacts to maritime archaeological remains of the former wharves
- Any project redesign resulting in new ground disturbance, vegetation removal, or new features must be assessed in an addendum to this SoHI.

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1.0 INTRODUCTION

1.1 Project background

1.1.1 Transport Access Program

The Transport Access Program (TAP) is a Transport for NSW initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure.

1.1.2 Ferry Wharf Upgrade Program

Transport for NSW (formerly Roads and Maritime Services) is the delivery agency for the upgrade of the Sydney ferry wharves within the TAP program (known as FWUP3). FWUP3 involves upgrades to seven wharves in Sydney Harbour, including North Sydney Wharf, South Mosman Wharf, Taronga Zoo Wharf, Darling Point Wharf, Watsons Bay Wharf, Greenwich Point Wharf and Double Bay Wharf.

The objectives of FWUP3 are:

- Achieve one hundred per cent compliance with the DSAPT for all assts, access paths and transport services within the wharf interchange
- Increase the rate at which passengers embark and disembark
- Make the wharf safer for passengers to embark and disembark
- Meet the current demand and enable future growth
- Enhance the efficiency of the interchange
- Improve passenger amenities and waiting areas
- Minimise construction impacts to customers and wharf operations
- Minimise the cost of ownership and maintenance
- Develop a functional, distinctive and iconic design heme that will unify and identify Sydney Harbour ferry wharves
- Discourage inappropriate activities at the wharves.

FWUP3 focusses on wharf interchanges which do not currently provide equitable access to ferry services, such as North Sydney Wharf, and as such do not meet the DSAPT or DDA requirements. The upgrade works associated with FWUP3 would include the installation of a combination of new jettys/gangways/pontoons, footpath regarding and installation of new footpaths, installation of kiss and drop accessible parking spaces, and landscaping work. As part of FWUP3, Cardno, on behalf of Transport for NSW, is preparing a REF for each wharf upgrade.

Artefact Heritage have been engaged by Cardno, on behalf of Transport for NSW, to prepare a SoHI to assess the potential impacts to listed heritage items and potential archaeological remains as a result of the proposed FWUP3 works at North Sydney Wharf (the proposal). This report is aimed at identifying what listed heritage items are present within and in the vicinity of the proposal, providing a preliminary assessment of potential archaeological remains which could be present, identifying potential impacts to the heritage items and potential archaeological remains, and providing recommendations, management strategies and mitigation measures.

1.2 Project location

For the purposes of the REF and this SoHI the construction footprint of the North Sydney Wharf upgrades has been defined as the construction area around the project footprint which includes the site compound and storage area in Kesterton Park. The project footprint has been defined as the physical footprint of the proposed works.

The construction footprint includes North Sydney Wharf and part of Kesterton Park, located at the end of High Street within the suburb of North Sydney. The construction footprint is located on the south-east side of Wurrabirri Point and within Lot A and Lot B of DP 396389, Lot 7, Lot 8 and Lot 9 of DP 12302, and Lot 1124 of DP 752067. The construction footprint is bounded by Neutral Bay to the east, Careening Cove to the south, and nineteenth and twentieth century residential development to the north-west. The construction footprint is located within the North Sydney Council Local Government Area (LGA), the County of Cumberland, and the Parish of Willoughby.

In addition to the project footprint, a visual buffer zone including the surrounding area between Neutral Bay, Careening Cove and part of Sydney Harbour north of Fort Denison has been assessed for visual impacts associated with the proposed FWUP3 works at North Sydney Wharf. The extent of the visual buffer zone has been based on a visibility analysis prepared by Cardno for the proposal (refer to Section 1.4.3).

The location of the project footprint is illustrated in Figure 1, and the visual buffer zone assessed in this SoHI is illustrated in Figure 2.

1.3 The proposal

The proposal is to upgrade the North Sydney Wharf as part of the TAP.

The water-based features of the proposal would include:

- Installation of a new 3.3m long by 3.3m wide concrete jetty, supported by three new piles, including minor modifications to the top of the seawall
- Installation of a new 12m by 27m pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with two pivot piles (to assist vessel berthing) provided at either end of the pontoon and two protection piles provided at the north end of the pontoon
- Installation of a new 18m uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- Safety and security features on the pontoon including an emergency help point, lighting, closed circuit television (CCTV), ladders to the water and a life buoy and tactile indicators where required.

The land-based features of the proposal would include:

- One accessible parking space at the cul-de-sac end of High Street
- One kiss-and-ride space or zone at the cul-de-sac end of High Street
- Three new bicycle parking hoops

- Footpath regrading to produce a Disability Standards for Accessible Public Transport 2002 (DSAPT) compliant grade
- Installation of a new accessible ramp between the existing footpath and the new gangway
- One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- Installation of new wayfinding signage, information boards, and opal card readers
- Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter.

The construction footprint and key features of the proposal are illustrated in Figure 3.

1.4 Report methodology and limitations

This SoHI has been prepared in accordance with the guidelines outlined by the Heritage Office, now Heritage NSW, Department of Premier and Cabinet (Heritage NSW, DPC), and Department of Urban Affairs & Planning in the document *Statements of Heritage Impact* as part of the *NSW Heritage Manual*.¹ This SoHI has been prepared in accordance with the principles contained in the most recent edition of *The Burra Charter: The Australian ICOMOS Charter for Places of Cultural Significance*.

1.4.1 NSW heritage significance assessment

Determining the significance of heritage items or a potential archaeological resource is undertaken by utilising a system of assessment centred on the *Burra Charter* of Australia International Council on Monuments and Sites (ICOMOS).

The principles of the charter are relevant to the assessment, conservation and management of sites and relics. The assessment of heritage significance is outlined through legislation in the Heritage Act and implemented through the *NSW Heritage Manual* and the *Archaeological Assessment Guidelines*.² The criteria specified by the guidelines encompass the four values identified in the *Burra Charter*, historical significance, aesthetic significance, scientific significance and social significance; and also consider representativeness and rarity values.

If an item meets one of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have heritage significance. The significance of an item or potential archaeological site can then be assessed as being of local or state significance. If a potential archaeological resource does not reach the local or state significance threshold, then it is not classified as a relic under the Heritage Act.

‘*State heritage significance*’, in relation to a place, building, work, relic, moveable object or precinct, means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

¹ Heritage Office and Department of Urban Affairs and Planning, “Statements of Heritage Impact,” 2002, <https://www.heritage.nsw.gov.au/assets/Uploads/a-z-publications/s-u/Statements-of-Heritage-Impact.pdf>.

² NSW Heritage Council, “Archaeological Assessment Guidelines,” in *NSW Heritage Manual* (New South Wales: Heritage Office, 1996).

'*Local heritage significance*', in relation to a place, building, work, relic, moveable object or precinct, means significance to an area in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.³

The overall aim of assessing archaeological significance is to identify whether an archaeological resource, deposit, site or feature is of cultural value. The assessment will result in a succinct statement of heritage significance that summarises the values of the place, site, resource, deposit or feature. The heritage significance assessment criteria are described in Table 1.

³ This section is an extract based on the Heritage Office Assessing Significance for Historical Archaeological Sites and Relics 2009:6.



 **Construction footprint**
20035 Seven Wharves Upgrade - North Sydney
LGA: North Sydney

Scale: 1:1000
Size: A4
Date: 17-07-2020

0 20 40 m 

Figure 1: Location of the construction footprint



Construction footprint and visual buffer zone
20035 Seven Wharves - North Sydney
LGA: North Sydney

Scale: 1:8000
Size: A4
Date: 17-07-2020

0 160 320 m



Figure 2: Location of the construction footprint and the wider visual buffer zone



Figure 3: Project footprint and construction footprint (provided by Cardno)

Table 1: NSW heritage significance assessment criteria

Criterion	Explanation
A – Historical Significance	An item is important in the course, or pattern, of NSW’s cultural or natural history (or the cultural or natural history of the local area)
B – Associative Significance	An item has a strong or special association with the life or works of a person, or group of persons, of importance in NSW’s cultural or natural history (or the cultural or natural history of the local area)
C – Aesthetic Significance	An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or in the local area)
D – Social Significance	An item has a strong or special association with a particular community or cultural group in NSW (or local area) for social, cultural or spiritual reasons
E – Research Potential	An item has the potential to yield information that will contribute to an understanding of NSW’s cultural or natural history (or cultural or natural history of the local area)
F – Rarity	An item possesses uncommon, rare or endangered aspects of NSW’s cultural or natural history (or the cultural or natural history of the local area)
G – Representative	An item is important in demonstrating the principal characteristics of a class of NSW’s cultural or natural places; or cultural or natural environments (or a class of the local area’s cultural or natural places; or cultural or natural environments)

1.4.2 Assessment of heritage impact

This SoHI has been prepared using the document *Statement of Heritage Impact 2002*, contained within the *NSW Heritage Manual*, as a guideline.

Impacts on heritage are identified as either:

- Direct impacts, resulting in the demolition or alteration of fabric of heritage significance
- Potential direct impact, resulting in impacts from vibration and demolition of adjoining structures
- Indirect impacts, resulting in changes to the setting or curtilage of heritage items or places, historic streetscapes or views.

Specific terminology and corresponding definitions are used in this assessment to consistently identify the magnitude of the proposal’s direct, indirect or potentially direct impacts on heritage items or archaeological remains. The terminology and definitions are based on those contained in guidelines produced by ICOMOS and are shown in Table 2.⁴ It is assumed that all direct and potential direct impacts are a result of construction. Indirect impacts are assumed to be operational unless specified as temporary in which case they are related to construction.

⁴ Including the document *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*, ICOMOS, January 2011.

Table 2: Terminology for assessing the magnitude of heritage impact

Magnitude	Definition
Major	<p>Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource.</p> <p>These actions cannot be fully mitigated</p>
Moderate	<p>This would include actions involving the modification of a heritage, including altering the setting of a heritage item or landscape, partially removing archaeological resources, or the alteration of significant elements of fabric from historic structures.</p> <p>The impacts arising from such actions may be able to be partially mitigated</p>
Minor	<p>Actions that would results in the slight alteration of heritage buildings, archaeological resources, or the setting of an historical item.</p> <p>The impacts arising from such actions can usually be mitigated</p>
Negligible	<p>Actions that would results in very minor changes to heritage items</p>
Neutral	<p>Actions that would have no heritage impact</p>

1.4.3 Assessment of visual impacts

Heritage items that are located within one kilometre of the construction footprint have been assessed for potential visual impacts. Cardno have prepared a *Landscape Character and Visual Impact Assessment (LCVIA)* for the proposal as part of the REF.⁵ As part of this, a visibility analysis has been undertaken and sightlines to and from the construction footprint have been established in order to assess the visual impacts associated with the proposal. This SoHI utilises the visibility analysis prepared by Cardno to assess visual impact on heritage items within the one-kilometre visual buffer zone. Both the views *towards* heritage items (whether the proposal would impair views of the item's significant visual characteristics) and views *away* from the items (whether the proposal would impair views of the heritage-significant surroundings or character of the items) have been assessed.

The visual buffer zone assessed in this SOHI is illustrated in Figure 2, and the visibility analysis undertaken by Cardno that the buffer zone is based on is illustrated in Figure 4.

The following grading, which has been informed by the LCVIA, has been used in this SoHI for identifying the location of heritage items in relation to the visual buffer zone:⁶

- Foreground zone (FZ): Heritage items within 200m of the construction footprint
- Middle ground zone (MZ): Heritage items within 200 – 500m of the construction footprint
- Background zone (BZ): Heritage items more than 500m from the construction footprint.

⁵ Cardno, 'Landscape Character and Visual Impact Assessment: North Sydney Wharf Upgrade'. Draft. Report to Transport for NSW, 2020.

⁶ Cardno, 'Landscape Character and Visual Impact Assessment: North Sydney Wharf Upgrade'. 20.



Figure 4: Visibility analysis prepared by Cardno. Source: Cardno⁷

⁷ Cardno, 'Landscape Character and Visual Impact Assessment: North Sydney Wharf Upgrade'. 19.

1.4.4 Non-Aboriginal archaeological assessment

A preliminary archaeological assessment has been undertaken for this SoHI. Non-Aboriginal archaeological potential is defined as the potential of a site to contain significant archaeological remains, including works or relics as identified in the Heritage Act. The assessment of non-Aboriginal archaeological potential is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) may have impacted on archaeological evidence for these former land uses. Knowledge of previous archaeological investigations, understanding of the types of archaeological remains likely to be associated with various land uses, and the results of site inspection are also taken into consideration when evaluating the potential of an area to contain archaeological remains.

The potential for the survival of archaeological remains in a particular place is significantly affected by activities which may have caused ground disturbance. These processes include the physical development of the site (for example, phases of building construction) and the activities that occurred there. The likelihood for the survival of these remains (i.e. their archaeological potential) is distinct from the 'archaeological significance' and 'archaeological research potential of these remains', should any exist. These designations refer to the cultural value of potential archaeological remains and are the primary basis of the recommended management actions included in this document. For example, there may be 'low potential' for certain remains to survive, but if they do, they may be assessed as being of State significance.

The *NSW Heritage Manual* provides the framework used for the significance assessment of the potential archaeological remains within the construction footprint. These guidelines incorporate the aspects of cultural heritage value identified in the *Burra Charter*. The Heritage Council also issued the 1996 *Archaeological Assessment Guidelines*⁸ and the Heritage Branch (now Heritage NSW, DPC) issued the 2009 *Assessing Significance for Historical Archaeological Sites and 'Relics'*.⁹ The assessment of historical archaeological sites requires a specialised framework in order to consider the range of values of an archaeological site.

The grades of archaeological potential used in this report are outlined in Table 3 below.

Table 3: Grades of archaeological potential

Grading	Justification
Nil	No evidence of historical development or use, or where previous impacts such as deep basement structures would have removed all archaeological potential
Low	Research indicates little or low intensity historical development, or where there have been substantial previous impacts, disturbance and truncation in locations where some archaeological remains such as deep subsurface features may survive
Moderate	Analysis demonstrates known historical development and some previous impacts, but it is likely that archaeological remains survive with some localised truncation and disturbance
High	Evidence of multiple phases of historical development and structures with minimal or localised twentieth century development impacts, and it is likely the archaeological resource would be largely intact.

⁸ NSW Heritage Council, "Archaeological Assessment Guidelines".

⁹ NSW Heritage Branch, *Assessing Significance for Historical Archaeological Sites and 'Relics'*.

1.4.5 Limitations

This SoHI provides a preliminary assessment of potential non-Aboriginal archaeology only. This SoHI does not provide an assessment for Aboriginal heritage.

This SoHI includes an assessment of the visual impacts on heritage items within one kilometre of the construction footprint which have views to and from the construction footprint. While it is possible that additional heritage items outside of the visual assessment area illustrated in Figure 2 would potentially be within sightlines of the new development, it is expected that these items are located at a sufficient distance from the construction footprint that the proposal would not result in visual impacts to these heritage items under normal circumstances. As a result, heritage items located outside of the one-kilometre visual assessment area have not been included in this SoHI.

1.5 Authorship

This report was prepared by Sarah Hawkins (Heritage Consultant) and Jayden van Beek (Senior Heritage Consultant) with management input and review by Josh Symons (Principal).

2.0 STATUTORY CONTEXT

2.1 Introduction

There are several items of State and Commonwealth legislation that are relevant to the current proposal. A summary of these Acts and the potential legislative implications follow.

Heritage listed items within and in the vicinity of the construction footprint were identified through a search of the relevant state and federal statutory and non-statutory heritage registers discussed below, including:

- World Heritage List (WHL)
- Commonwealth Heritage List (CHL)
- National Heritage List (NHL)
- State Heritage Register (SHR)
- Section 170 Heritage and Conservation Registers
- North Sydney Local Environmental Plan (LEP) 2013
- NSW State Heritage Inventory (SHI) Database
- Register of the National Estate (RNE)
- Register of the National Trust of Australia (NSW) (RNTA).

Items listed on these registers have been previously assessed against the NSW heritage assessment guidelines. Statements of heritage significance, based on the NSW heritage assessment guidelines, as they appear in relevant heritage inventory sheets and documents, are provided in this assessment.

2.2 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legislative framework for the protection and management of matters of national environmental significance, that is, flora, fauna, ecological communities and heritage places of national and international importance. Heritage items are protected through their inscription on the WHL, NHL or the CHL.

The EPBC Act stipulates that a person who has proposed an action that will, or is likely to have, a significant impact on a World, National or Commonwealth heritage site must refer the action to the Minister for the Environment (hereafter the Minister). The Minister would then determine if the action requires approval under the EPBC Act. If approval is required, an environmental assessment would need to be prepared. The Minister would approve or decline the action based on this assessment.

There are no items within or in the immediate vicinity of the construction footprint listed on the WHL, NHL or CHL.

The construction footprint is located about 350m from the edge of the visual buffer zone of the Sydney Opera House (WHL 166rev) [Figure 6]. The visual buffer zone assessed in this SoHI overlaps the visual buffer zone of the Sydney Opera House (WHL 166rev).

There is one item listed on the CHL within the visual buffer zone:

- Customs Marine Centre (Place ID 105249).

2.3 NSW Heritage Act 1977

The Heritage Act is the primary piece of legislation affording protection to heritage items (natural and cultural) in NSW. Under the Heritage Act, 'items of environmental heritage' include places, buildings, works, relics, moveable objects and precincts identified as significant. Significance is based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. State significant items can be listed on the NSW SHR and are given automatic protection under the Heritage Act against any activities that may damage an item or affect its heritage significance. The Heritage Act also protects 'relics', which can include archaeological material, features and deposits.

Under the Heritage Act, all government agencies are required to identify, conserve and manage heritage items in their ownership or control. Section 170 of the Act requires all government agencies to maintain a Heritage and Conservation Register that lists all heritage assets and an assessment of the significance of each asset. They must also ensure that all items inscribed on its list are maintained with due diligence in accordance with State Owned Management Principles approved by the Government on advice of the NSW Heritage Council. These principles serve to protect and conserve the heritage significance of items and are based on NSW heritage legislation and guidelines.

2.3.1 Relics Provisions

The Heritage Act also provides protection for 'relics', which includes archaeological material or deposits. According to Section 139 (Division 9: Section 139, 140-146):

- (1) A person must not disturb or excavate any land knowingly or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, damaged or destroyed unless the disturbance is carried out in accordance with an excavation permit.
- (2) A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.
- (3) This section does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Register.
- (4) The Heritage Council may by order published in the Gazette create exceptions to this section, either unconditionally or subject to conditions, in respect of any of the following:
 - (a) Any relic of a specified kind or description
 - (b) Any disturbance of excavation of a specified kind or description
 - (c) Any disturbance or excavation of land in a specified location or having specified features or attributes,
 - (d) Any disturbance or excavation of land in respect of which an archaeological assessment approved by the Heritage Council indicates that there is little likelihood of there being any relics in the land.

Section 4(1) of the Heritage Act (as amended in 2009) defines a relic as:

...Any deposit, artefact, object or material evidence that: relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and is of State or local heritage significance.

A relic has been further defined as:

Relevant case law and the general principles of statutory interpretation strongly indicate that a 'relic' is properly regarded as an object or chattel. A relic can, in some circumstances, become part of the land be regarded as a fixture (a chattel that becomes permanently affixed to land).¹⁰

Excavation permits are issued by the Heritage Council of NSW, or its Delegate, under Section 140 of the Heritage Act for relics not listed on the SHR or under Section 60 for relics listed on the SHR. An application for an excavation permit must be supported by an Archaeological Research Design and Archaeological Assessment prepared in accordance with the Heritage NSW, DPC archaeological guidelines. Minor works that will have a minimal impact on archaeological relics may be granted an exception under Section 139 (4) or an exemption under Section 57 (2) of the Heritage Act.

2.3.2 Works

The Heritage Act defines 'works' as being in a separate category to archaeological 'relics'. 'Works' refer to remnants of historical structures which are not associated with artefactual material that may possess research value. 'Works' may be buried, and therefore archaeological in nature, however, exposure of a 'work' does not require approved archaeological excavation permits under the Act.

The following examples of remnant structures have been considered to be 'works' by the NSW Heritage Council:

- Former road surfaces or pavement and kerbing
- Evidence of former drainage infrastructure, where there are no historical artefacts in association with the item.
- Building footings associated with former infrastructure facilities, where there are no historical artefacts in association with the item.
- Evidence of former rail track, sleepers or ballast.

Where buried remnants of historical structures are located in association with historical artefacts in controlled stratigraphic contexts (such as intact historic glass, ceramic or bone artefacts), which have the potential to inform research questions regarding the history of a site, the above items may not be characterised as 'works' and may be considered to be 'relics'. The classification of archaeological remains as a 'work' therefore is contingent on the predicted remains being associated with historical structures as well as there being no prediction of the recovery of intact artefactual deposits which may be of research interest.

2.3.3 The State Heritage Register

The SHR was established under Section 22 of the Heritage Act and is a list of places and objects of particular importance to the people of NSW, including archaeological sites. The SHR is administered

¹⁰ NSW Heritage Branch.

by Heritage NSW, DPC and includes a diverse range of over 1500 items, in both private and public ownership. To be listed, an item must be deemed to be of heritage significance for the whole of NSW.

To carry out activities within the curtilage of an item listed on the SHR, approval must be gained from the Heritage Council by securing a Section 60 permit. In some circumstances, under Section 57(2) of the Heritage Act, a Section 60 permit may not be required if works are undertaken in accordance with the Heritage Council document *Standard Exemptions for Works Requiring Heritage Council Approval* or in accordance with agency specific exemptions.¹¹ This includes works that are only minor in nature and will have minimal impact on the heritage significance of the place.

There are no items within or in the immediate vicinity of the construction footprint listed on the SHR.

There are two items within the visual buffer zone listed on the SHR (Figure 6):

- Hastings (SHR no. 00567)
- Nutcote (SHR no. 00505).

2.3.4 Section 170 registers

Under the Heritage Act all government agencies are required to identify, conserve and manage heritage items in their ownership or control. Section 170 (s170) requires all government agencies to maintain a Heritage and Conservation Register that lists all heritage assets and an assessment of the significance of each asset. They must also ensure that all items inscribed on its list are maintained with due diligence in accordance with State Owned Heritage Management Principles approved by the Government on advice of the Heritage Council. These principles serve to protect and conserve the heritage significance of items and are based on NSW heritage legislation and guidelines.

There are no items within or in the immediate vicinity of the construction footprint listed on s170 heritage and conservation registers.

2.4 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act requires that environmental impacts are considered prior to land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits. The Proposal is subject to assessment under Part 5 of the EP&A Act.

The EP&A Act also requires that local governments prepare planning instruments (such as LEPs and Development Control Plans [DCPs]) in accordance with the EP&A Act to provide guidance on the level of environmental assessment required. The construction footprint falls within the boundaries of the North Sydney LGA. Schedule 5 of the North Sydney LEP 2013 includes a list of items/sites of heritage significance within the North Sydney LGA.

¹¹ Heritage Council of New South Wales, "Standard Exemptions For Works Requiring Heritage Council Approval" (Heritage Branch, Department of Planning, 2009), <https://www.environment.nsw.gov.au/resources/heritagebranch/heritage/StandardExemptions.pdf>.

2.4.1 North Sydney Local Environmental Plan 2013

Heritage items listed on the North Sydney LEP 2013 are managed in accordance with the provisions of Section 5.10 Heritage Conservation of this LEP. Clause 5 of this section of the North Sydney LEP 2013 states that:

The objectives of this clause are as follows –

- (a) to conserve the environmental heritage of North Sydney,*
- (b) to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views,*
- (c) to conserve archaeological sites,*
- (d) to conserve Aboriginal objects and Aboriginal places of heritage significance*

Requirement for consent. Development consent is required for any of the following:

- a) Demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance)-*
 - (i) a heritage item*
 - (ii) an Aboriginal object*
 - (iii) a building, work, relic or tree within a heritage conservation area*
-

There are four heritage items and heritage conservations areas listed on the North Sydney LEP 2013 that are located within or in the immediate vicinity of the construction footprint:

- Kesterton Park (LEP no. I0858) [within construction footprint]
- North Sydney bus shelters (LEP no. I0407) [within construction footprint]
- Careening Cove (LEP no. CA10) [adjacent to the construction footprint]
- Rockcliff Mansions (LEP no. I0853) [adjacent to the construction footprint].

There are nineteen heritage items listed on the North Sydney LEP 2013 within the visual buffer zone and one heritage item listed on the City of Sydney LEP 2012 (Table 4).

2.4.2 Development Control Plan

The North Sydney DCP 2013 is a supporting document that compliments the provisions contained within the North Sydney LEP 2013 and provides specific design detail in regard to sympathetic development on, or in the vicinity of, items listed on Schedule 5 of the North Sydney LEP 2013.

Section 13 of the DCP 2013 provides sympathetic considerations for development in the vicinity of a heritage listed item. These considerations include ensuring that the character, bulk, scale and height of new development does not unreasonably overshadow a nearby heritage item, that colouring and texture of new materials of a new development is sympathetic to a heritage item, and that views of a heritage item should not be obscured from the point of view of areas of public domain.

2.5 State Environmental Planning Policy (Infrastructure) 2007

In 2007, the ISEPP was introduced to streamline the development of infrastructure projects delivered by state agencies, including Transport for NSW. Generally, where there is conflict between the provisions of the ISEPP and other environmental planning instruments, the ISEPP prevails. Under the ISEPP, development for the purpose of wharves or wharf infrastructure facilities may be carried out by a public authority without consent on any land. The ISEPP overrides the controls included in the LEPs and DCPs, and Transport for NSW is required to consult with the relevant local councils only when development:

*is likely to affect the heritage significance of a local heritage item, or of a heritage conservation area, that is not also a State heritage item, in a way that is more than minor or inconsequential.*¹²

When this is the case, the proponent must not carry out such development until it has:

- Had an assessment of the impact prepared
- Given written notice of the intention to carry out the development, with a copy of the assessment, to the council for the area in which the heritage item or heritage conservation area (or the relevant part of such an area) is located
- Taken into consideration any response to the notice that is received from the council within 21 days after the notice is given.

2.6 Non-statutory heritage registers

In addition to the heritage registers established by State and Commonwealth legislation, there are a number of relevant non-statutory registers which should be considered. The following registers were searched:

- Register of the National Trust of Australia (NSW) (RNT)
- Register of the National Estate (RNE).

The RNE lists historic, Aboriginal and natural heritage places throughout Australia. Originally established under the *Australian Heritage Commission Act 1975*, the RNE entered more than 13,000 places into the register. The RNE was frozen on 19 February 2007 following amendments to the *Australian Heritage Council Act 2003*. It ceased to be a statutory register in February 2012. The RNE is now maintained on a non-statutory basis as an archive and educational resource.

The following items are listed on the RNE:

- Customs Marine Centre (ID 11166)
- Hastings (ID 14699)
- Nutcote (ID 16484).

¹² ISEPP Clause 14. Accessed 12 May 2020. http://www7.austlii.edu.au/cgi-bin/viewdoc/au/legis/nsw/consol_reg/sepp2007541/s14.html.

2.7 Heritage registers search

A search of all relevant registers was undertaken on 9 February 2020. The results are displayed in Table 4 below. A map of the curtilages of the relevant heritage items is provided in Figure 5 and Figure 6.

Table 4: Heritage listed items within the construction footprint and the visual buffer zone

Item	Address	Significance	Listing	Distance from construction footprint
Kesterton Park	High Street	Local	North Sydney LEP 2013 no. I0858	Within
North Sydney Bus Shelters	High Street	Local	North Sydney LEP 2013 no. I0407	Within
Careening Cove Conservation Area	N/A	Local	North Sydney LEP 2013 no. CA10	Adjacent
Rockcliff Mansions	144 High Street	Local	North Sydney LEP 2013 no. I0853	Adjacent
Sydney Opera House (buffer zone)	2 Circular Quay east, Sydney (buffer zone extends to Argyle Street and Fitzroy Street)	World	WHL 166rev NHL ID 105738 SHR no. 01685 City of Sydney LEP 2012 no. I1712 RNE ID 2353 RNT	Visual buffer zone (350m south-east)
Customs Marine Centre	Ben Boyd Centre	Local	CHL ID 105249 North Sydney LEP 2013 no. I0576 RNE ID 101166	Visual buffer zone (320m north)
Hastings	2 Hayes Street	State	SHR no. 00567 North Sydney LEP 2013 no. I0628 RNE ID 14699	Visual buffer zone (280m north)
Nutcote	5 Wallaringa Avenue	State	SHR no. 00505 North Sydney LEP 2013 no. I0730 RNE ID 16484	Visual buffer zone (290m north-east)
Gasworks Remains, HMAS Platypus	1 Kiara Close and 118-138 High Street	Local	North Sydney LEP 2013 no. I0859	Visual buffer zone (100m north)
'House'	17 Elamang Avenue	Local	North Sydney LEP 2013 no. I0215	Visual buffer zone (200m south)
'House'	5 Elamang Avenue	Local	North Sydney LEP 2013 no. I0212	Visual buffer zone (240m south)
Site and remains of Port Jackson and Manly Steamship Company depot	Kurraba Road	Local	North Sydney LEP 2013 no. I0669	Visual buffer zone (360m east)

Item	Address	Significance	Listing	Distance from construction footprint
'Once Upon A Time'	115A Kurraba Point	Local	North Sydney LEP 2013 no. I0660	Visual buffer zone (315m north-east)
Site of former Spains Wharf	Spains Wharf Road	Local	North Sydney LEP 2013 no. I0705	Visual buffer zone (305m north-east)
'House'	7 Wallaringa Avenue	Local	North Sydney LEP 2013 no. I0731	Visual buffer zone (300m north-east)
'House'	9 Wallaringa Avenue	Local	North Sydney LEP 2013 no. I0732	Visual buffer zone (300m north-east)
Wallaringa Mansions	1 Wallaringa Avenue	Local	North Sydney LEP 2013 no. I0736	Visual buffer zone (300m north-east)
Neutral Bay Wharf	1-7 Hayes Street	Local	North Sydney LEP 2013 no. I0627	Visual buffer zone (280m north)
Anderson Park	N/A	Local	North Sydney LEP 2013 no. I0767	Visual buffer zone (500m north-west)



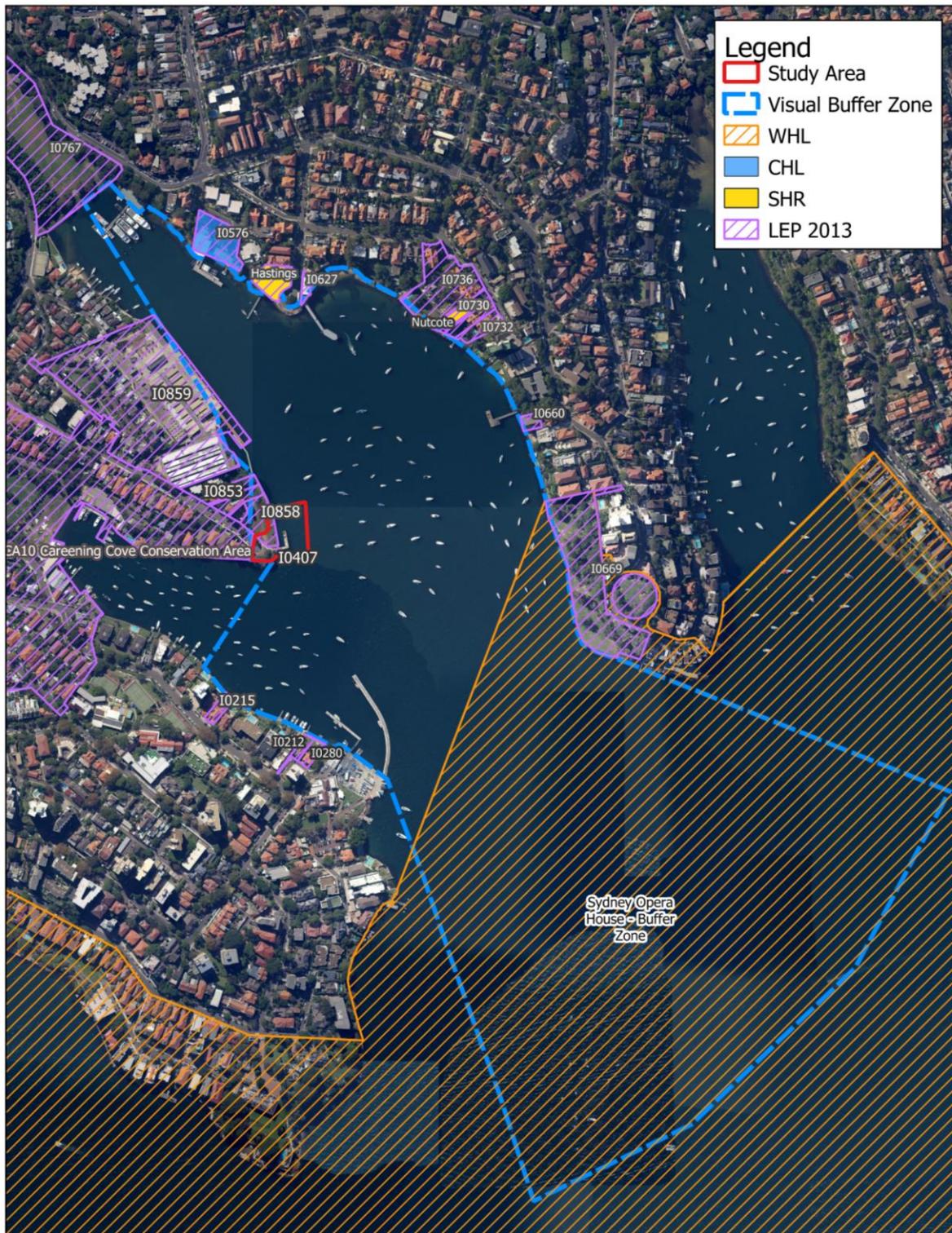
Source: C:\Users\SHawkins\Documents\20035 Seven Wharves\North Sydney Wharf\Artefact QGIS Template (with Heritage layers).qgz

Heritage items near construction footprint
20035 Seven Wharves Upgrade - North Sydney
 LGA: North Sydney

Scale: 1:800
 Size: A4
 Date: 17-07-2020

0 16 32 m

Figure 5: Heritage listings within and in close proximity to the construction footprint



Source: C:\Users\SHawkins\Documents\20035 Seven Wharves\North Sydney Wharf\Artefact QGIS Template (with Heritage layers).agx

Heritage visual buffer zone
 20035 Seven Wharves - North Sydney
 LGA: North Sydney

Scale: 1:8000
 Size: A4
 Date: 17-07-2020

0 160 320 m

Figure 6: Heritage items within the visual buffer zone

3.0 HISTORICAL BACKGROUND

3.1 Early European settlement in North Sydney

3.1.1 Early settlement in North Sydney

Shortly after settlement at Port Jackson exploration of Sydney's North Shore commenced, with early expeditions to Manly, through Middle Harbour, and to North Sydney. In the early 1820s James Milson, one of the colony's earliest free settlers, leased 120 acres from Robert Campbell, comprising the area of Milsons Point and Kirribilli.¹³ Here, Milson established a dairy, orchard, and vegetable gardens on the harbour foreshore, and operated a ballast-supply business for ships.¹⁴ In 1828 Sir Thomas Mitchell, while solving a dispute between Milson and Campbell, identified a suitable site for a township, recommending subdivision and the establishment of a major road to Broken Bay in the north, at the mouth of the Hawkesbury River.¹⁵ Mitchell's plan for the area was not enacted however, and due to the growing public demands to purchase land in the area it was resurveyed in 1836.¹⁶ The selected township site was established at the current location of the North Sydney CBD and included a traditional grid layout of ten major streets.¹⁷

In 1789 Neutral Bay had been established by Governor Phillip for foreign ships visiting Sydney. Careening Cove, located to the west of Neutral Bay was named so as it was a shallow cove used for careening, in which ships would be landed on the beach, allowing for the hull to be cleaned.¹⁸ The natural vegetation in the area included grass trees, grevilleas, banksia, Sydney blue gums and blackbutt trees.¹⁹ An intermittent creek ran into the bay and provided fresh water for the foreign ship crewmen.

3.1.1.1 Whaling allotments

Between the two bays several land allotments were established for workers within the whaling industry, which was established in 1791 and operated from North Sydney (Figure 7). Between the land parcels, Whaling Street was surveyed in 1830, leading along the peninsula where North Sydney Wharf is now located.²⁰ In the early nineteenth century the whaling industry employed thousands of men, with hundreds of colonial ships operating in the trade around Australia.²¹

Following the arrival of the First Fleet, approximately one third of convict transportation and store ships sent from Britain to Sydney prior to 1800 were repurposed whaling ships, many of which arrived in the colony and commenced whaling from Sydney.²² The industry was prominent across much of the Southern Hemisphere, with earlier ports in Peru frequently used by the British. Following the outbreak of the British War with Spain in 1797, Sydney became an increasingly popular whaling base.

¹³ Leonie Masson, "North Sydney," *The Dictionary of Sydney*, 2010, https://dictionaryofsydney.org/entry/north_sydney.

¹⁴ Isadore Brodsky, *North Sydney, 1788-1962*, 13 (North Sydney (N.S.W): Municipal Council of North Sydney, 1963).

¹⁵ Brodsky, 15.

¹⁶ Lucas, Stapleton, Johnson & Partners, "Platypus Renewal Project Public Domain and Access Improvements and Refurbishment of Selected Buildings Heritage Impact Statement," 9. Heritage Impact Statement, 2017, https://www.harbourtrust.gov.au/media/1759/sbp_heritage-impact-assessment.pdf.

¹⁷ Masson, "North Sydney."

¹⁸ Lucas, Stapleton, Johnson & Partners, "Platypus Renewal Project Heritage Impact Statement." 9.

¹⁹ Leonie Masson and Ian Hoskins, "Neutral Bay," *The Dictionary of Sydney*, 2008, https://dictionaryofsydney.org/entry/neutral_bay.

²⁰ North Sydney Council, "High Street," Naming North Sydney, n.d., <http://www.photosau.com.au/StantonStreets/scripts/home.asp>.

²¹ Mark Howard, "Sydney's Whaling Fleet," 2011, *The Dictionary of Sydney*, accessed January 4, 2020, https://dictionaryofsydney.org/entry/sydneys_whaling_fleet/.

²² Howard.

The new maritime industry was heavily encouraged by Governor Phillip, who had begun his maritime career on a whaling ship and saw the immediate financial benefit to the new colony.²³

The area that the current construction footprint is in was originally granted to Kemmis and Brown in 1830 as part of the whaling allotments. Additional whaling allotments were granted in the nearby suburb of Mosman (named after the prominent whaler Archibald Mosman) and throughout the lower North Shore.²⁴ A whaling station was established at Mosman Bay in 1832, east of the current construction footprint.²⁵ However, there is no evidence that a whaling station or other infrastructure was located at North Sydney.

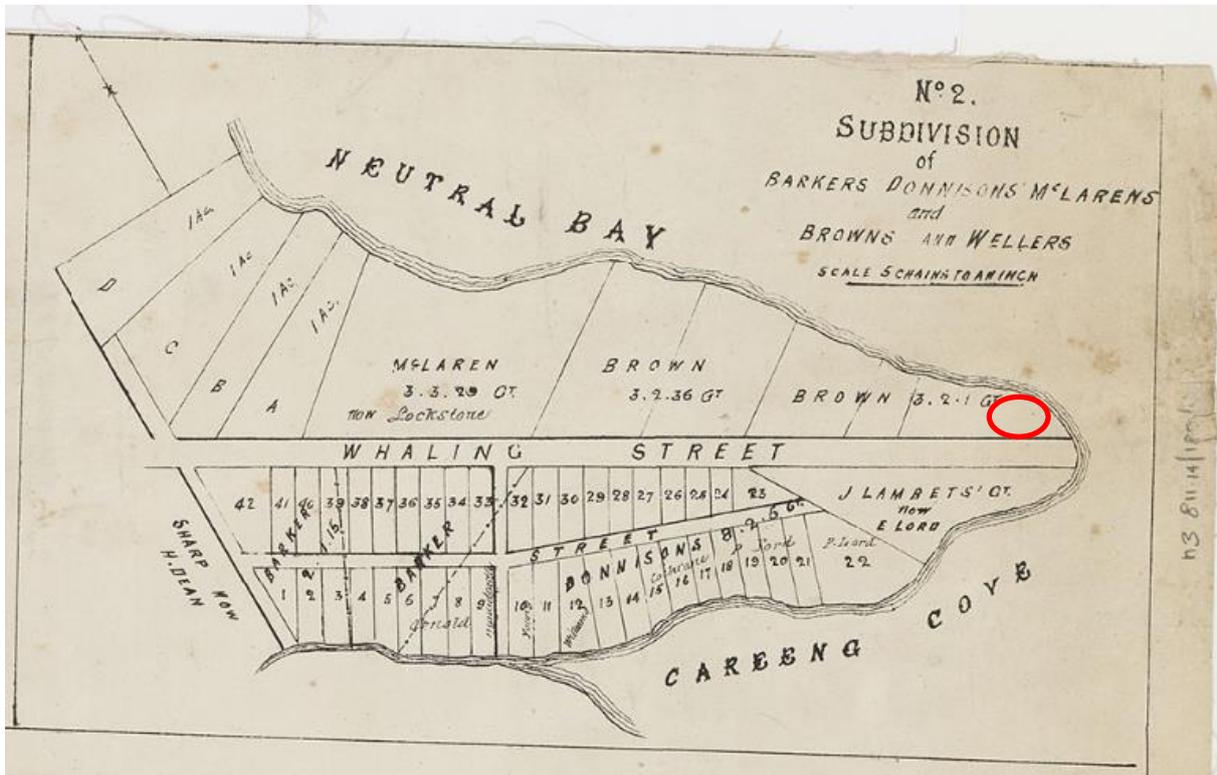


Figure 7: Subdivision plans of the North Shore, Sydney, dated c.1958, with the indicative location of the construction footprint marked in red. Source: State Library of New South Wales²⁶

3.1.1.2 Early land grants and industry

By the 1840s the whaling industry was suffering as a result of overfishing. The average quantities of oil dropped, subsequently seeing decreases in profit and wages for crews. Experienced sailors deserted the industry for work elsewhere and several ship owners pulled their vessels from the trade.²⁷ From the 1820s James Milson had determined that the North Shore of Sydney Harbour was suitable for ballast quarrying, which commenced in the area of the construction footprint from the 1840s onwards. The whaling allotments on the Careening Cove-Neutral Bay Peninsula were subdivided into forty-two lots in July of 1841.²⁸ The subdivision was advertised as having 'Building

²³ Howard.

²⁴ John Newton, *A Savage History: Whaling in the Pacific and Southern Oceans* (Sydney, N.S.W: New South Publishing, 2013).

²⁵ Gavin Souter, *Mosman: A History* (Melbourne: Brio Books, 2012).

²⁶ *Subdivision Plans of the North Shore, Sydney, Approximately 1859, 1859, 1859*, IE3764469 FL3764478, State Library of New South Wales,

http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?embedded=true&toolbar=false&dps_pid=IE3764469&_ga=2.255715272.1906594067.1585549174-706910494.1581896604.

²⁷ Howard, "Sydney's Whaling Fleet."

²⁸ Lucas, Stapleton, Johnson & Partners, "Platypus Renewal Project Heritage Impact Statement," 9.

Allotments and Harbour Shipping Frontages'. High Street (formerly Whaling Street) was formalised as a private lane after failing to be established as a main government road to the peninsula point.²⁹ Plans from the mid-nineteenth century show the proposed road as a wide lane to the point, and was realistically likely a wide dirt track. However, High Street appears on plans from the late-nineteenth century as a private lane between industrial and residential properties, however still served as the main thoroughfare for the peninsula.³⁰ Within Careening Cove the ship repair industry continued throughout the mid and late nineteenth century.

In c.1870 the Kemmis and Brown allotment was purchased by Patrick Hayes, which he quarried for building stone (Figure 8).³¹ By 1880 Hayes had established the Oaks Steam Brick Company on Military Road, located directly north of the construction footprint, adjacent to the extant Oaks Hotel.³² Records of Hayes' land use are limited. It is evident that the land grant was quarried for building materials, although whether Hayes also lived on the land is uncertain. It is likely that stores, or cottages of stone or timber at the least would have been on the site for workers during the day, such as those located at quarries in Pyrmont (Figure 9). The illustration shows that these structures could be quite sizeable and featured furnaces or fireplaces, determined by the presence of a chimney.

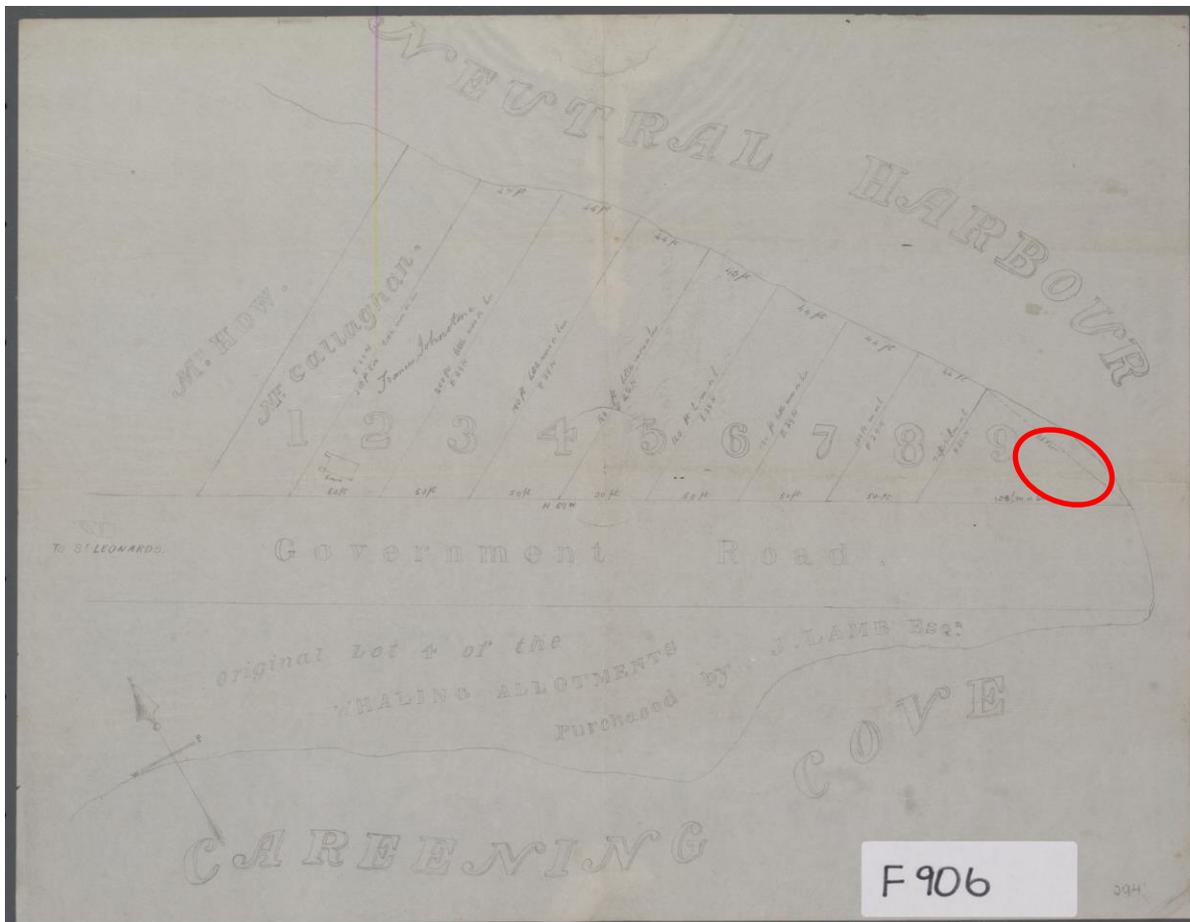


Figure 8: Careening Cove land grants, with the indicative location of the construction footprint marked in red. Source: State Library of NSW

²⁹ North Sydney Council, "High Street".

³⁰ Lucas, Stapleton, Johnson & Partners, "Platypus Renewal Project Heritage Impact Statement", 9.

³¹ NSW Department of Planning, Industry and Environment, "Kesterton Park", Heritage NSW, 2020, <https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2181174>.

³² North Sydney Council, "Far Enough Away: A Walking Tour of Neutral Bay", North Sydney History Walk, n.d., <https://www.northsydney.nsw.gov.au/Home>.

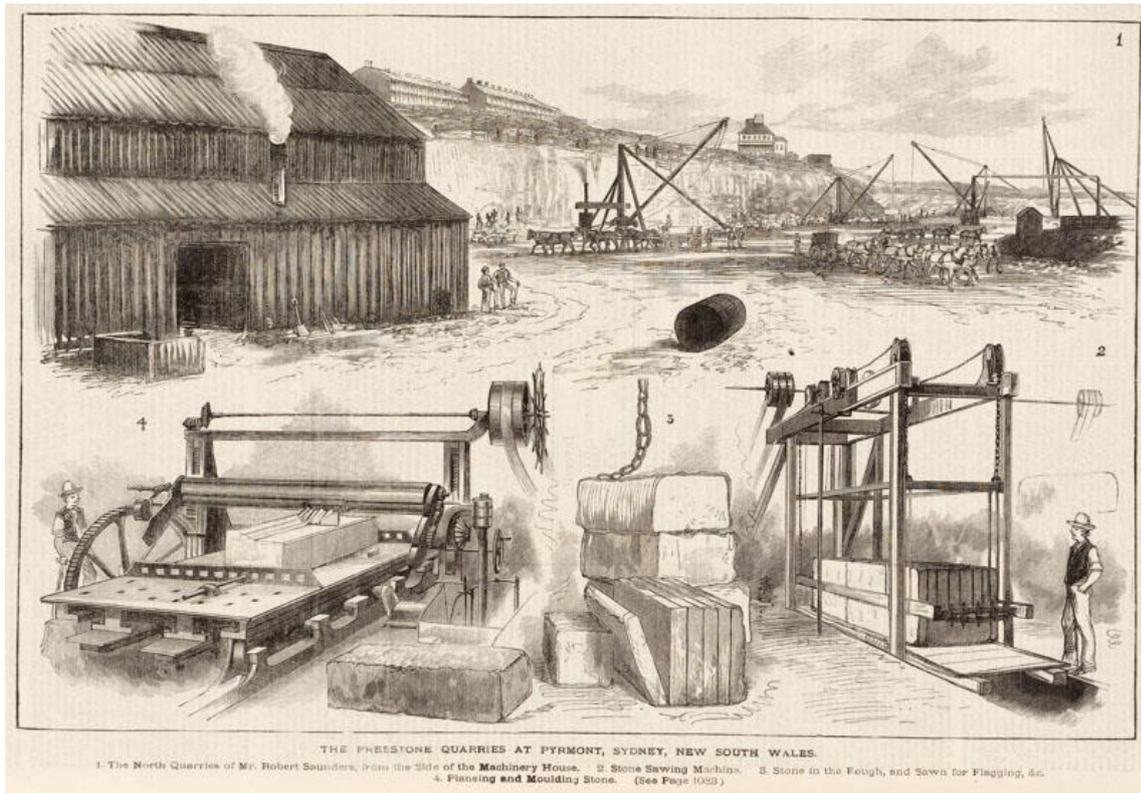


Figure 9: Prestons 'Paradise' Quarry at Pyrmont with example of store building, c.1883.
Source: Pyrmont History³³

3.2 North Sydney in the twentieth century

3.2.1 North Shore Gas Works

In 1877 the North Shore Gas Company was established to the north-west of the construction footprint on High Street. The company was established by J.W. Fell and Charles Watt, who undertook a land reclamation program into Neutral Bay for the extension of the gas works.³⁴ Figure 11 shows the area north of the construction footprint prior to land reclamation, with a steep vertical drop and rocky mudflat foreshore. Land reclamation in the 1880s saw several metres of land fill added to the site, creating a straight edge along the foreshore (Figure 12). The reclamation and formalisation of the foreshore appears to have been initially limited to the north-east side of the peninsula, as Sydney Water Board plans from 1891 depict the south-west side of the peninsula as being very rough and non-linear (Figure 10). The area became heavily developed, with several gas retort houses, in which coal was heated to generate gas, being constructed on the water's edge. In the 1890s the growth of the company slowed as a result of the economic depression, although in the early twentieth century additional buildings, including a third retort house, were constructed. A tramway system was installed throughout the gas works for transportation of coal.³⁵

In 1924 gas production ceased and many of the buildings were repurposed and reduced in size, and during the great depression the site closed. Figure 13 shows the gasworks during the mid-1920s as an extensive industrial site with impressive structures and a large wharf along much of the foreshore.

³³ Australian Town and Country Journal, *The Freestone Quarries at Pyrmont, Sydney, New South Wales*, March 12, 1883, Sketch, March 12, 1883, Trove, National Library of Australia, <https://trove.nla.gov.au/newspaper/article/71006264?searchTerm=%22freestone%20quarries%22%20pyrmont#>.

³⁴ Lucas, Stapleton, Johnson & Partners, "Platypus Renewal Project Heritage Impact Statement." 9.

³⁵ Lucas, Stapleton, Johnson & Partners, 9.

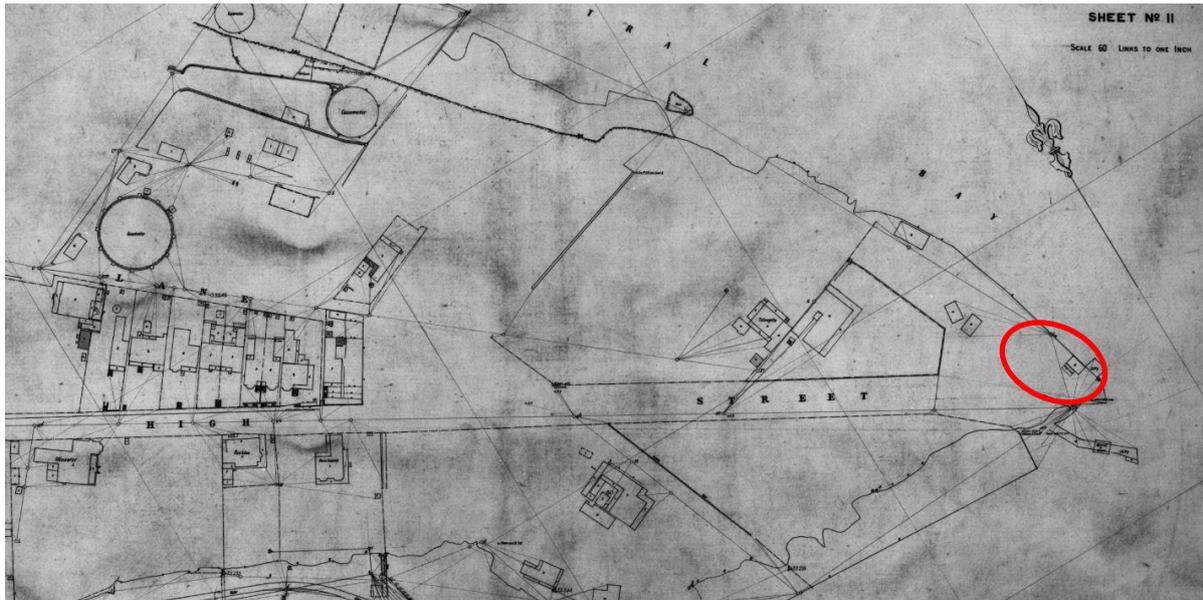


Figure 10: Metropolitan Water Sewerage and Drainage Board Detail Series, North Sydney Sheet No. 11, published 1891 and revised 1892, showing the North Shore Gas Company and the difference straightened north-east end of the peninsula. The indicative location of the construction footprint is marked in red. Source: Sydney Water Archives³⁶



Figure 11: North Shore Gas Works at Neutral Bay, 1882. Likely prior to land reclamation. Source: Willoughby Council Library³⁷

³⁶ Metropolitan Water Sewerage and Drainage Board Detail Series, North Sydney Sheet No. 11, 1881 (revised 1882), PWDS1544-S882, Sydney Water Archives.

³⁷ North Shore Gas Company, Neutral Bay, 1882, 1882, Photographic image, 1882, Willoughby Library, <https://willoughbytest.spydus.com/cgi-bin/spydus.exe/FULL/WPAC/ARCENQ/4004668/6810319,1?FMT=IMG>.

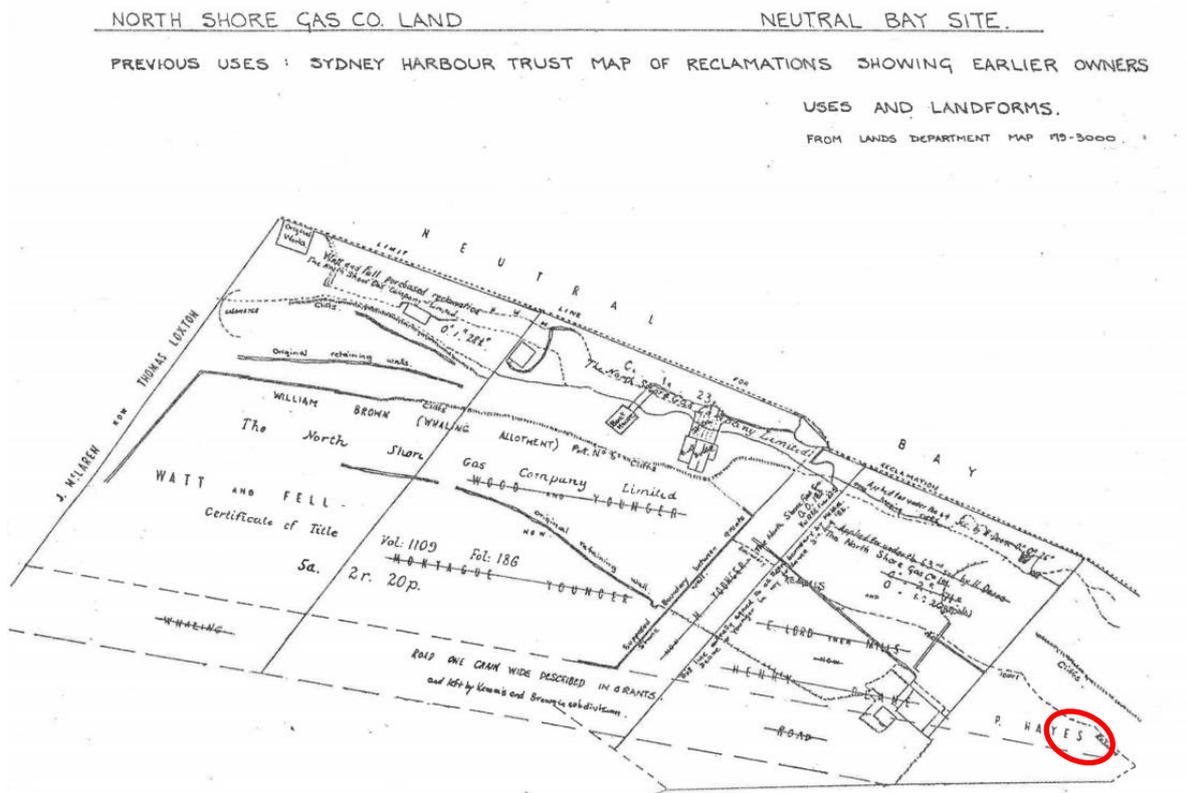


Figure 12: Plan of the North Shore Gas Co. and reclamation, c.1880s-90s, with the indicative location of the construction footprint marked in red. Source: Lands Department Map 179-3000



Figure 13: North Shore Gasworks at Neutral Bay, 1927. Source: Willoughby Library³⁸

³⁸ North Shore Gas Company, Neutral Bay, 1927, 1927, Photographic image, 1927, Negative no: N59, Willoughby Library, <https://willoughbytest.spydus.com/cgi-bin/spydus.exe/FULL/WPAC/ARCENQ/4004673/6810969,1>.



Figure 14: Demolition of the North Sydney Gasworks, 1941. Source: Australian War Memorial³⁹

3.2.2 Royal Australian Navy Torpedo Factory

In 1941 the existing Gasworks buildings were demolished (Figure 14) for the construction of the Royal Australian Navy (RAN) Torpedo Factory, which manufactured torpedoes for World War II. Following the bombing of Pearl Harbour, the Australian Government determined that Australia should manufacture its own torpedoes.⁴⁰ Initially, many of the Gasworks buildings were intended to be repurposed, however they were unsuitable for the new site use and were demolished. A purpose-built factory was constructed and completed in February 1943 (Figure 15).⁴¹ Aerial imagery taken of the site during this time shows the large warehouse and shows the area which now comprises of Kesterton Park as a laydown site (Figure 16).

Following the end of the war in 1945 the factory production decreased drastically, and the focus switched from producing new torpedoes to maintenance. The factory was renamed the Royal Australian Navy Torpedo Establishment in 1958.⁴²

³⁹ North Sydney, NSW. 1941. *The Demolition of the North Sydney Gasworks Factory to Make the Land Available for the Construction of the RAN Torpedo Facility.*, 1941, Photographic image, 1941, Naval Historical Collection, Australian War Memorial, <https://www.awm.gov.au/collection/C259636>.

⁴⁰ Lucas, Stapleton, Johnson & Partners, "Platypus Renewal Project Heritage Impact Statement." 9-10.

⁴¹ Lucas, Stapleton, Johnson & Partners.

⁴² Lucas, Stapleton, Johnson & Partners.

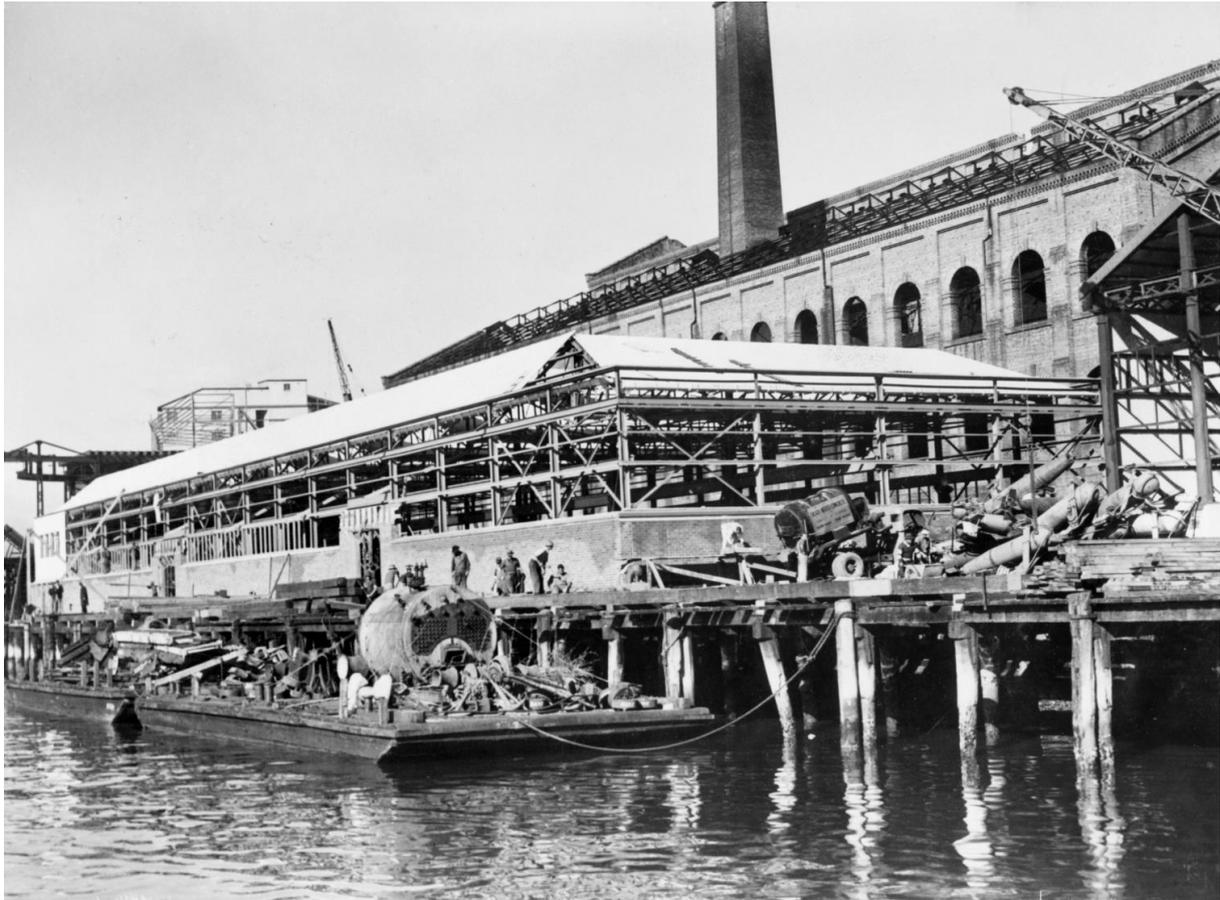


Figure 15: Construction of the RAN Torpedo Facility. Source: Australian War Memorial⁴³

3.2.3 HMAS Platypus

In 1964 it was announced by the Minister for the Navy that the RAN Torpedo Establishment was to be converted into a support base for six Oberon-class submarines. The Neutral Bay site was an appropriate base on account of the existing facilities, wharf, and the storage of the remaining RAN Torpedos.⁴⁴ Furthermore, Neutral Bay was familiar to submarine fleets which had been stationed at nearby Balmoral (HMAS Penguin).⁴⁵ The construction of the base was met with some resistance from residents who believed that the base would become a target in any future attacks, and that the submarine noise had resulted in property damage.⁴⁶ A large administration building was constructed in 1965 and the base operated until 1999, when HMAS Platypus was decommissioned.⁴⁷

⁴³ North Sydney, NSW. C.1942. *Exterior of a Building of the RAN Torpedo Factory under Construction, Seen from the Harbour*, 1942, Photographic image, 1942, Naval Historical Collection, Australian War Memorial, <https://www.awm.gov.au/collection/C259009>.

⁴⁴ Peter R. Smith, "HMAS Platypus - a Submarine Naval Base," Naval Historical Society of Australia, September 2017, <https://www.navyhistory.org.au/hmas-platypus-a-submarine-naval-base/>.

⁴⁵ Smith.

⁴⁶ Smith.

⁴⁷ Smith.

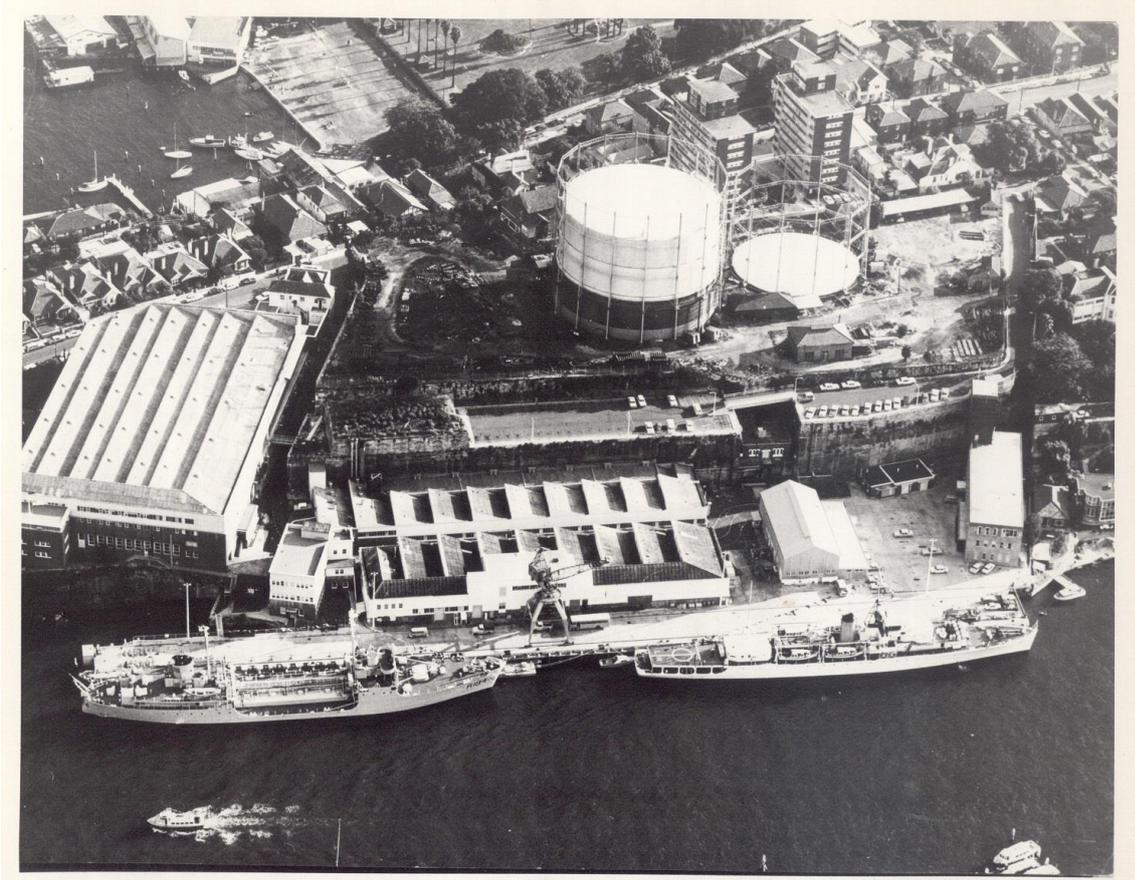


Figure 16: HMAS Platypus Base, 1970s. Source: Commercial Real Estate⁴⁸

3.2.4 Residential subdivision and development

Early subdivision of North Sydney had begun in 1843 with the sale of Crown Lands, especially north of St Leonards, however much of the land around the harbour foreshore remained used for industry and maritime purposes. By 1869 the Borough of St Leonards had been formed and provided utilities to the township, including gas, town water and sewerage, government roads, and garbage collection.⁴⁹ The residential development of the area was increased by the transportation connections of the harbour ferries, a cable tramway, and the North Shore train line. The population was largely professional workers and skilled tradespeople and several schools opened in the area in the early twentieth century.⁵⁰ Several houses were constructed along High Street during residential subdivision at this time (Figure 17).

North Sydney and the suburbs of Kirribilli, Milsons Point and Neutral Bay changed in the early twentieth century following the construction of the Sydney Harbour Bridge. The construction of the Bradfield Highway resulted in the alteration of several roads and the relocation of several public buildings, including the town hall. Entire streets were resumed and demolished.⁵¹ Near the construction footprint, residential development began to occur around Careening Cove and the

⁴⁸ *Ships at the HMAS Platypus Base, 1970s*, Photographic image, 1970s, <https://www.commercialrealestate.com.au/news/historic-former-submarine-base-in-north-sydney-to-be-opened-up-for-commercial-activity-44755/>.

⁴⁹ Masson, "North Sydney."

⁵⁰ Masson.

⁵¹ NSW Department of Planning, Industry and Environment, "Sydney Harbour Bridge, Approaches and Viaducts (Road and Rail)," Heritage NSW, 2020, <https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5045703>.

Rockcliff Mansion apartment building on High Street was constructed in the 1920s. The Art Deco style was prominent within the 1930s rebuilding schemes throughout the North Shore. Municipal council schemes for improvement of the town saw the development of public transportation and road improvements. As industrial sites closed, residential subdivision occurred along much of the foreshore, with Neutral Bay, Mosman, Kirribilli and Lavender Bay seeing a boom in residential Federation and Inter-War development.⁵² Areas of reclaimed industrial land were also converted into harbour-front public parks, such as Anderson Park at Neutral Bay and Milson Park at Careening Cove. Kesterton Park was gazetted and created following the closure of the RAN Torpedo Base, providing a harbourfront park adjacent to the High Street ferry wharf, which was originally established in c.1888. The park was named in honour of Alderman William Kesterton, who was Mayor of North Sydney between 1945-1949. The opening of the Harbour Bridge and the train line from the city saw an increase in population, however this declined following World War II.⁵³

Post-war development saw a large commercial centre develop in North Sydney, with a building boom and cheap rents encouraging several companies of various size relocating to North Sydney. This continued throughout the late 1900s and early 2000s, as the area grew into a twin city to the Sydney CBD with a bustling commercial district.⁵⁴ Today the Kirribilli and Neutral Bay area of North Sydney retains a Federation residential appearance and suburban character, with charming tree-lined streets and cafes present throughout the suburbs. The coves which were previously used for ship are now home to large numbers of moored recreational boats.

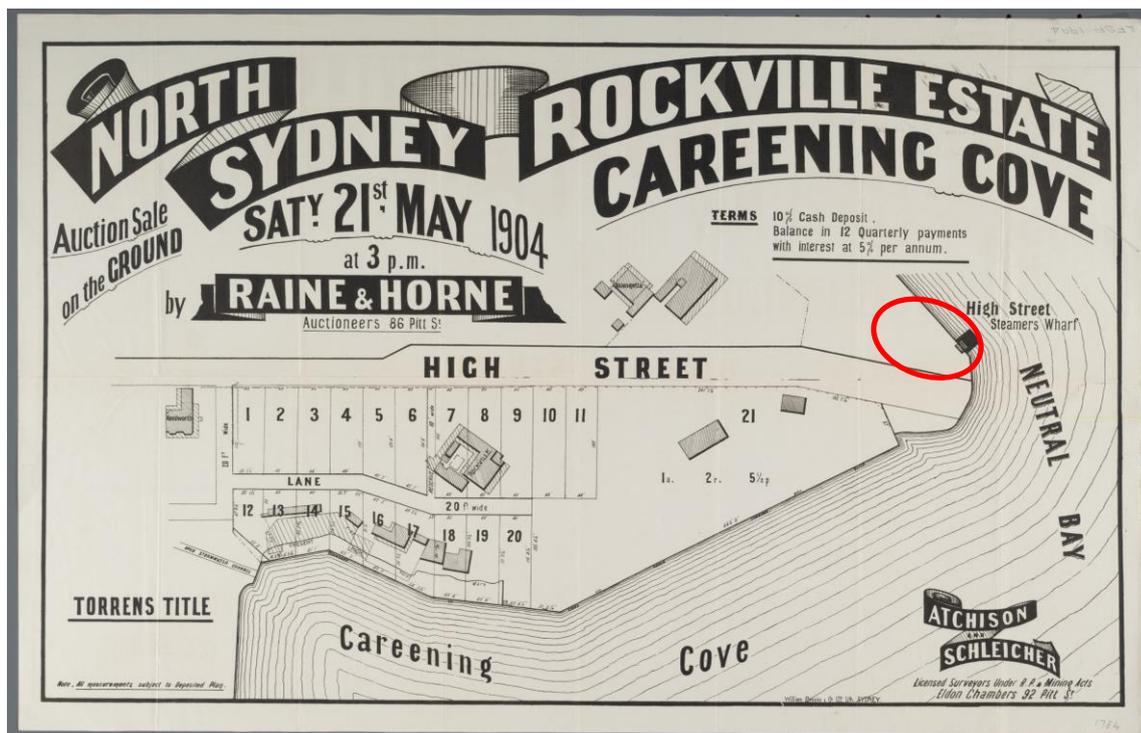


Figure 17: The Rockville Estate subdivision plan showing the High Street Steamers Wharf, 1904, with the indicative location of the construction footprint marked in red. Source: National Library of Australia⁵⁵

⁵² Masson, "North Sydney."

⁵³ Masson.

⁵⁴ Masson.

⁵⁵ Raine & Horne, *North Sydney, Rockville Estate, Careening Cove / Auction Sale on the Ground, Saty 21st May 1904 at 3 p.m. by Raine & Horne, Auctioneers 86 Pitt St, 1904*, Subdivision plan, 1904, National Library of Australia, <https://nla.gov.au/nla.obj-230392470/view>.

3.3 The North Shore ferries

3.3.1 Sydney ferries

Sydney Harbour has been a crucial part of Sydney's lifestyle, transportation and industry for much of its European history. Prior to European colonisation, the Eora people of various groups around Sydney Harbour and the Parramatta River utilised the harbour for transportation and food supply. From the arrival of the First Fleet at Port Jackson/Sydney Cove (now Circular Quay) in 1788, European exploration occurred via ships through the harbour, which was a major influence in location of new settlements. As early as 1789 the convict built ship the *Rose Hill Packet* provided a ferry service along the Parramatta River between the major settlements at Sydney Cove and Parramatta (Rose Hill at the time).⁵⁶ As early as the 1820s both the North and South Heads of the harbour were recognised as important military locations, with the original Macquarie Lighthouse and associated barracks established at South Head by 1818. Early industry was concentrated around the harbour and dominated by maritime trades. The need for workers to be in close proximity to the harbour led to the development of major historic suburbs near dockyards at Millers Point, Pyrmont and Balmain. It is estimated that until the 1880s, approximately 80% of Sydney's population lived within walking distance of the harbour.⁵⁷

In 1861 the North Shore Ferry Company was established and operated the first commuter-style ferry across the harbour.⁵⁸ At the time there were less than 1000 people living in the North Sydney area, however ferry was the only available transportation method at the time. As the Sydney Harbour Bridge had not been constructed, rail or vehicular transportation was not available. The establishment of the ferry service contributed to the growth of the North Shore suburbs including Manly, which grew from a population of 500 in 1871 to 8000 by 1901.⁵⁹ Early ferries on the harbour were purpose built steam paddlers (Figure 18), many of which were constructed at Morts Dock in Balmain in the early twentieth century.⁶⁰

The popularity of the route and the growth of the North Shore region resulted in several competitors starting business, including Sydney Ferries Limited and the Port Jackson and Manly Steamship Company. The busiest route was Circular Quay to Milsons Point, where at either end passengers could change onto trams or trains.⁶¹

Following the construction of the Sydney Harbour Bridge, which opened in 1932, ferry patronage dropped significantly (Figure 19). The bridge and the train network allowed faster travel and prevented the need for multiple modes of transport. Ferry services were overall halved.⁶² Vehicular ferries had also been common throughout the early twentieth century, however these services were entirely eradicated following the opening of the harbour Bridge.⁶³ In the late nineteenth and early twentieth centuries ferries had been constructed locally, however as the costs of local construction increased and were no longer financially viable, subsequent ferries were constructed in Scotland.⁶⁴

Following financial hardship among private ferry operators in the mid twentieth century, many of the ferry services were acquired by the State Government in 1951. In the 1980s several new ferries were

⁵⁶ Gary Wotherspoon, "Ferries," The Dictionary of Sydney, 2008, <https://dictionaryofsydney.org/entry/ferries>.

⁵⁷ Grace Karskens, "Harbour Life: Tracing Early Sydney's Watery History," The Conversation, 2014, <http://theconversation.com/harbour-life-tracing-early-sydneys-watery-history-21892>.

⁵⁸ Wotherspoon, "Ferries."

⁵⁹ Wotherspoon.

⁶⁰ "The Manly Ferry," Australian National Maritime Museum, 2018, <http://arhv.anmm.gov.au/en/collections/details/34289/the-manly-ferry>.

⁶¹ Wotherspoon, "Ferries."

⁶² Wotherspoon.

⁶³ Wotherspoon.

⁶⁴ "The Manly Ferry."

constructed at Newcastle, reopening the local shipbuilding industry. The 1980s ferries – many of which remain a frequent sight on the Harbour – included the Freshwater, Narrabeen, Queenscliff and Collaroy, double storey designs which reflected the design of the ‘golden era’ ferries.

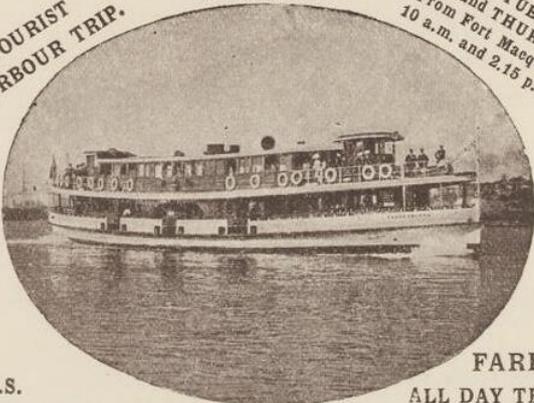
SYDNEY FERRIES (LIMITED).

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[See also page 42.]

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From Fort Macquarie
10 a.m. and 2.15 p.m.

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Unequaled
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Figure 18: Sydney Ferries advertisement, c.1890s. Source: National Library of Australia⁶⁵

⁶⁵ The Bureau, "Sydney Ferries (Limited) Regular Service of High-Class Steamers from Nos. 1, 4, 5 & 6 Jetties," *Trips around Sydney, New South Wales*, 1909, National Library of Australia.



Figure 19: Ferry on Sydney Harbour during construction of the Sydney Harbour Bridge, 1928.
Source: City of Sydney Archives⁶⁶

3.3.2 North Sydney Wharf

In 1880 the primary wharf for Neutral Bay appeared to be to the north-east of the construction footprint, located on the western shore of Neutral Bay (Figure 20). By 1888 however a small wharf had been established at the end of High Street and was illustrated on subdivision plans, located about 10m to the south-west of the present-day wharf (Figure 21). The ferry route travelled between Circular Quay, High Street, Neutral Bay wharf at Hayes Street and two additional wharves at Kurraba Point.

⁶⁶ Graeme Andrews, *Ferry KURAMIA and the Bridge That Finished Her Career*, 1928, Photographic image, 1928, Graeme Andrews Working Harbour Photograph Collection, City of Sydney Archives, <https://archives.cityofsydney.nsw.gov.au/nodes/view/713840?keywords=graeme%20andrews%20working%20harbour%20collection&all=1&whole=1>.

Following the closure of the Oaks Steam Brickmaking Company in 1891, much of the area around High Street was converted into an industrial area for the North Sydney Gasworks (Figure 10). Sydney Water Board plans from this time depict the wharf at the end of High Street as a long jetty which extended out from south-west end of the peninsula (Figure 22), that had yet to be formalised, with a rectangular waiting room located about half way along the jetty (Figure 23 to Figure 25). The Water Board plans also show that a second wharf had been constructed along the formalised edge of the peninsula in the location of the present-day wharf. In contrast to the long wharf to the south, the second wharf was depicted as being shorter and slightly wider, and not extending a great distance out from the peninsula. Located adjacent to the wharf were two structures, one of which is identified as a possible weigh bridge. The presence of the adjacent weigh bridge suggests that the second wharf may have been for transporting goods rather than for public transportation. Two other rectangular structures were also shown to be located to the north-west. Photographs of the long wharf indicate that the foreshore along the south-west side of the peninsula was not reclaimed and formalised until after 1918 (Figure 25).

Photographs from the 1930s looking towards the wharf show that the adjacent area was densely built up and heavily industrialised, with several vehicular and passenger ferries docked at the Gas Works (Figure 26). By 1943, when extensive aerial photographs were taken of much of the greater Sydney region (Figure 27), the earlier long wharf had had been demolished and the south-west side of the peninsula had been formalised with the construction of the seawall. It is likely that the former wharf was demolished at the same time that the seawall was constructed. Immediately north, the area which now forms Kesterton Park appears to have been utilised as a stockpiling facility or laydown area for the adjacent RAN Torpedo Factory.

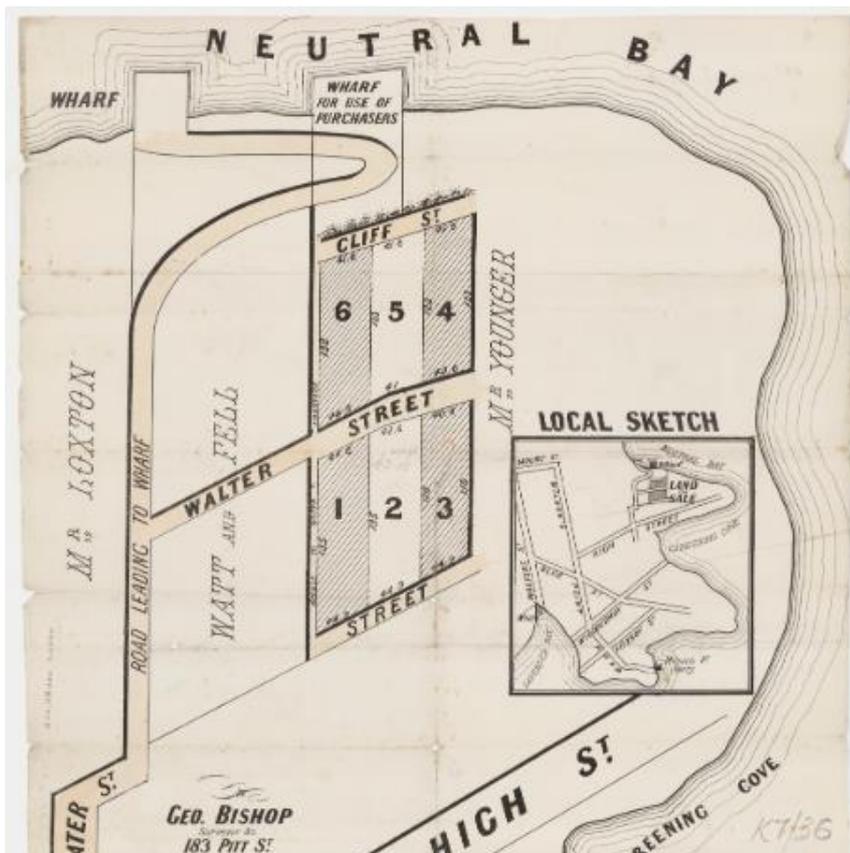


Figure 20: First Neutral Bay wharf in 1880 subdivision plan. Source: State Library of NSW⁶⁷

⁶⁷ [Plan Kirribilli Area] - Cliff St, Walter St, High St [1880]., 1880, Subdivision plan, 1880, State Library of New South Wales, http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?dps_pid=IE9012476&change_ing=

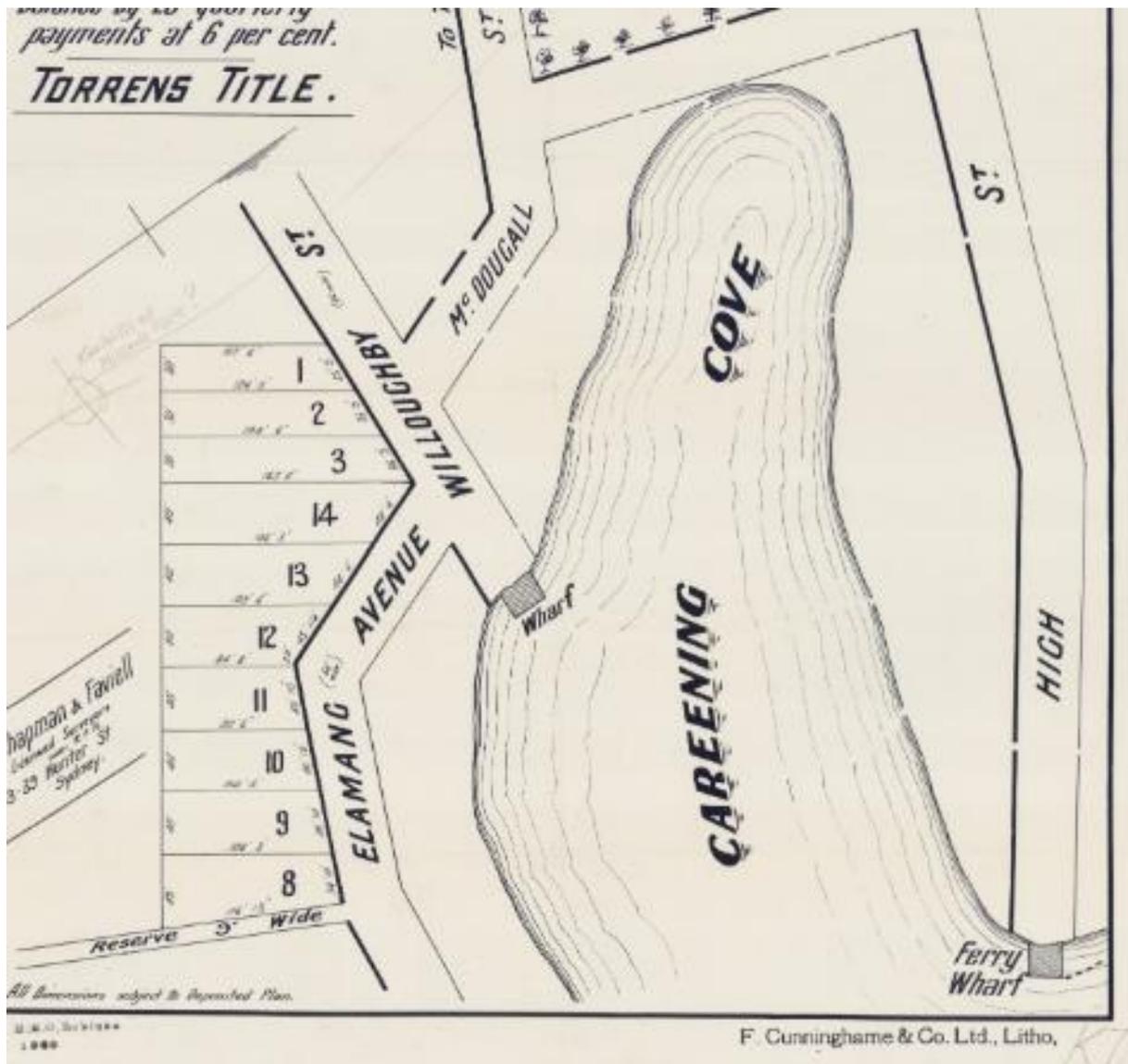


Figure 21: Careening Cove subdivision plan showing North Sydney wharf at the end of High Street, 1888. Source: State Library of NSW⁶⁸

⁶⁸ Careening Cove, North Sydney, - High St, Elamang Ave, Willoughby St, McDougall St, 1919, 1888, Subdivision plan, 1888, IE9000527 FL9000533, State Library of New South Wales, http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?dps_pid=IE9000527&change_lng=.

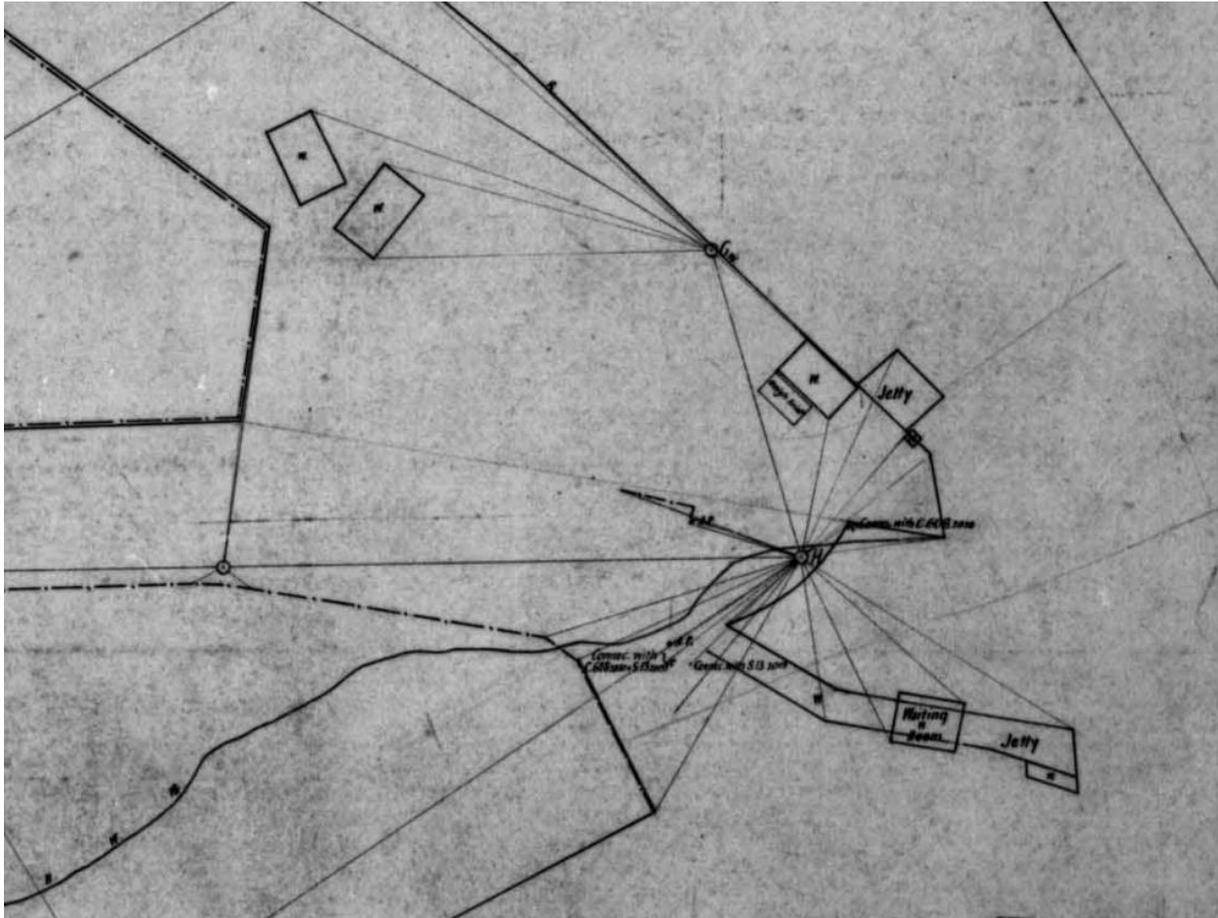


Figure 22: Detail of the Metropolitan Water Sewerage and Drainage Board Detail Series, North Sydney Sheet No. 11, 1891/1892, showing the two wharves and associated structures at the end of High Street. Source: Sydney Water Archives⁶⁹

⁶⁹ Metropolitan Water Sewerage and Drainage Board Detail Series, North Sydney Sheet No. 11, 1881 (revised 1882), PWDS1544-S882, Sydney Water Archives.



Figure 23: High Street Wharf viewed from the west side of Careening Cove, c.1880s. Source: Stanton Library⁷⁰

⁷⁰ C. Bayliss, *View across Careening Cove to Neutral Bay*, c.1880s, Photographic image, c.1880s, Stanton Library, <https://www.aurorashore.com.au/montage/stanton/Gallery.aspx?keyword=high+street+wharf&method=0&sort=1003&showall=true&fname=&bibid=R0000743099&>.

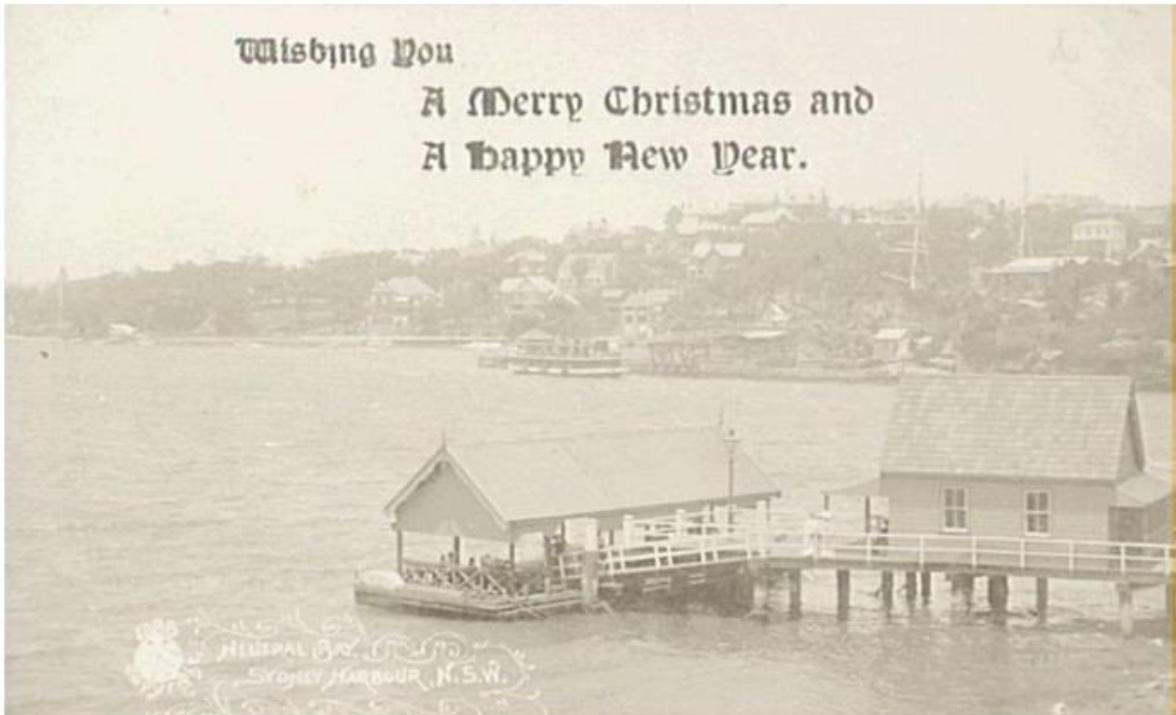


Figure 24: Neutral Bay Wharf with High Street Wharf in background, c.1905. Source: Stanton Library⁷¹



Figure 25: High Street Wharf and High Street, c.1918. Source: Stanton Library⁷²

⁷¹ Neutral Bay, Sydney Harbour, N.S.W., 1905, Postcard, 88 x 140 mm, 1905, Stanton Library, <https://www.aurorashore.com.au/montage/stanton/Gallery.aspx?keyword=high+street+wharf&method=0&sort=1003&showall=true&fname=&bibid=R0000746566&>.

⁷² Sir Samuel Walder, *Jack's Day Fete in the Royal Sydney Yacht Squadron Grounds, Looking towards High Street Wharf*, Taken from "The Walder", 19 Holbrook Avenue, Kirribilli, October 26, 1918, Photographic image, October 26, 1918, Stanton Library,



Figure 26: Ferry approaching North Sydney Wharf with ferries docked at Gas Works, 1930s.
Source: State Library of NSW⁷³

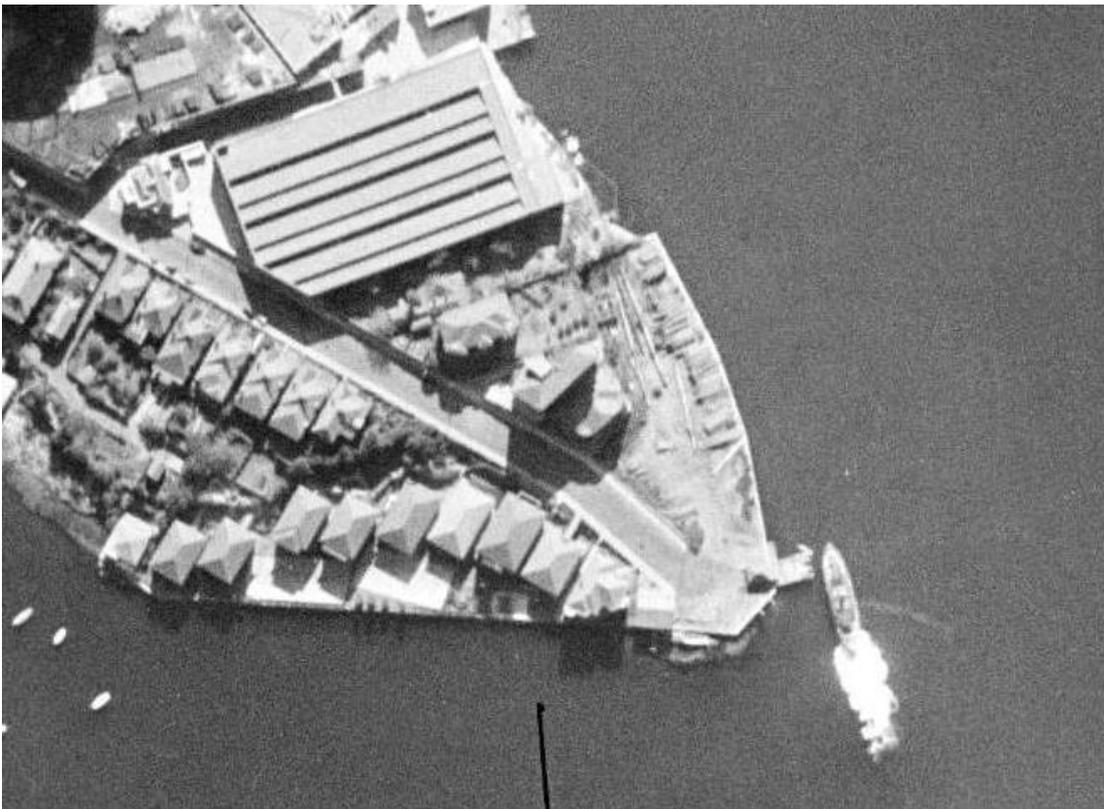


Figure 27: Aerial imagery showing 2nd North Sydney wharf and RAN Torpedo facility, 1943.
Source: NSW Historical Imagery, Department of Finance, Services and Innovation

<https://www.aurorashore.com.au/montage/stanton/Gallery.aspx?keyword=high+street+wharf&method=0&sort=1003&showall=true&fname=&bibid=R0000749064&>

⁷³ North Sydney Ferry Wharf Showing Passenger and Vehicular Ferries, 1930s, Photographic image, 1930s, IE1289503, State Library of New South Wales,

http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?embedded=true&toolbar=false&dps_pid=IE1289503&_ga=2.188621800.1906594067.1585549174-706910494.1581896604.

Aerial imagery from 1950 indicates that the stockpiling facility had been removed by that time and the land was cleared (Figure 28). A small extension of the remaining wharf abutting the seawall is evident, potentially reflecting a smaller jetty landing. However, this feature had been removed by 1960. Within Kesterton Park several small built structures and a circular feature are evident, potentially reflecting picnic shelters. By the 1970s several plantings were present in Kesterton Park (Figure 29).

By 1986 the former wharf had demolished and replaced with the extant L-shaped structure, featuring a gangplank out from the seawall and a right-angled turn to the north (Figure 30). The wharf is a timber and precast concrete construction, situated on piling and with the northern alignment comprised of three small flights of steps.



Figure 28: Aerial imagery showing 2nd North Sydney Wharf and remediation of Kesterton Park, 1951. Source: NSW Government Historical Imagery, Department of Finance, Services and Innovation⁷⁴

⁷⁴ Department of Finance, Services & Innovation, *Historic Aerial Photos: Sydney*, January 5, 1951, Aerial image, January 5, 1951.



Figure 29: Aerial imagery of 2nd North Sydney wharf showing establishment of recreational grounds at Kesterton Park, 1978. Source: NSW Government Historical Imagery, Department of Finance, Services and Innovation⁷⁵



Figure 30: Aerial imagery of 3rd (extant) North Sydney Wharf, 1980. Source: NSW Historical Imagery, Department of Finance, Services and Innovation⁷⁶

⁷⁵ *Historic Aerial Photos: Sydney*, June 5, 1978, Aerial image, June 5, 1978, Department of Finance, Services & Innovation, https://portal.spatial.nsw.gov.au/download/historic/2713/2713_15_052.jp2.jpeg.

⁷⁶ Department of Finance, Services & Innovation, *Historic Aerial Photos: Sydney*, March 8, 1986, Aerial image, March 8, 1986.

4.0 SITE INSPECTION

4.1 Introduction

A site inspection was conducted on 12 March 2020 by Jayden van Beek (Senior Heritage Consultant) from Artefact Heritage and the FWUP3 North Sydney Wharf project team. The aim of the site inspection was to inspect the area of proposed impacts to inform the specialist studies for the FWUP3 REF, including to inform a preliminary assessment of archaeological potential and to identify heritage items in the vicinity of the construction footprint that may be affected by the proposal. The inspection was undertaken on foot and a photographic record was made.

4.2 Site context and setting

North Sydney Wharf is located on the south-east side of Wurrabirri Point at the end of High Street in the suburb of North Sydney. High Street slopes downwards towards the end of the peninsula and access to the existing North Sydney Wharf is provided by a concrete pathway (Figure 31 and Figure 32). From there the wharf extends out into the water and then runs north along the east side of the peninsula (Figure 33). The wharf is an open concrete structure with no shelter that steps down across four levels. At the time of the site inspection the lowest level was underwater.

Directly adjacent to the wharf access point and alongside the edge of the peninsula is one of the historical bus shelters that forms part of the North Sydney Bus Shelters heritage item (LEP no. I0407). The 'Kesterton' bus shelter features the same design as the other bus shelters forming the heritage item, consisting of a small square structure with stop-chamfered timber posts founded on concrete pads and supporting a timber framed hipped roof covered with terracotta shingle tiles (Figure 34). Attached to the timber posts at the entrance of the shelter is a help point box and inside the shelter is a standard bench as well as a metal box and security camera. Fixed to the top of the shelter is an antenna.

Along the east side of the peninsula to the north of the existing wharf is the North Sydney LEP listed Kesterton Park (LEP no. I0858). The park is a relatively flat open area that slopes gently towards the edge of the peninsula (Figure 35). The park is bounded by High Street to the west (which is higher than the park level due to previous quarrying), vertical quarried sandstone walls to the north-west, and the seawall to the east. A pedestrian footpath runs along the east side of the park with benches and small trees spaced alongside it, and at the north end is a playground and the pedestrian walkway continues over the water adjacent to Sub Base Platypus (LEP no. I0859) (Figure 36). The proposed access to the new wharf is located towards the north end of the park.

The proposed location of the new wharf has clear views looking east across Neutral Bay towards the suburb of Kurraba Point (Figure 37), and across Darling Harbour to the south-east. The suburb of Kirribilli is also visible across Careening Cove to the south of the peninsula, however views towards Kirribilli are partially obstructed by the higher ground and trees planted on the south side of the peninsula (Figure 38). The Inter-War Free Classical style Rockcliff Mansions located at 144 High Street, which was constructed in the 1920s and is listed on the North Sydney LEP (no. I0853), looks out over the peninsula and the bay (Figure 39).



Figure 31: South-east view of North Sydney Wharf from High Street



Figure 32: North-east view of the proposed location of the new wharf from High Street



Figure 33: East view of North Sydney Wharf from the pedestrian path



Figure 34: South-west view of the LEP listed 'Kesterton' bus shelter from North Sydney Wharf



Figure 35: North-west view of the LEP listed Kesterton Park from North Sydney Wharf



Figure 36: North-west view of the north end of Kesterton Park from the location of the proposed wharf



Figure 37: West view across Neutral Bay from the proposed wharf location to Kurraba Point



Figure 38: South view from the proposed wharf location to Kirribilli



Figure 39: North-west view from the proposed wharf location to the LEP listed Rockcliff Mansions

5.0 HERITAGE SIGNIFICANCE

5.1 Introduction

This section outlines the significance assessments and statements of significance for the listed heritage items within the construction footprint. The significance of the heritage items has been assessed against the NSW heritage significance criteria outlined in Table 1. Statements of significance have also been provided for the heritage items which have been identified in Table 4 as being adjacent to the construction footprint.

5.2 Kesterton Park (LEP no. I0858)

5.2.1 Significance assessment

The SHI entry for Kesterton Park (LEP no. I0858) does not contain a detailed significance assessment for the heritage item. As a result, a significance assessment has been prepared as part of this SoHI and is detailed in Table 5.

Table 5: Significance assessment for Kesterton Park (LEP I0858), prepared by Artefact Heritage

Criterion	Explanation
A – Historical Significance	<p>Kesterton Park is associated with quarrying activities in the late-19th century which was characteristic of harbour peninsulas during this period. The area has also been associated with historical industries including the Oaks Steam Brick Company and the World War II RAN Torpedo Factory. The area is associated with the provision and development of transportation in North Sydney and has been the location of ferry wharves since the late-19th century.</p> <p>Kesterton Park has local significance under this criterion</p>
B – Associative Significance	<p>Reviews of the historical records have not indicated that Kesterton Park does not have a strong association with the life or works of a person or group of significance in NSW's cultural or natural history. The park was named after Alderman W. Kesterton who was Mayor of North Sydney from 1945-1949, however he was not connected to the park itself.</p> <p>Kesterton Park does not meet the threshold for local significance under this criterion</p>
C – Aesthetic or Technical Significance	<p>Kesterton Park is a landscape green space with a spectacular visual setting. It is located at the base of a magnificent sandstone cliff face that has been modified by past quarrying activities, and it features clear views of Neutral Bay and across Sydney Harbour. Kesterton Park does not demonstrate aspects of technical significance however, and the sandstone seawall is of a standard design for its time.</p> <p>Kesterton Park has local significance under this criterion</p>
D – Social Significance	<p>Kesterton Park is a public green space which is valued by the local community within North Sydney. Prior to the establishment of the park the area was associated with the local quarrying industry which has shaped the local landscape and the World War II RAN Torpedo Factory. The area has also been associated with public transportation to North Sydney and has served as a ferry wharf point since the late 19th century.</p> <p>Kesterton Park has local significance under this criterion</p>

Criterion	Explanation
E – Research Potential	<p>Kesterton Park was established during the mid-20th century and is typical example of a public green space. It provides little to no insights into the dedication of public places or of developing responsibilities or services provided by local councils.</p> <p>Kesterton Park does not reach the threshold of local significance under this criterion</p>
F – Rarity	<p>Kesterton Park is an area of public green space that was established in the mid-twentieth century. Public parks from this period are not rare within North Sydney and there are several parks in the area.</p> <p>Kesterton Park does not meet the threshold for local significance under this criterion</p>
G – Representativeness	<p>Kesterton Park is representative of areas of reclaimed industrial land that were converted into harbour-front public parks. Other examples of these public parks within North Sydney included Anderson Park at Neutral Bay and Milson Park at Careening Cove. The park is representative of quarrying industries that were typical of late-19th century harbour peninsulas.</p> <p>Kesterton Park has local significance under this criterion</p>

5.2.2 Statement of significance

Kesterton Park (LEP no. I0858) is of local heritage significance.

The following statement of significance has been extracted, in full, from the SHI database entry for Kesterton Park (LEP no. I0858):

Main interest derived from evidence of quarrying activities in the late, nineteenth century, an action which was characteristic of harbour peninsulas during the period. This provides indirect evidence of development and transport technologies of the period. A popular public open space with a spectacular aspect to the harbour.⁷⁷

5.3 North Sydney Bus Shelters (LEP no. I0407)

5.3.1 Significance assessment

The SHI entry for the North Sydney Bus Shelters (LEP no. I0407) is limited. However, the heritage review for the North Sydney Bus Shelters (LEP no. I0407), provided in the 2015 *North Sydney Council Bus Shelter Heritage Review by David Scobie Architects*, provides both an individual significance assessment for the ‘Kesterton’ bus shelter (BS058) and a significance assessment for the overall bus shelter group. The significance assessment in Table 6 has been extracted, in full, from individual assessment for the ‘Kesterton’ bus shelter (BS058).

⁷⁷ Department of Planning, Industry and Environment (DPIE – formerly Office of Environment and Heritage), 2013a. ‘Kesterton Park’. State Heritage Inventory (SHI), database no. 2181174. Accessed online 8/5/2020 at: <https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2181174>.

Table 6: Significance assessment for North Sydney Bus Shelters (LEP no. I0407)⁷⁸

Criterion	Explanation
A – Historical Significance	<p><i>The bus shelter is historically significant at the local level as an item of Municipal design within the provision by NSW State Government of a public transport service from 1886 1958 in the form of tramways overtaken by Bus services along similar routes</i></p> <p>North Sydney Bus Shelters has local significance under this criterion</p>
B – Associative Significance	<p><i>The bus shelter is significant due to the association with Ted Mack, 1933 -; B.Arch. UNSW 1958; Councillor North Sydney Council 1974-88; Mayor North Sydney Council 1983-87; Independent NSW Legislative Assembly North Shore 1981-88; Independent Federal MP North Sydney 1990-1996. Mack instigated the concept of a standard bus shelter, and was influential in the design and colour scheme. The bus shelter is significant due to the association with John Kinstler, Council Architect North Sydney Council 1981-1992. The site is associated with generations of travellers using the Ferry service</i></p> <p>North Sydney Bus Shelters has local significance under this criterion</p>
C – Aesthetic or Technical Significance	<p><i>The design of the shelter was an interpretation of tram shelters used in the Sydney metropolitan area, designed and constructed by NSW Government Tramways during the first period of cable trams 1886-1909 and the second period electric trams 1909 - 1932. The structures, materials and colour scheme positively contribute to the character of North Sydney. The shelter contributes to the setting and to the historic and aesthetic significance of the heritage items within the vicinity, in particular Kesterton Park and the Jetty.</i></p> <p><i>The standard bus shelter structure has technical value for the design approach, which provided an interpretation of early twentieth century Tramway designs using traditional materials and finishes including concrete footing pads, timber structure and cladding with terra cotta shingled roofing, without resorting to mimicry or replication of the federation style. The design provided amenities including lighting, seating and community notice boards, and has proven versatile with the provision of sympathetic electric advertising panels</i></p> <p>North Sydney Bus Shelters has local significance under this criterion</p>
D – Social Significance	<p><i>The bus shelters are valued by the local community within North Sydney with evidence provided through the listing of many structures on heritage studies, lists and inventories including the National Trust (NSW), the North Sydney LEP and the North Sydney Heritage Study 1993. The standard design has won a range of awards for community identification and street furniture, including the Keep Australia Beautiful Award (June 1988). The community notice boards are highly valued and utilised by their respective neighbourhoods</i></p> <p>North Sydney Bus Shelters has local significance under this criterion</p>
E – Research Potential	<p>North Sydney Bus Shelters does not reach the threshold of local significance under this criterion</p>
F – Rarity	<p><i>The individual shelters are generally named and identified as part of particular neighbourhoods and travel destinations, with each structure bearing the name in bold lettering and the Council logo</i></p> <p>North Sydney Bus Shelters does not meet the threshold for local significance under this criterion</p>

⁷⁸ David Scobie Architects, 'North Sydney Council Bus Shelter Heritage Review by David Scobie Architects'. Report to North Sydney Heritage Council, 2015. 211-215.

Criterion	Explanation
G – Representativeness	<p><i>The bus shelters have representative significance as a class of structure erected by Local Government as part of the provision of a public transport service operated by State Government</i></p> <p>North Sydney Bus Shelters does not meet the threshold of local significance under this criterion</p>

5.3.2 Statement of significance

The North Sydney Bus Shelters (LEP I0407) is of local heritage significance.

The following statement of significance has been extracted, in full, from the individual heritage assessment of 'Kesterton' bus shelter (BS058) in the 2015 *Planning Proposals: North Sydney Bus Shelter*.

This bus shelter is a standard timber framed building with hipped terra-cotta shingled roof, in a traditional design modelled on early tram shelters and valued as a visual landmark, functional shelter and marker of the later bus route.⁷⁹

5.4 Careening Cove (LEP no. CA10)

5.4.1 Statement of significance

Careening Cove (LEP no. CA10) is of local heritage significance.

The SHI entry for Careening Cove (LEP no. CA10) does not contain a statement of significance for the heritage conservation area. However, The North Sydney DCP 2013 does include a statement of significance for the conservation area within the Kirribilli Planning Area. The following statement of significance has been extracted, in full, from Part C – Section 8: Kirribilli Planning Area of the North Sydney DCP 2013:

The Careening Cove Conservation Area is significant:

(a) as a largely consistent early 20th century residential area with an unusual and irregular pattern of street layout and irregular subdivision pattern that give the area a particular character.

(b) as retaining much of the urban detail and fabric seen in gardens, fencing, street formations, use of sandstone for retaining and building bases, sandstone kerbing and natural rock faces.

(c) for the amphitheatre like form around the reclaimed Milson Park and the head of the bay.

⁷⁹ David Scobie Architects, 'North Sydney Council Bus Shelter Heritage Review by David Scobie Architects'. 211-215.

(d) for the remaining waterfront industrial and recycled industrial development that gives the area much of its character.⁸⁰

5.5 Rockcliff Mansions (LEP no. I0853)

5.5.1 Statement of significance

The Rockcliff Mansions (LEP no. I0853) is of local heritage significance.

The following statement of significance has been extracted from the SHI database entry for the Rockcliff Mansions (LEP no. I0853):

Representative example of an apartment block in the Inter-War Free Classical style of large scale in a prominent location. Stylistically interesting expression of Italianate details in period materials and form and the work of prominent Sydney architect, Stuart Mould. Important indicator of post-Federation improvement in desirability of the area for this type of development.⁸¹

⁸⁰ North Sydney Council, 'Section 8 Kirribilli Planning Area'. North Sydney DCP 2013 Part C, 2013. C8-13.

⁸¹ DPIE, 2013. 'Rockcliff Mansions'. *SHI database no. 2180044*. Accessed online 8/5/2020 at: <https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2180044>.

6.0 PRELIMINARY ARCHAEOLOGICAL ASSESSMENT

6.1 Introduction

This section provides a preliminary discussion of the construction footprint's potential to contain historical archaeological remains. The potential for the survival of archaeological remains is significantly affected by previous activities which may have caused ground disturbance. This assessment is therefore based on consideration of current ground conditions and analysis of the historical development around the construction footprint.

Areas of archaeological potential are illustrated in Figure 40.

6.2 Land use summary

Non-Aboriginal occupation and development around the construction footprint has been divided into four general phases of historical activity, which are summarised below.

6.2.1 Phase 1 (1788-1870): Informal use and whaling allotments

Neutral Bay and Careening Cove, located on either side of the construction footprint, were used for maritime industry during this period. Neutral Bay served as a neutral harbour for foreign (i.e. non-British) ships travelling to Sydney, while Careening Cove was used for the beaching of ships for cleaning. Land use of the construction footprint at this point is undocumented and no formal land grants had been dedicated. The construction footprint may have been used informally, including minor land clearance or as an informal lookout.

In 1830 the construction footprint was included in the 'whaling allotment' land grant scheme which was common across North Sydney. The area of the construction footprint was granted to Messrs Kemmis and Brown, however little information about the landowners or their use of the land is available. The allotments were for whalers and fishermen, rather than for whaling-related activities themselves, and there is no recorded whaling activity within the construction footprint. The land grant was likely cleared of vegetation, followed by the establishment of boundary fences, and potentially saw the construction of small undocumented timber slab cottages with outbuildings. Little information about Kemmis and Brown exists, other than their assumed occupation as whalers. As whalers, the grant owners were likely at sea for six-month minimum periods. If wives and families did not inhabit the grant while the men were at sea the grants may have been uninhabited for much of the time.

High Street, originally called Whaling Street, was laid out as a government road during this period and may have been upgraded over time.

6.2.2 Phase 2 (1870-1941): Industrial use

In 1870 the Kemmis and Brown land grant was purchased by Patrick Hayes, who quarried the area for building materials. Hayes was the owner and operator of the Oak Steam Brick Company located on Military Road. It is unlikely that Hayes lived within the grant, likely utilising it for quarrying and living elsewhere. Small outbuildings or dwelling for workers may have been present, however. The quarrying is likely to have disturbed and potentially destroyed archaeological remains from Phase 1, due to the extensive excavation and earthworks associated with the quarrying of stone.

From 1877 the North Sydney Gas Company operated to the north of the construction footprint, undertaking land reclamation and an extensive building program. The operations of the Gas Company are not expected to have carried into the construction footprint originally, however, it is

possible that reclamation along what is now Kesterton Park may have been undertaken as part of reclamation programs at the adjacent North Sydney Gas Company. The historical plans and photographs indicate that more than one reclamation event was undertaken in the area around the construction footprint during this period. By 1888 only the northern side of the peninsula had been reclaimed and the current seawall was likely established as part of the reclamation. The southern side of the seawall was not reclaimed and formalised until after 1918.

By 1888 at least one wharf had been constructed at the end of High Street and by 1891 two wharves were present (which are no longer extant). The southern wharf was a long jetty that extended out from the peninsula and featured a waiting room, while the northern wharf was shorter and did not extend far from land. At least two structures were associated with the northern wharf and were located on the land immediately adjacent to the west, with one being a possible weigh bridge (Figure 22).

During this time High Street was formalised as a private laneway between the industrial areas and residential subdivision on the western side of High Street.

6.2.3 Phase 3 (1941-c.1950): RAN Torpedo Facility

In 1941 the North Sydney Gas Company land was purchased by the RAN and converted into a Torpedo Manufacturing Facility as part of the World War II effort. The existing Gas Company buildings were demolished and several new structures were built. The northern part of the construction footprint within Kesterton Park appears to have been used as a laydown or stockpiling facility for the Torpedo Factory, however no buildings or structures are located within the construction footprint.

6.2.4 Phase 4 (c.1950-present): Kesterton Park and recreational use

Following the end of World War II, the stockpiling area at the south of the RAN Facility was cleared and steadily converted into the public parkland which is present today. Aerial imagery shows that vegetation planting occurred, and footpaths and picnic areas were added. No new structures appear to have been built during this phase which were later removed.

In the 1980s the second wharf was demolished and the current wharf was constructed.

6.3 Preliminary assessment of archaeological potential

6.3.1 Phase 1 (1788-1870): Informal use and whaling allotments

Archaeological remains associated with Phase 1 may include evidence of land clearance, including tree boles. Following the establishment of formal land grants in 1830 as part of the whaling allotment scheme, archaeological evidence related to the formalisation of boundaries may be present, including timber fencing and post holes. Evidence of undocumented structures within the construction footprint, associated with the whalers Kemmis and Brown may be present, including earthen, timber, or stone floor surfaces, in addition to stone foundations associated with timber slab huts or stone or weatherboard cottages. It is anticipated however that the subsequent use of the construction footprint for quarrying has disturbed or removed archaeological evidence of lightweight structures, timber remains, or cut and fill remains such as tree boles and post holes.

Deeper subsurface evidence of wells, cesspits or cisterns may be present in association with the whaling allotments. Excavation cuts or stone lining of wells may be present at depth; however, these remains are expected to have been partially or fully disturbed by subsequent earthworks in later phases, including by quarrying activities during Phase 2. Excavation cuts and backfill deposits

associated with cesspits or cisterns may be present, in addition to fills containing discarded artefacts, archaeobotanical samples, or zooarchaeological samples. If present, these deposits would likely be truncated by quarrying activities.

Archaeological evidence associated with Phase 1 may have included yard scatters and rubbish pits located nearby any dwelling structures, which may include artefacts. However, as these are often shallow deposits, it is likely that evidence of these remains has been removed by subsequent quarrying activities and deep excavation associated with Phase 2.

Early road surfaces and kerbs associated with High (Whaling) Street may have been present, however during this phase High Street was likely an informal dirt track, potentially with a metalled surface. Later road formalisation and upgrades, in addition to excavation for services, has likely disturbed remains associated with Phase 1 road surfaces.

Overall, there is **low** archaeological potential for remains associated with Phase 1.

6.3.2 Phase 2 (1870-1941): Industrial use

Archaeological remains associated with Phase 2 could include evidence of quarrying associated with the Oak Steam Brick Company. Potential archaeological evidence may include excavation cuts associated with quarrying activities. Additional potential remains may include remains of undocumented structures such as building footings and foundations, postholes from timber structures and fence posts, cesspits and associated artefactual deposits, or rubbish deposits.

Archaeological remains from Phase 2 would likely primarily consist of evidence of land reclamation fills from the late nineteenth and early twentieth centuries. Reclamation fill may include late 1800s backfill deposits which likely includes rubbish deposits from the time of filling. However, these deposits would be highly mixed and would not represent *in situ* deposits, and the provenance of any artefacts would not be identifiable. It is possible that evidence of earlier seawalls or retaining walls may be buried within the reclamation fills.

It is currently unknown if earlier seawalls or retaining walls were constructed prior to the current seawall, with none of the historical plans or maps indicating their presence. However, archaeological evidence observed at other wharf sites in Sydney, such as at Balmain East, have demonstrated that earlier stone masonry walls could have been present prior to reclamation events, or that retaining walls may have been built and buried as part of the reclamation process.⁸² Remains of earlier sea/retaining walls are more likely to be present if more than one reclamation event was undertaken, and it is known that at least two separate reclamation events were undertaken around the construction footprint. However, further investigation of the historical records would be required to identify with more certainty if earlier walls are likely to have been present.

The first two wharves at the end of High Street were constructed during this phase. Potential archaeological evidence may include timber support piers and timber demolition material. This could include maritime archaeological remains. Archaeological remains associated with the two structures adjacent to the northern wharf may also survive, including the possible weigh bridge. These structures were situated within the construction footprint. Although remains of these structures may have been disturbed as a result of the building demolition and establishment of Kesterton Park, there has been limited activity in the location of the former structures since the park was established. As a result, there is a greater chance that remains of the two structures may have survived. Previous investigations of a nineteenth century weigh bridge at Barangaroo South by Casey & Lowe in 2012,

⁸² Artefact Heritage, 'Balmain East Transport Interchange Upgrade: Archaeological Investigation Results'. Report to Transport for NSW, 2018.

indicate that archaeological remains of the possible weigh bridge could include brick and concrete structural remains and potentially evidence of modifications over time.⁸³

Evidence of early road surfaces associated with High Street, including metalled or stone surfaces, sandstone kerbing, and early utilities including drains may be present within the construction footprint. Historic photographs show that High Street featured sandstone kerbing at this time, and the street was widened in 1916.

Overall, there is **moderate to high** archaeological potential for evidence of reclamation fill, but generally **low to moderate** potential for other remains associated with Phase 2 such as road surfaces, evidence of quarrying, retaining walls and evidence of the former wharf structures.

6.3.3 Phase 3 (1941-c.1950): RAN Torpedo Facility

Aerial imagery from 1943 shows that the northern part of the construction footprint was used as a stockpiling facility for the RAN Torpedo Facility during World War II. The photograph does not show any built structures located within the construction footprint. There are several rectangular features located on the foreshore, which may be shipping containers or other temporary structures.

Overall, there is **nil-low** archaeological potential for remains associated with Phase 3.

6.3.4 Phase 4 (c.1950-present): Kesterton Park and recreational use

Evidence of Phase 4, including Kesterton Park landscaping, road surfaces, and the existing North Sydney Wharf is extant and as such would not be considered archaeological.

Overall, there is **nil** archaeological potential associated with Phase 4.

6.4 Preliminary assessment of archaeological significance

This section assesses the significance of the potential archaeological remains outlined in the previous section. As with other types of heritage items, archaeological remains should be managed in accordance with their significance. Assessing the heritage value of archaeological remains is complicated by the fact that their extent and nature is often unknown. Judgement must therefore be based on expected or potential attributes.

Archaeological significance assessments have only been prepared for those historical phases which potential archaeological remains have been identified.

6.4.1 Archaeological significance assessment

Archaeological remains from Phase 1 and Phase 2 associated with whaling allotments, the former quarry on the site or the Oak Steam Brick Company, may hold historical significance for their association with the development of North Sydney and early industries in the area. These remains may also hold research potential for their ability to provide greater material evidence and information regarding the structures and land use during the early history of the area, particularly for the former whaling allotments for which little documentation is available. Evidence of earlier alignments of High Street, such as former road surfaces and kerbing, and evidence of the former wharves that were known to be present would be significant for their association with the development of transportation routes and travel in the area. Evidence of a former weigh bridge may provide technological

⁸³ Casey & Lowe, 'Archaeological Excavation, Barangaroo South Preliminary Results'. Report to Lend Lease, 2012.

information on wharfage infrastructure and may provide insights into technological changes over time. Research undertaken to date has also indicated that intact archaeological remains of former weigh bridges associated with wharves are relatively rare.

Evidence of reclamation fill is unlikely to be significant on its own as the deposits would be highly mixed and the provenance of any artefactual material would not be identifiable. As a result, artefact bearing reclamation fill would have little to no research potential. However, evidence of former sea/retaining walls and the modification of the landscape, such as evidence of quarrying, would be significant for their association with the formation and development of the LEP listed Kesterton Park (LEP no. I0858). This is indicated by the statement of significance for Kesterton Park (LEP no. I0858) which makes reference to the former quarrying in that location (see Section 5.2.2). Overall, potential archaeological remains from Phase 1 and Phase 2 may have historical significance at a local level.

Phase 3 is associated with the RAN Torpedo Facility and Australia's war effort in World War II. Intact archaeological remains associated with Australia's war effort would be significant for their historical and social values. However, the area around the current construction footprint appears to have been limited to a laydown and stockpiling area. As a result, the potential archaeological remains are likely to be minor in nature and are unlikely to demonstrate a strong association with the war effort. As a result, potential archaeological remains from Phase 3 are unlikely to reach the threshold of local significance.

Overall, the preliminary archaeological assessment has identified that the construction footprint has potential to contain archaeological remains of local significance, including evidence of former road surfaces, quarrying activities, earlier sea/retaining walls and the former wharf infrastructure. However, these archaeological remains are generally unlikely to be found in association with *in situ* artefact bearing deposits, such as intact occupation deposits. Artefactual material would primarily be associated with reclamation fills, which would not be considered *in situ* deposits. As a result, the potential archaeological remains within the construction footprint would likely be classified as 'works'. The preliminary archaeological assessment has found that there is generally nil to low potential for 'relics' as defined by the Heritage Act.

6.4.2 Summary of archaeological potential and significance

A summary of the preliminary assessment of archaeological potential and significance is provided in Table 7.

Table 7: Summary of archaeological potential and significance

Phase	Potential remains	Potential	Significance
Phase 1 (1788-1870)	Evidence of informal use and undocumented structures of whaling allotments	Nil to low	Local
Phase 2 (1870-1941)	Evidence of quarrying; land reclamation; earlier sea/retaining walls; earlier wharves and associated infrastructure (both terrestrial and maritime remains); former road surfaces	Low to moderate for structural remains and evidence of quarrying Moderate to high for reclamation fill	Local for structural remains / former seawalls / quarrying etc. Reclamation fill would not reach the threshold of local significance
Phase 3 (1941-c.1950)	Evidence of temporary structures	Nil to low	Unlikely to reach the threshold of local significance

Phase	Potential remains	Potential	Significance
Phase 4 (c.1950-present)	Not considered archaeological	Nil	N/A

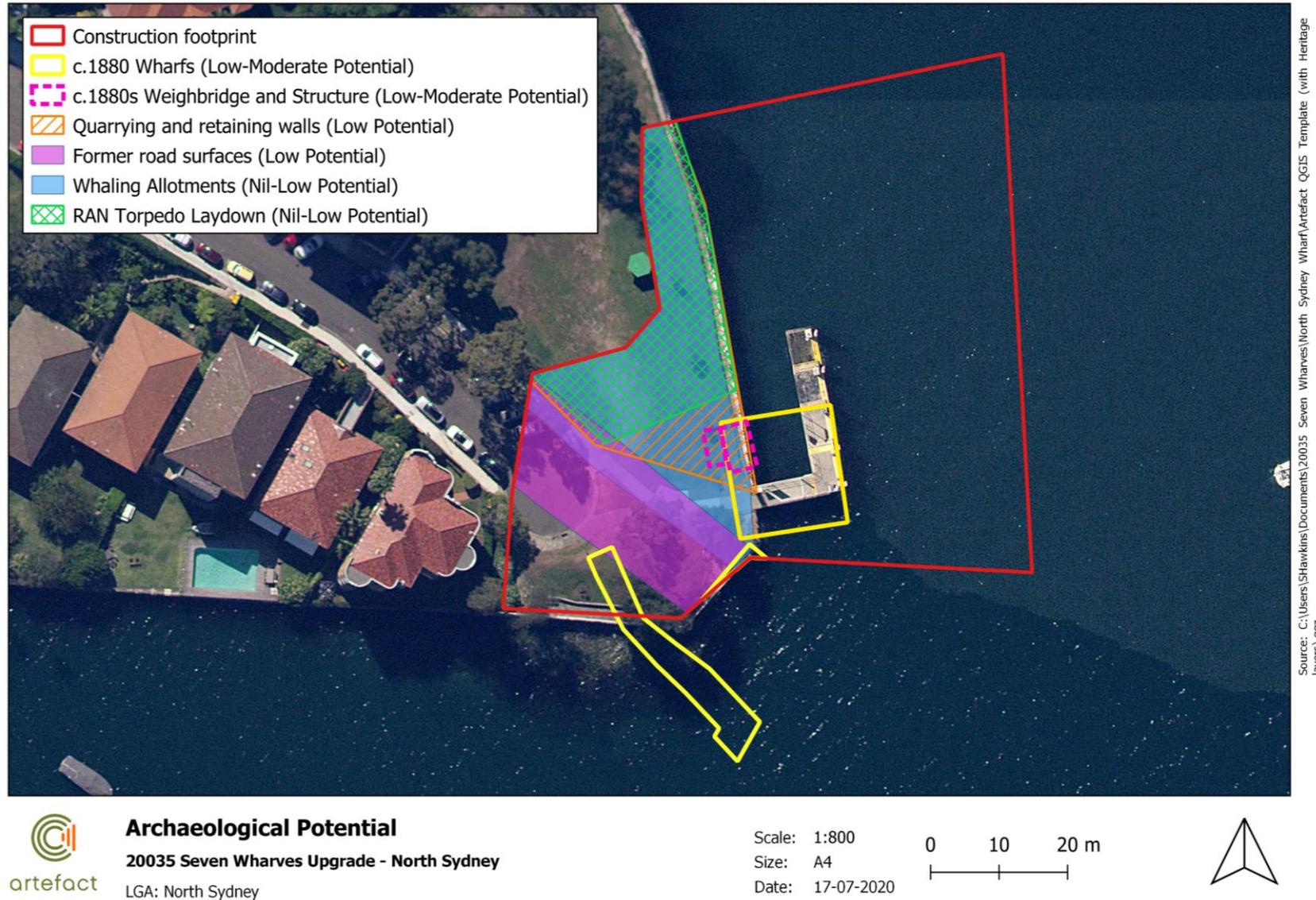


Figure 40: Areas of archaeological potential

7.0 PROPOSED WORKS

7.1 Introduction

This section describes the main design features of the proposal and outlines the associated construction activities at North Sydney Wharf.

7.2 Proposed works

7.2.1 Major water-based features

7.2.1.1 Jetty

The new jetty would consist of a concrete deck entirely supported by concrete headstock(s) on three steel piles. The jetty would be about 3.3m wide and 3.3m long. The deck level would be +1.975m AHD to account for future sea level rise. The jetty would provide support to the gangway and extend over the seawall. Minor cut back to the top of the seawall would be required to allow the top of the jetty to be level with the existing path.

7.2.1.2 Gangway

The aluminium gangway (about 18m long and 2.5m wide) would connect the jetty and the floating pontoon. A transition plate would be installed over the join between the landside connection and the gangway. The gradient of the gangway would vary according to the tides. The gangway gradient would vary according to the tides to be almost horizontal at high tide, and to be a maximum of 1-in-14 for 80 per cent of the tide levels to comply with DSAPT requirements.

7.2.1.3 Pontoon

The pontoon is a rectangular shaped steel floating structure 27m long and 12m wide. The pontoon would be used as both ferry embarking and waiting area and would be held in place by four steel piles. The pontoon comprises several cells which would be ballasted to provide a freeboard of about one metre to match the ferry still level. The pontoon cells are independent of one another to ensure redundancy within the structure, such that if one cell is punctured or damaged, the pontoon is not compromised for stability.

The pontoon would be located on the southern side of the new gangway, about 14 metres from the seawall. Three of the tidal steps from the existing wharf would be demolished to provide sufficient space for the new pontoon structure.

The berthing position on the new pontoon is in deeper water (from -5m to -7.5m depth at LAT) than the existing wharf, which would reduce the risk of seabed disturbance and turbidity from ferry wash during low tides.

Pontoon mounted bollards are provided for ferry mooring lines. The berthing and mooring loads are ultimately resisted by the four pontoon guide piles, which also act to restrain the pontoon.

The pontoon would comprise glass screens and a curved roof structure, supported by steel columns fixed to the pontoon deck, to provide weather protection for the waiting area. The pontoon would be fitted with steel handrails.

A services pod would contain waste bins, customer information, life buoy, data/electrical cabinet.

7.2.2 Major land-based features

7.2.2.1 Pedestrian access

The footpath along the cul-de-sac end of High Street leading to the wharf is at a wheelchair accessible grade (1:40), although further north along High Street, the grade becomes relatively steep. The concept design includes an accessible walkway and ramp from the accessible parking space to the gangway, which also provides access to High Street. This new walkway would tie-in to the existing foreshore footpath at the same grade.

7.2.2.2 Cyclist facilities

The concept design includes three new bicycle parking hoops at the southern edge of Kesterton Park, near the accessible walkway and ramp and accessible parking space and kiss-and-ride space. This location was chosen to cluster all parking in the one location and to discourage cycling on the footpath and accessible ramp.

7.2.2.3 Parking

The concept design includes provision for one accessible kiss-and-ride space on the east side of the High Street cul-de-sac.

The concept design includes one accessible parking space at the cul-de-sac end of High Street (adjacent to the proposed kiss-and-ride space) leading to an accessible ramp that connects to the wharf.

7.2.3 Supporting infrastructure

While the specifics of the supporting infrastructure, lighting, signage, and furniture would be confirmed during the detailed design, they would be consistent with the provisions included on the other wharves on the network. It would therefore include:

- Opal fixed location readers (tap on/off machines) to be relocated at the entrance to the wharf
- Safety and security lighting in the waiting shelter and on the pontoon wharf
- Passenger information boards, notices, and (electronic and display board), timetables
- Safety ladders around the walkway and wharf pontoon
- Strung cabling and ducting to provide power and communications
- CCTV
- Passenger facilities
- Tactile flooring
- New signage to assist with information and navigation (wayfinding).

The above would be developed in accordance with Transport for NSW design specifications.

7.2.4 Earthworks

There would be limited earthworks associated with the proposal. A small amount of riverbed sediment would be disturbed during the piling work, and demolition of the existing wharf; however, no sediment would be removed. Earthworks during construction of the land-based elements would include demolition of existing pavements and build up earthworks for the construction of the new ramps. Construction of the new parking area, pavement and kerbs may also involve limited earthworks.

Any materials collected would be tested and waste classified. Where possible, the materials would be reused under an exception, unless they classify as a non-exempt waste, in which case they would be shipped (barged) offsite for collection and disposal at a licenced waste management facility.

7.2.5 Work methodology

The proposal would likely comprise a sequence of work activities similar to that summarised in Table 8.

Table 8: Planned construction activities

Activity	Associated work
Site establishment	<p>Land-side works</p> <ul style="list-style-type: none"> Establishment of a temporary site compound (erect site offices, amenities and plant/material storage areas etc.) on the land. The site compound would be located in Kesterton Park Site entry and exit points, and haul roads would be established for the construction work site Traffic control measures (including for vehicles, watercraft, pedestrians and cyclists) would be established in accordance with the traffic management plan. Appropriate wayfinding signage would be installed advising of alternative transport options where necessary Environmental controls would be established in accordance with the Construction Environmental Management Plan (CEMP)
	<p>Water-side works</p> <ul style="list-style-type: none"> Establishment of a construction work area using floating booms to delineate this area. This would make allowance for the outward reach of the construction barge's four anchorage points, over which marine vessels may not cross for safety reasons. The anticipated size of the barges is up to about 20m by 30m Environmental controls would be established in accordance with the CEMP
Construction of land side works	<ul style="list-style-type: none"> Land side works would involve the installation of retaining walls, ramps, earthworks, a new accessible parking space, kiss-and-ride space, footpaths and landscaping Clear and grub the site and demolish existing pavements Install new storm water system including new drainage along the western side of the new accessible walkway and replacement of the existing kerb and gutter at the High Street cul-de-sac with new dish drain. Construct new jetty (about 3.3m by 3.3m) including minor modifications to the top of the seawall Construct a new retaining wall along the eastern side of the new accessible ramp. The existing surface level would be regraded to suit the new ramp including an area of infill along the eastern side of the retaining wall. There would be a height difference between the accessible ramp and the existing footpath. The retaining wall would be approximately 0.25m wide and would vary in height between 0.45m and 1.465m. The retaining wall materials would be consistent with the existing urban design and landscape character (e.g. local stone) Retaining walls would also be constructed along the northern side of the bicycle hoop and kiss and ride space, and along the southern side of accessible parking space. Build up earthworks levels and construct new ramps Construct new parking area Construct new pavement and kerbs Finishing works (architectural, landscaping, street furniture, etc.).

Activity	Associated work
Demolition and removal of existing wharf structure	<ul style="list-style-type: none"> • The existing wharf would be closed when safe navigable access to the wharf cannot be maintained • Three tidal steps would be demolished • The six piles and three fender piles associated with the three tidal steps would be removed (either fully or cut and capped)
Installation of steel piles within the waterway	<ul style="list-style-type: none"> • Steel locator piles for the pontoon and foundation piles for the jetty would be installed into bedrock. These piles would be transported by barge to the site from the off-site facility • The installation of the piles for the jetty will likely be undertaken by a barge mounted piling rig. The piles would be installed near to the wall but without impacting the existing seawall. The jetty would be an independent structure to the seawall. • Guide piles required for the pontoon would be installed via a barge mounted piling rig • All pile foundation systems would be into bedrock as follows: <ul style="list-style-type: none"> ○ Pre-drilling into rock ○ Positioning steel pile casing with crane mounted driving unit and piling guide ○ Driving or vibrating the steel pile casings into position ○ Cutting the steal pile casings to length and backfilling with concrete
Installation of the pontoon and gangway	<ul style="list-style-type: none"> • The existing wharf would be closed when navigable access to the wharf cannot be maintained • Lifting and placement of components for the new wharf would be carried out using a barge-mounted crane • The new pontoon structure would be constructed at an off-site facility and floated to site. The pontoon would be secured to the locator piles and packing plates used to trim the plan position • The new gangway would be fabricated at an off-site facility and floated to site by barge. The gangway would be lifted into position by the crane • Finishing works completed (architectural, services, handrails, etc.)
Installation of new or improved facilities	<ul style="list-style-type: none"> • Provision for new Opal readers • Installation of new microwave aerial and removal of the existing aerial • Installation of bicycle parking hoops adjacent to the wharf • Installation of wayfinding signage • Landscaping of the construction areas
Site clean up	<ul style="list-style-type: none"> • The site would be cleaned up and restored to its previous state • Sedimentation controls and temporary structures would be removed

Key features of the proposal are illustrated in Figure 41 and virtual renders of the proposed wharf design are illustrated in Figure 42 to Figure 44.

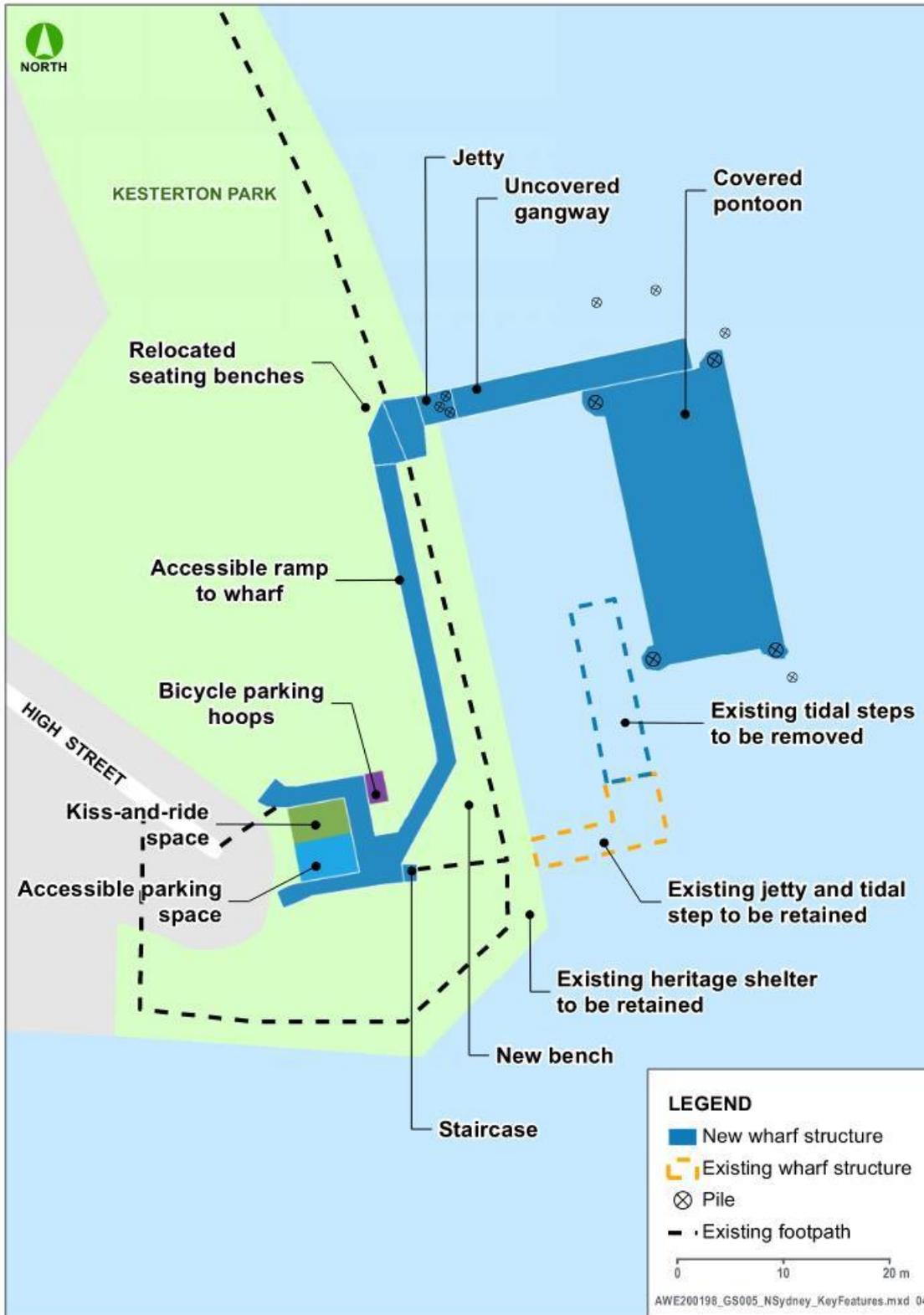


Figure 41: Key features of the proposal (provided by Cardno)



Figure 42: Render of the proposed wharf design from landside perspective (Kesterton Park), view to the south-east (provided by Transport for NSW)



Figure 43: Render of the proposed wharf design from landside perspective (High Street cul-de-sac), view to the east (provided by Transport for NSW)



Figure 44: Render of the proposed wharf design from waterside perspective, view to the north-west (provided by Transport for NSW)

8.0 HERITAGE IMPACT ASSESSMENT

8.1 Introduction

This section provides a heritage impact assessment for the heritage items located within and adjacent to the construction footprint, and within the wider visual buffer zone. An assessment of impacts to potential archaeological remains has also been included based on the preliminary archaeological assessment.

Individual visual impact assessments have been prepared for the heritage items within the FZ due to their closer proximity to the proposed works. Heritage items within the MZ have been assessed as a group as impacts to these items would generally be limited to the same visual impacts. Only visual impacts have been assessed for the heritage items within the MZ due to their distance from the construction footprint. No heritage items have been identified within the BZ and as a result an impact assessment for this area is not included.

8.2 Kesterton Park (LEP no. I0858)

8.2.1 Direct and potential direct (physical) heritage impacts

The proposed works would see the construction of a DDA compliant accessible ramp and footpath extension within the curtilage of Kesterton Park (LEP no. I0858). A gangway, parking spaces, and a staircase would be constructed. A temporary site compound would be located within the heritage curtilage. These works would result in the removal of trees along the foreshore, modifications to the existing seawall and moderate ground disturbance.

The statement of significance for Kesterton Park (LEP no. I0858) identifies that significance of the item primarily derives from its historical association with quarrying activities and its use as a public green space with views of Sydney Harbour. Although the existing seawall is not specifically identified as a significant element it is still located within the curtilage of the heritage item and is considered to be part of the fabric of the park, though it is not considered to be a main element. The existing North Sydney Wharf, however, is not within the curtilage of Kesterton Park (LEP no. I0858) and is not considered to be significant fabric.

The proposed works would see minor changes to the overall setting and layout of the park, largely associated with the removal of existing trees, and the construction of new modern elements associated with the wharf. The four small trees along the edge of the existing footpath are not original trees from the formation of the park in the mid-twentieth century and were only planted after 1980. As these are newer plantings, they are of lower significance compared to other trees within the park, however, they are still a contributing element to the green space. The primary impact would be associated with the establishment of the new ramp and the kiss-and-ride and accessible parking spaces. While these would be located along the current footpaths, they would be larger in size, particularly the parking spaces, and would result in a loss of useable green space. These impacts however would be concentrated in a relatively small area of the park and its heritage curtilage, and the loss of green space would equate to about five percent of the overall park area. As a result, most of the green space would not be impacted. Although the construction compound itself and stockpiling area would be larger in size and would remove more access to green space, this impact would be temporary in nature and would be resolved following the completion of the works. Excavations within the park are also anticipated to be restricted to minor areas and relatively shallow depths, and the green space would be mostly restored following the works except where the new development would be located.

The proposed works would also result in direct and potential direct impacts to the seawall along the edge of the park. A small portion of the seawall would be directly modified for the installation of the new gangway abutment and to make the seawall flush with the new pavement. This would involve the removal of the top row of sandstone blocks in the immediate area of the gangway, with the impacted section measuring about 3.3m long. However, the affected area would be limited to this localised portion of the seawall and the remainder would be unaffected. The proposed works would include piling into the bedrock in proximity to the existing seawall for the installation of the new wharf piles, and the use of a vibratory roller for landscaping. These works would be located within the minimum safe working distance for cosmetic damage, which is identified in the 2016 Roads and Maritime Services *Construction Noise and Vibration Guideline* as being within 50m of vibration intensive plant.⁸⁴ Therefore, due to the close proximity of the works the vibrations associated with the piling and vibratory roller have the potential to cause structural impacts to the fabric of the seawall. However, only a small number of piles are required and the potential impacts could be largely mitigated through control measures (see mitigation measures and recommendations in Section 9.2). Furthermore, as noted above the seawall is not considered to be main contributing element to the significance of Kesterton Park (LEP no. I0858). As a result, it is expected that any potential direct impacts resulting from vibrations would be minimal.

Although the proposed works would result in impacts to Kesterton Park (LEP no. I0858) and a small loss of useable green space, the proposed works would enable greater access to the park by some members of the community with disabilities. This would help to partially offset the small loss of green space.

Overall, the proposed works would result in a **minor to moderate** direct impact to Kesterton Park (LEP no. I0858) and a **negligible** potential direct impact, but these impacts would not affect the overall significance of the heritage item.

8.2.2 Indirect (visual) heritage impacts

The proposed works would involve the construction of a new wharf adjoining Kesterton Park with additional features including the DDA compliant ramp, retaining wall, paving and car parking spaces within Kesterton Park. These works would also result in the removal of four young trees along the eastern boundary of Kesterton Park. Although the trees were only planted after 1980, they still contribute to the aesthetics of the park and contribute to views of the area. As assessed above, the proposed works would result in a small loss of green space for the introduction of the new elements, equalling about 5% of the park. The landscaping works would involve alterations to the height of the park through the introduction of fill, in order to raise the ground level for the retaining wall and ramp. The proposed works would also directly impact a 3.3m long section of the seawall and introduce new negative visual elements within the park, including the wharf structure, the ramp, the retaining wall, and the parking spaces. All of these would impact the aesthetics of the park.

The proposed wharf and associated elements have been designed however to reduce the visual imprint of the new features. The wharf structure has been designed to be small in size and feature a low height, though it would still be larger and taller than the existing wharf. The wharf has also been designed to respond to existing visual cues on the harbour by using lightweight materials, simple lines, and muted colours. The visual impact of the retaining wall would be reduced by using materials that would be consistent with the existing urban design and landscape character of the park, namely the use of local stone. As a result, although the new elements would result in visual impacts, the overall character of the park would be retained. The introduction of a new wharf would also be consistent with the historical use of the area. Furthermore, the design of the wharf is consistent with

⁸⁴ Roads and Maritime Services, 'Construction Noise and Vibration Guideline'. Roads and Maritime Services, 2016. 71.

other wharves in Sydney and would still retain views from the park across Neutral Bay, including to several nearby heritage items, although the views to and from the park would be partially obstructed by the wharf.

Overall, the proposed works would result in a **minor to moderate** visual impact to Kesterton Park (LEP no. I0858), but this impact would not affect the overall significance of the heritage item.

8.3 North Sydney Bus Shelter (LEP no. I0407)

8.3.1 Direct and potential direct (physical) heritage impacts

The existing bus shelter would be retained as part of the proposal. The proposed works associated with the bus shelter include the removal of the existing aerial on top of the bus shelter, and the removal of other elements such as the CCTV camera, emergency help point and ticket machine. These are not considered to be contributing elements to the significance of the bus shelter however, and therefore the removal of them would not result in impacts to significant fabric.

The bus shelter would be located about five to ten metres south of the proposed ground works and the piling for the new wharf piles. As a result, the bus shelter would be located within the minimum safe working distance for cosmetic damage and the vibrations associated with the proposed works could result in potential direct impacts. However, the bus shelter at Kesterton Park is only one shelter of the larger North Sydney Bus Shelter (LEP no. I0407) group, which is made up of 51 bus shelters. As a result, any potential direct vibration impacts to the bus shelter at Kesterton Park would cause minimal impacts to North Sydney Bus Shelter (LEP no. I0407) overall.

Overall, the proposed works would result in a **neutral** direct and **negligible** potential direct impact to North Sydney Bus Shelter (LEP no. I0407), but this impact would not affect the overall significance of the heritage item.

8.3.2 Indirect (visual) heritage impacts

The proposed works would see the construction of the proposed wharf, footpaths and parking within the vicinity of the bus shelter, and the removal of the aerial and other non-significant fabric. The new wharf and retaining wall would introduce an intrusive element in the vicinity of the bus shelter which would impact its visual setting. However, the new features would not obscure significant views from the bus shelter to Kesterton Park and the proximity of the bus shelter to a wharf is consistent with its current setting. The proposed wharf and retaining wall have also been designed to be less obtrusive through the use of lightweight and consistent materials, simple lines, and muted colours. The visual impact would also be partially mitigated by the removal of the aerial and other non-significant elements from the bus shelter, which would result in a visual improvement. Furthermore, the bus shelter at Kesterton Park is part of a larger group and therefore any negligible visual impacts would be even smaller compared to the overall heritage group.

Overall, the proposed works would result in a **negligible** visual impact to North Sydney Bus Shelter (LEP no. I0407), but this impact would not affect the overall significance of the heritage item.

8.4 Careening Cove Conservation Area (LEP no. CA10)

8.4.1 Direct and potential direct (physical) heritage impacts

The proposed works are located outside of the curtilage of Careening Cove Conservation Area (LEP no. CA10). As a result, there would be no direct impacts to Careening Cove Conservation Area (LEP no. CA10). The closest building within Careening Cove Conservation Area (LEP no. CA10) to the

project footprint is located about 20m from the nearest proposed work (installation of accessible parking space and kiss-and-ride space). As identified in the 2016 Roads and Maritime Services *Construction Noise and Vibration Guideline*, the safe working distance for the plant to be used for the proposed works is about 50m.⁸⁵ As a result, the built fabric of Careening Cove Conservation Area (LEP no. CA10) would be located within the minimum safe working distance for cosmetic damage and the vibrations associated with the proposed works could result in potential direct impacts. However, only three buildings within the much larger conservation area would be located within the minimum safe working distance, with all other buildings in the conservation area located at a safe distance. As a result, it is expected that any potential direct impacts resulting from vibrations would be minimal compared to the overall conservation area.

Overall, the proposed works would result in **neutral** direct and **negligible** potential direct impacts to Careening Cove Conservation Area (LEP no. CA10), but this impact would not affect the overall significance of the heritage item.

8.4.2 Indirect (visual) heritage impacts

The construction of the new wharf and associated features would introduce new visually intrusive elements within sight of the Careening Cove Conservation Area (LEP no. CA10). However, the wharf and associated elements have been designed to be less obtrusive through the use of lightweight and consistent materials, simple lines, and muted colours. The wharf would also be consistent with the historical use of the area, it would only be visible from a small number of buildings at the far south-east corner of the overall conservation area, and views to and from the wharf would be partially obscured by the existing trees along the edge of High Street. As a result, the visual impact associated with the proposed works would be minimal.

Overall, the proposed works would result in a **negligible** visual impact to the Careening Cove Conservation Area (LEP no. CA10), but this impact would not affect the overall significance of the heritage item.

8.5 Rockcliff Mansions (LEP no. I0853)

8.5.1 Direct (physical) heritage impacts

The proposed works are located outside of the curtilage of Rockcliff Mansions (LEP no. I0853). As a result, there would be no direct impacts to Rockcliff Mansions (LEP no. I0853). Rockcliff Mansions (LEP no. I0853) is located 30m north-west from the nearest proposed work (installation of the new ramp and gangway), and about 40m from the proposed piling for the wharf piles. As a result, Rockcliff Mansions (LEP no. I0853) would be located within the minimum safe working distance for cosmetic damage and the vibrations associated with the proposed works could result in potential direct impacts. However, as the structure is located towards the edge of the minimum safe working distance it is expected that any potential direct impacts resulting from vibrations would be minimal.

Overall, the proposed works would result in **neutral** direct and **negligible** potential direct impact to Rockcliff Mansions (LEP no. I0853), but this impact would not affect the overall significance of the heritage item.

8.5.2 Indirect (visual) heritage impacts

The construction of the new wharf and associated features would introduce new visually intrusive elements within sight of Rockcliff Mansions (LEP no. I0853), which looks down onto Kesterton Park

⁸⁵ Roads and Maritime Services, 'Construction Noise and Vibration Guideline'. 16.

and the proposed location of the wharf. However, the wharf and associated elements have been designed to be less obtrusive through the use of lightweight and consistent materials, simple lines, and muted colours. The wharf would be consistent with the historical use of the area and generally only the top two floors of the mansions would be able to see the wharf, as views from the lower floors would be obstructed by the adjacent building. The construction of the wharf would not interrupt views looking towards the mansion and would not interrupt views from the mansion to Sydney Harbour. As a result, the visual impact associated with the proposed works would be minimal.

Overall, the proposed works would result in a **negligible** visual impact to Rockcliff Mansions (LEP no. I0853), but this impact would not affect the overall significance of the heritage item.

8.6 Gasworks Remains, HMAS Platypus (LEP no. I0859)

8.6.1 Direct (physical) heritage impacts

The proposed works are located outside of the curtilage of Gasworks Remains, HMAS Platypus (LEP no. I0859) which is located about 100m north of the construction footprint. As a result, there would be no direct impacts to Gasworks Remains, HMAS Platypus (LEP no. I0859), and the works would be far enough away that there would be no risk of potential direct impacts resulting from vibrations.

Overall, the proposed works would result in **neutral** direct and potential direct impacts to Gasworks Remains, HMAS Platypus (LEP no. I0859).

8.6.2 Indirect (visual) heritage impacts

The construction of the proposed wharf would introduce a new visually intrusive element within sight of Gasworks Remains, HMAS Platypus (LEP no. I0859). However, the proposed wharf is consistent with the historical use of the area, the wharf would be located 100m away, and it would generally only be visible from a small portion of the pedestrian walkway at the south-east corner of the heritage item which is a very small portion of the overall heritage item. The new wharf is not expected to obscure views from Gasworks Remains, HMAS Platypus (LEP no. I0859) to Sydney Harbour to a greater extent than the current wharf. The location of the new wharf, located slightly further north on the point, may enable greater visual connection between the North Sydney Wharf and the HMAS Platypus. As a result, the visual impact associated with the proposed works would be minimal.

Overall, the proposed works would result in a **negligible** visual impact to Gasworks Remains, HMAS Platypus (LEP no. I0859) and this impact would not affect the overall significance of the heritage item.

8.7 Visual impacts to heritage items in the MZ

This section provides a visual impact assessment for the heritage items located within the MZ of the visual buffer zone (located 200 – 500m from the construction footprint). The items within the MZ are listed in Table 9.

Table 9: Heritage items within the MZ of the visual buffer zone

Item	Address	Significance	Listing	Distance from construction footprint
Sydney Opera House (buffer zone)	2 Circular Quay east, Sydney (buffer zone extends to Argyle Street and Fitzroy Street)	World	WHL 166rev NHL ID 105738 SHR no. 01685 City of Sydney LEP 2012 no. I1712 RNE ID 2353 RNT	350m south-east
Hastings	2 Hayes Street	State	SHR no. 00567 North Sydney LEP 2013 no. I0628 RNE ID 14699	280m north
Nutcote	5 Wallaringa Avenue	State	SHR no. 00505 North Sydney LEP 2013 no. I0730 RNE ID 16484	290m north-east
Customs Marine Centre	Ben Boyd Centre	Local	CHL ID 105249 North Sydney LEP 2013 no. I0576 RNE ID 101166	320m north
'House'	17 Elamang Avenue	Local	North Sydney LEP 2013 no. I0215	200m south
'House'	5 Elamang Avenue	Local	North Sydney LEP 2013 no. I0212	240m south
Site and remains of Port Jackson and Manly Steamship Company depot	Kurraba Road	Local	North Sydney LEP 2013 no. I0669	360m east
'Once Upon A Time'	115A Kurraba Point	Local	North Sydney LEP 2013 no. I0660	315m north-east
Site of former Spains Wharf	Spains Wharf Road	Local	North Sydney LEP 2013 no. I0705	305m north-east
'House'	7 Wallaringa Avenue	Local	North Sydney LEP 2013 no. I0731	300m north-east
'House'	9 Wallaringa Avenue	Local	North Sydney LEP 2013 no. I0732	300m north-east
Wallaringa Mansions	1 Wallaringa Avenue	Local	North Sydney LEP 2013 no. I0736	300m north-east
Neutral Bay Wharf	1-7 Hayes Street	Local	North Sydney LEP 2013 no. I0627	280m north
Anderson Park	N/A	Local	North Sydney LEP 2013 no. I0767	500m north-west

The proposed construction of the wharf would introduce a new intrusive element within sight of the heritage items listed above, which have views to and from and construction footprint. However, while direct sightlines are present to and from each of these heritage items, they are located at a sufficient

distance that the wharf would not interrupt prominent views and would generally only be partially visible in the background. The wharf and associated elements have been designed to be less obtrusive through the use of lightweight and consistent materials, simple lines, and muted colours. Renders of the proposed design show that the low height of the proposed wharf would enable the retention of views between heritage items on Kurraba Point in the east with Kesterton Park, Careening Cove and the Rockcliff Mansion. The new wharf would be consistent with the historical use of the area and views to the wharf would be mostly comparable to views to the existing wharf. Other elements of the proposed works such as new paving and parking spaces would be low to the ground and therefore would not be visible at that distance.

Overall, the proposed works would have a **negligible** visual impact to most of the heritage items listed in Table 9, but this impact would not affect the overall significance of the heritage items.

The proposed work would not result in a visual impact to Sydney Opera House (WHL 166rev). Although the visual buffer zone of the Sydney Opera House does extend into the MZ, the new wharf would not have any sightlines to the Sydney Opera House itself. Furthermore, the wharf would not be visible in any views from the Sydney Opera House buffer zone to the Sydney Opera House. As a result, the proposed works would result in a **neutral** visual impact to the Sydney Opera House and buffer zone (WHL 166rev).

8.7.1 Impacts to archaeological resources

The proposed works would require excavations of up to about 500mm in depth within Kesterton Park for the construction of the DDA compliant ramp, the construction of retaining walls, installation of services and landscaping. These excavations would be undertaken in areas that have been preliminarily assessed as having nil to low potential to contain locally significant archaeological remains associated with Phase 1, and low to moderate potential to contain locally significant archaeological remains associated with Phase 2 (with moderate to high potential for non-significant reclamation fills).

As evidence of landscape modification and quarrying contribute to the significance of Kesterton Park (LEP no. I0858), impacts to these potential archaeological remains would also result in an impact to Kesterton Park (LEP no. I0858). Overall though, the proposed excavations are relatively minor and would only be in a small area of the park. Therefore, it is unlikely that the excavations would impact any remnant intact deep subsurface features such as wells, cisterns, or cesspits, and it is also expected that any evidence of quarrying would be buried below the impact depth of the proposed excavations and therefore would not be impacted. The removal of non-significant Phase 2 reclamation fills, including minor artefactual material contained within the fill, would not result in an archaeological impact to Kesterton Park (LEP no. I0858).

It is not expected that the proposed works would impact potential terrestrial or maritime archaeological remains of the former wharves, since the excavations and piling are located further to the north of documented location of the former wharves. Furthermore, the removal of the existing tidal step piles, which are located in proximity to the former northern wharf, is not planned to involve excavations of the surrounding sediment. The proposal has also been designed to avoid excavations within the footprint of the two structures associated with the former northern wharf, including the possible weigh bridge, which were both located within the construction footprint and may still survive. Excavation within the footprint of these structures would generally be limited to a proposed shallow swale along the west side of the existing footpath, however, this would be shallower than the footpath and therefore is unlikely to impact any potential remains. The remaining excavations would primarily be located to the west of the former weigh bridge and would be at a higher elevation than the existing footpath (due the current slope of the ground surface). As a result, the proposal has largely mitigated the risk of potential impacts to significant remains of the weigh bridge.

Overall, the proposed works would potentially result in **negligible** impacts to archaeological remains of local significance. As a result, it is unlikely that detailed archaeological management and investigation would be required.

The preliminary archaeological assessment has identified that the potential archaeological remains within the construction footprint would likely be limited to ‘works’. As a result, based on the preliminary archaeological assessment it is unlikely that the proposed works would result in impacts to significant archaeological ‘relics’.

8.8 Summary of impacts to heritage items

A summary of impacts to relevant heritage items is provided in Table 10.

Table 10: Summary of heritage impacts

Heritage item	Direct	Indirect	Potential direct	Archaeological
Kesterton Park	Minor to moderate	Minor to moderate	Negligible	Negligible
North Sydney Bus Shelter	Neutral	Negligible	Negligible	Neutral
Careening Cove Conservation Area	Neutral	Negligible	Negligible	Neutral
Rockcliff Mansions	Neutral	Negligible	Negligible	Neutral
Gasworks Remains, HMAS Platypus	Neutral	Negligible	Neutral	Neutral
Sydney Opera House (buffer zone)	Neutral	Neutral	Neutral	Neutral
Hastings	Neutral	Negligible	Neutral	Neutral
Nutcote	Neutral	Negligible	Neutral	Neutral
Customs Marine Centre	Neutral	Negligible	Neutral	Neutral
‘House’	Neutral	Negligible	Neutral	Neutral
‘House’	Neutral	Negligible	Neutral	Neutral
Site and remains of Port Jackson and Manly Steamship Company depot	Neutral	Negligible	Neutral	Neutral
‘Once Upon A Time’	Neutral	Negligible	Neutral	Neutral
Site of former Spains Wharf	Neutral	Negligible	Neutral	Neutral
‘House’	Neutral	Negligible	Neutral	Neutral
‘House’	Neutral	Negligible	Neutral	Neutral
Warringa Mansions	Neutral	Negligible	Neutral	Neutral
Neutral Bay Wharf	Neutral	Negligible	Neutral	Neutral
Anderson Park	Neutral	Negligible	Neutral	Neutral

8.9 Statement of heritage impact

A statement of heritage impact has been prepared according to the NSW Heritage Office guidelines in Table 11 below.

Table 11: Statement of heritage impact for the proposal

Development	Discussion
<p>What aspects of the Proposal respect or enhance the heritage significance of the study area?</p>	<p>The proposed works are primarily limited to Kesterton Park (LEP no. I0858) and would not remove significant fabric of the North Sydney Bus Shelter (LEP no. I0407). The existing heritage listed North Sydney Bus Shelter (LEP no. I0407) would be retained and only non-significant elements would be removed. This would be a positive visual impact which would help to mitigate the visual impact of the new wharf to the setting of the shelter and park. The proposal would result in impacts Kesterton Park (LEP no. I0858) through the introduction of new structures, such as the proposed wharf, parking spaces and retaining wall, and the loss of about 5% of the public green space of the park. However, the new wharf is consistent with the historical use of the area, the wharf and associated elements have been designed with appropriate materials and colours to reduce the visual impact, and most of the park landscape would be unchanged. The proposal would also allow greater accessibility and appreciation of Kesterton Park (LEP no. I0858) by providing DDA compliant access.</p> <p>The preliminary archaeological assessment has identified the potential for locally significant archaeological remains of a former weigh bridge and associated wharf infrastructure. However, the proposal has been redesigned to avoid impacts to the potential archaeological remains.</p> <p>The proposed wharf has been designed to be relatively unobtrusive and would not have a strong impact on the context and setting of Kesterton Park (LEP no. I0858), or on views to and from heritage items in the area. The proposed wharf would not result in any visual impacts to the Sydney Opera House (WHL 166rev)</p>
<p>What aspects of the Proposal could have a detrimental impact on the heritage significance of the study area?</p>	<p>The proposed works would directly impact a localised section of the seawall in Kesterton Park (LEP no. I0858) and remove four small trees. The works would also result in a loss of about 5% of the significant public green space in Kesterton Park (LEP no. I0858) and may result in impacts to significant archaeological remains. However, the introduction of a new wharf within Kesterton Park (LEP no. I0858) is consistent with the historical use and setting of the area. Because of the shallow nature of the excavations, impacts to potential archaeological remains would be negligible and the archaeological remains are unlikely to include significant archaeological 'relics'.</p> <p>Vibrations associated with the proposed works have the potential to result in structural impacts to the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within the Careening Cove Conservation Area (LEP no. CA10), and to</p>

Rockcliff Mansions (LEP no. I0853). However, the risk of potential indirect impacts could be largely mitigated through control measures. The proposal would also introduce new intrusive visual elements which would be visible from most heritage items in the area, including Customs Marine Centre (CHL ID 105249), Hastings (SHR no. 00567) and Nutcote (SHR no. 00505). However, the generally negligible visual impacts to the heritage items within the visual buffer zone would have minimal impact to the overall setting and character of these items and would not impact their overall heritage significance. The proposed works are necessary to make North Sydney Wharf DDA compliant

Have more sympathetic options been considered and discounted?

Two options were assessed as part of the concept design. Option 1 had the new ramp located along the foreshore at the south end of Wurrabirri Point rather than along the east side. This would have removed the impact to Kesterton Park (LEP no. I0858). This option was discounted in favour of Option 2 (the current design) due to the simpler construction design and greater accessibility of Option 2. Option 2 was then refined to reduce impacts to Kesterton Park (LEP no. I0858). Following the preliminary archaeological assessment, the design has been further refined to avoid impacts to potential remains of the former weigh bridge by relocating a proposed utility line

9.0 MANAGEMENT AND MITIGATION MEASURES

9.1 Conclusions

This SoHI has determined the following:

- The construction footprint is located within the curtilages of two heritage items listed on the North Sydney Local Environmental Plan (LEP) 2013:
 - Kesterton Park (LEP no. I0858)
 - North Sydney Bus Shelter (LEP no. I0407)
- The construction footprint is located adjacent to two heritage items listed on the North Sydney LEP 2013:
 - Careening Cove Conservation Area (LEP no. CA10)
 - Rockcliff Mansions (LEP no. I0853)
- The visual buffer zone for the construction footprint also includes:
 - The visual buffer zone of one heritage item listed on the World Heritage List (WHL):
 - Sydney Opera House (buffer zone) [WHL 166rev]
 - One heritage item listed on the Commonwealth Heritage List (CHL):
 - Customs Marine Centre (CHL ID 105249)
 - Two heritage items listed on the State Heritage Register (SHR):
 - Hastings (SHR no. 00567)
 - Nutcote (SHR no. 00505)
 - Nineteen heritage items listed on the North Sydney LEP 2013 and Sydney LEP 2012
- A preliminary archaeological assessment has determined that the construction footprint has nil to low potential to contain locally significant archaeological remains associated with Phase 1 (1788-1870 Informal use and whaling allotments), and low to moderate potential to contain locally significant archaeological remains associated with Phase 2 (1870-1941 Industrial use), including evidence of former nineteenth century wharves and a weigh bridge. The construction footprint also has moderate to high potential to contain non-significant reclamation fills associated with Phase 2. The archaeological remains would likely be limited to evidence of former 'works' and the construction footprint is unlikely to contain significant 'relics' as defined by the *NSW Heritage Act 1977* (Heritage Act)
- The impacts on the identified heritage items resulting from the proposed works are summarised in the table below, and include:
 - Minor to moderate direct and indirect and negligible potential direct impacts to Kesterton Park (LEP no. I0858)
 - Negligible indirect and neutral direct and potential direct impacts to North Sydney Bus Shelter (LEP no. I0407)
 - Neutral direct and negligible indirect and potential direct impacts to Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853)
 - Neutral direct, indirect and potential direct impacts to Sydney Opera House (WHL 166rev)

- Negligible indirect and neutral direct and indirect impacts to Customs Marine Centre (CHL ID 105249)
- Negligible indirect and neutral direct and indirect impacts to Hastings (SHR no. 00567) and Nutcote (SHR no. 00505)
- Negligible indirect and neutral direct and indirect impacts to the remaining LEP heritage items
- Based on the preliminary archaeological assessment, excavations associated with the proposal would result in negligible impacts to potential archaeological remains of local significance. However, the proposed excavations are unlikely to impact significant 'relics'
- The proposed works would not impact the overall significance of the heritage items within and adjacent to the construction footprint, or the heritage items within the visual buffer zone
- The impacts associated with the proposed works are necessary to make North Sydney Wharf compliant with the requirements of the DDA.

Heritage item	Direct	Indirect	Potential direct	Archaeological
Kesterton Park	Minor to moderate	Minor to moderate	Negligible	Negligible
North Sydney Bus Shelter	Neutral	Negligible	Negligible	Neutral
Careening Cove Conservation Area	Neutral	Negligible	Negligible	Neutral
Rockcliff Mansions	Neutral	Negligible	Negligible	Neutral
Sydney Opera House (buffer zone)	Neutral	Neutral	Neutral	Neutral
Customs Marine Centre	Neutral	Negligible	Neutral	Neutral
Hastings	Neutral	Negligible	Neutral	Neutral
Nutcote	Neutral	Negligible	Neutral	Neutral
Remaining LEP items in the visual buffer zone	Neutral	Negligible	Neutral	Neutral

9.2 Mitigation measures and recommendations

The following mitigation measures should be enacted to minimise heritage impacts:

- As the proposed works would not impact upon the Commonwealth heritage values of Customs Marine Centre (CHL ID 105249), or the World heritage values of the Sydney Opera House (WHL 166rev), a referral to the Commonwealth in accordance with the EPBC Act would not be required
- The proposed works would result in impacts to Kesterton Park (LEP no. I0858), which is listed on the North Sydney LEP 2013, that are more than minor in nature. As a result, the proposal is not consistent with the general requirements for exempt development under Section 20 of the ISEPP. Therefore, consultation is required with North Sydney Council prior to any impacts occurring

- A copy of this report must be submitted to North Sydney Council for their records to inform them of the impacts to Kesterton Park (LEP no. I0858). The proposal must take into consideration any response to the impact assessment that is received from North Sydney Council within 21 days after the notice is given
- The preliminary archaeological assessment has identified low to moderate potential for archaeological remains of local significance to be present within the construction footprint, including evidence of a former nineteenth century weigh bridge. However, due to the shallow nature of the proposed excavations there is limited risk of archaeological impacts and therefore impacts to the identified archaeological resources would be negligible. Furthermore, the preliminary archaeological assessment has found that the potential archaeological remains would likely be limited to 'works'. As a result, an exception under Section 139 (4) of the Heritage Act would not be required for the proposed works and the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be implemented should any archaeological remains be encountered during works
- If unexpected 'relics' are encountered during excavation, a s146 relics notification would be forwarded to Heritage NSW, DPC. 'Relics' cannot be impacted without appropriate approvals under the Heritage Act
- If any design changes would result in additional excavations and impacts to potential archaeological remains of the former weigh bridge, further archaeological assessment and management would be required. This may include a program of archaeological test excavation
- If significant archaeological remains are encountered during works, design options for avoiding impacts to the significant archaeological remains should be considered where practicable and opportunities should be investigated for the implementation of heritage interpretation
- A heritage induction would be provided to workers prior to construction, informing them of the location and significance of known heritage items and the implementation of the Unexpected Heritage Item Procedure 2015 if unanticipated heritage items or depositions are located during construction. The heritage induction would include management of expected non-significant archaeological remains, such as minor artefactual material associated with Phase 2 reclamation fills
- A structural engineer should assess whether the vibrations associated with the proposed landscaping and piling for the wharf piles, would potentially result in direct impacts to the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) and to Rockcliff Mansions (LEP no. I0853)
- During the construction works, regular inspections of the construction activities and work areas should be undertaken by structural engineers and any other required specialist to monitor and review the construction methodology and confirm the integrity of the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) and Rockcliff Mansions (LEP no. I0853). Assessment and monitoring of vibration impacts should adhere to:

- British Standard BS 7385: *Part 2: Evaluation and Measurement for Vibrations in Buildings – Part 2 Guide to Damage Levels from Ground-Borne Vibration*
- German Standard DIN 4150, *Part 3: Structural Vibration in Buildings: Effects on Structures*
- If vibration monitors are attached to the seawall in Kesterton Park (LEP no. I0858), the North Sydney Bus Shelter (LEP no. I0407), structures within Careening Cove Conservation Area (LEP no. CA10) or Rockcliff Mansions (LEP no. I0853), they must not be attached with permanent fixings. They should be removable without causing damage. Bees wax may be a suitable attachment method
- If it is identified that levels of vibration are causing damage to heritage fabric, works must cease, and the construction methodology reviewed by the project engineers in consultation with a Heritage Consultant in order to mitigate further impacts. A temporary protection plan to outline protection measures required for significant fabric during activities causing potential vibration impacts would be prepared prior to commencement of works
- Care must be taken during the removal of the non-significant elements from the North Sydney Bus Shelter (LEP no. I0407) to ensure that significant fabric is not damaged in the process. A work method statement should be prepared to guide the removal of elements from the bus shelter to minimise the risk of inadvertent impacts
- Works within Kesterton Park (LEP no. I0858) must be kept to a minimum where possible and be undertaken with care to minimise impacts to the local heritage item and minimise the loss of public green space and vegetation
- A work method statement should be prepared to guide the modification of the seawall within Kesterton Park (LEP no. I0858) for the new gangway abutment and pavement finish
- Any trees or vegetation required to be removed, including the four small trees along the existing footpath, should be reinstated following the completion of the works to minimise impacts to the visual characteristics of Kesterton Park (LEP no. I0858)
- All impacted areas and ground surfaces must be reinstated as near as possible to their original state following the completion of works within Kesterton Park (LEP no. I0858)
- A Photographic Archival Recording should be undertaken of Kesterton Park (LEP no. I0858) to document its current visual setting prior to any impacts and modifications
- If underwater excavations are proposed in the location of the current wharf, then a maritime archaeological assessment should be undertaken to assess the potential for impacts to maritime archaeological remains of the former wharves
- Any project redesign resulting in new ground disturbance, vegetation removal, or new features must be assessed in an addendum to this SoHI.

10.0 REFERENCES

- Andrews, Graeme. *Ferry KURAMIA and the Bridge That Finished Her Career*. 1928. Photographic image. Graeme Andrews Working Harbour Photograph Collection. City of Sydney Archives. <https://archives.cityofsydney.nsw.gov.au/nodes/view/713840?keywords=graeme%20andrews%20working%20harbour%20collection&all=1&whole=1>.
- Artefact Heritage, 'Balmain East Transport Interchange Upgrade: Archaeological Investigation Results'. Report to Transport for NSW, 2018.
- Australian Town and Country Journal. *The Freestone Quarries at Pyrmont, Sydney, New South Wales*. March 12, 1883. Sketch. Trove. National Library of Australia. <https://trove.nla.gov.au/newspaper/article/71006264?searchTerm=%22freestone%20quarries%22%20pyrmont#>.
- Bayliss, C. *View across Careening Cove to Neutral Bay*. c.1880s. Photographic image. Stanton Library. <https://www.aurorashore.com.au/montage/stanton/Gallery.aspx?keyword=high+street+wharf&method=0&sort=1003&showall=true&fname=&bibid=R0000743099&>.
- Brodsky, Isadore. *North Sydney, 1788-1962*. North Sydney (N.S.W): Municipal Council of North Sydney, 1963.
- Careening Cove, North Sydney, - High St, Elamang Ave, Willoughby St, McDougall St, 1919*. 1888. Subdivision plan. IE9000527 FL9000533. State Library of New South Wales. http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?dps_pid=IE9000527&change_Ing =.
- Cardno, 'Landscape Character and Visual Impact Assessment: North Sydney Wharf Upgrade'. Draft. Report to Transport for NSW, 2020.
- Casey & Lowe, 'Archaeological Excavation, Barangaroo South Preliminary Results'. Report to Lend Lease, 2012.
- David Scobie Architects, 'North Sydney Council Bus Shelter Heritage Review by David Scobie Architects'. Report to North Sydney Heritage Council, 2015. 211-215.
- Department of Finance, Services & Innovation. *Historic Aerial Photos: Sydney*. January 5, 1951. Aerial image.
- . *Historic Aerial Photos: Sydney*. March 8, 1986. Aerial image.
- Heritage Council of New South Wales. "Standard Exemptions For Works Requiring Heritage Council Approval." Heritage Branch, Department of Planning, 2009. <https://www.environment.nsw.gov.au/resources/heritagebranch/heritage/StandardExemptions.pdf>.
- Heritage Office, and Department of Urban Affairs and Planning. "Statements of Heritage Impact," 2002. <https://www.heritage.nsw.gov.au/assets/Uploads/a-z-publications/s-u/Statements-of-Heritage-Impact.pdf>.
- Historic Aerial Photos: Sydney*. June 5, 1978. Aerial image. Department of Finance, Services & Innovation. https://portal.spatial.nsw.gov.au/download/historic/2713/2713_15_052.jp2.jpeg.
- Howard, Mark. "Sydney's Whaling Fleet." 2011. *The Dictionary of Sydney*. Accessed January 4, 2020. https://dictionaryofsydney.org/entry/sydneys_whaling_fleet/.
- Karskens, Grace. "Harbour Life: Tracing Early Sydney's Watery History." *The Conversation*, 2014. <http://theconversation.com/harbour-life-tracing-early-sydneys-watery-history-21892>.
- Lucas, Stapleton, Johnson & Partners. "Platypus Renewal Project Public Domain and Access Improvements and Refurbishment of Selected Buildings Heritage Impact Statement." Heritage Impact Statement, 2017. https://www.harbourtrust.gov.au/media/1759/sbp_heritage-impact-assessment.pdf.

- Masson, Leonie. "North Sydney." *The Dictionary of Sydney*, 2010.
https://dictionaryofsydney.org/entry/north_sydney.
- Masson, Leonie, and Ian Hoskins. "Neutral Bay." *The Dictionary of Sydney*, 2008.
https://dictionaryofsydney.org/entry/neutral_bay.
- Neutral Bay, Sydney Harbour, N.S.W.* 1905. Postcard, 88 x 140 mm. Stanton Library.
<https://www.aurorashore.com.au/montage/stanton/Gallery.aspx?keyword=high+street+wharf&method=0&sort=1003&showall=true&fname=&bibid=R0000746566&>.
- Newton, John. *A Savage History: Whaling in the Pacific and Southern Oceans*. Sydney, N.S.W.: NewSouth Publishing, 2013.
- North Shore Gas Company, Neutral Bay, 1882*. 1882. Photographic image. Willoughby Library.
<https://willoughbytest.spydus.com/cgi-bin/spydus.exe/FULL/WPAC/ARCENQ/4004668/6810319,1?FMT=IMG>.
- North Shore Gas Company, Neutral Bay, 1927*. 1927. Photographic image. Negative no: N59. Willoughby Library. <https://willoughbytest.spydus.com/cgi-bin/spydus.exe/FULL/WPAC/ARCENQ/4004673/6810969,1>.
- North Sydney Council. "Far Enough Away: A Walking Tour of Neutral Bay." *North Sydney History Walk*, n.d. <https://www.northsydney.nsw.gov.au/Home>.
- . "High Street." *Naming North Sydney*, n.d.
<http://www.photosau.com.au/StantonStreets/scripts/home.asp>.
- North Sydney Ferry Wharf Showing Passenger and Vehicular Ferries*. 1930s. Photographic image. IE1289503. State Library of New South Wales.
http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?embedded=true&toolbar=false&dps_pid=IE1289503&_ga=2.188621800.1906594067.1585549174-706910494.1581896604.
- North Sydney, NSW. 1941. The Demolition of the North Sydney Gasworks Factory to Make the Land Available for the Construction of the RAN Torpedo Facility*. 1941. Photographic image. Naval Historical Collection. Australian War Memorial. <https://www.awm.gov.au/collection/C259636>.
- North Sydney, NSW. C.1942. Exterior of a Building of the RAN Torpedo Factory under Construction, Seen from the Harbour*. 1942. Photographic image. Naval Historical Collection. Australian War Memorial. <https://www.awm.gov.au/collection/C259009>.
- NSW Department of Planning, Industry and Environment. "Kesterton Park." *Heritage NSW*, 2020.
<https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2181174>.
- . "Sydney Harbour Bridge, Approaches and Viaducts (Road and Rail)." *Heritage NSW*, 2020.
<https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5045703>.
- NSW Heritage Branch. *Assessing Significance for Historical Archaeological Sites and 'Relics'*. Parramatta: NSW Heritage Branch, Department of Planning, 2009.
- NSW Heritage Council. "Archaeological Assessment Guidelines." In *NSW Heritage Manual*. New South Wales: Heritage Office, 1996.
- [Plan Kirribilli Area] - Cliff St, Walter St, High St [1880]*. 1880. Subdivision plan. State Library of New South Wales.
http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?dps_pid=IE9012476&change_ing=
- Raine & Horne. *North Sydney, Rockville Estate, Careening Cove / Auction Sale on the Ground, Saty 21st May 1904 at 3 p.m. by Raine & Horne, Auctioneers 86 Pitt St*. 1904. Subdivision plan. National Library of Australia. <https://nla.gov.au/nla.obj-230392470/view>.
- Roads and Maritime Services, 'Construction Noise and Vibration Guideline'. Roads and Maritime Services, 2016.

- Ships at the HMAS Platypus Base*. 1970s. Photographic image.
<https://www.commercialrealestate.com.au/news/historic-former-submarine-base-in-north-sydney-to-be-opened-up-for-commercial-activity-44755/>.
- Smith, Peter R. "HMAS Platypus - a Submarine Naval Base." Naval Historical Society of Australia, September 2017. <https://www.navyhistory.org.au/hmas-platypus-a-submarine-naval-base/>.
- Souter, Gavin. *Mosman: A History*. Melbourne: Brio Books, 2012.
- Subdivision Plans of the North Shore, Sydney, Approximately 1859*. 1859. IE3764469 FL3764478. State Library of New South Wales.
http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?embedded=true&toolbar=false&ds_ps_pid=IE3764469&_ga=2.255715272.1906594067.1585549174-706910494.1581896604.
- The Bureau. "Sydney Ferries (Limited) Regular Service of High-Class Steamers from Nos. 1, 4, 5 & 6 Jetties." *Trips around Sydney, New South Wales*, 1909. National Library of Australia.
- Australian National Maritime Museum. "The Manly Ferry," 2018.
<http://arhv.anmm.gov.au/en/collections/details/34289/the-manly-ferry>.
- Walder, Sir Samuel. *Jack's Day Fete in the Royal Sydney Yacht Squadron Grounds, Looking towards High Street Wharf, Taken from "The Walder", 19 Holbrook Avenue, Kirribilli*. October 26, 1918. Photographic image. Stanton Library.
<https://www.aurorashore.com.au/montage/stanton/Gallery.aspx?keyword=high+street+wharf&method=0&sort=1003&showall=true&fname=&bibid=R0000749064&>.
- Wotherspoon, Gary. "Ferries." *The Dictionary of Sydney*, 2008.
<https://dictionaryofsydney.org/entry/ferries>.



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Appendix H

Procedure for Aboriginal cultural heritage consultation and investigation clearance letter



4/06/2020

Rebecca Murray
Environment Officer
Environment Officer | Greater Sydney Project Office

Dear Rebecca

Re: Preliminary assessment results for the North Sydney Ferry Upgrade *proposal area* proposal based on Stage 1 of the *Procedure for Aboriginal cultural heritage consultation and investigation* (the procedure).

The project, as described in the Stage 1 assessment checklist, was assessed as being unlikely to have an impact on Aboriginal cultural heritage. The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate any known Aboriginal objects or places in the immediate study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Roads and Maritime Services' procedure.
- The Aboriginal cultural heritage potential of the study area appears to be severely reduced due to past disturbance.

Your project may proceed in accordance with the environmental impact assessment process, as relevant, and all other relevant approvals.

If the scope of your project changes, you must contact me and your regional environmental staff to reassess any potential impacts on Aboriginal cultural heritage.

If any potential Aboriginal objects (including skeletal remains) are discovered during the course of the project, all works in the vicinity of the find must cease. Follow the steps outlined in the Roads and Maritime Services' *Unexpected Archaeological Finds Procedure*.

For further assistance in this matter and do not hesitate to contact me.

Yours sincerely

A handwritten signature in black ink that reads 'M. Lester'.

Mark Lester
Aboriginal Cultural Heritage Officer – Sydney Region
27-31 Argyle St Parramatta NSW 2150
Phone - 02 8849 2583 Mobile – 0448 731 510

Roads and Maritime Services

Appendix I

Socio-economic impact assessment

Socio-economic Impact Assessment

North Sydney Wharf Upgrade

AWE200198



Prepared for
Transport for NSW

9 October 2020

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

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1 Introduction

1.1 Overview

Transport for NSW proposes to construct a new wharf interchange at North Sydney (the proposal) as part of the NSW Government's Transport Access Program (TAP). TAP is an initiative to deliver modern, safe and accessible transport infrastructure across NSW.

This socio-economic impact assessment (SEIA) has been prepared by Cardno (NSW/ACT) Pty Ltd on behalf of Transport for NSW. For the purposes of these works, Transport for NSW is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979*.

The SEIA has been prepared to inform the Review of Environmental Factors (REF) for the proposal. The SEIA is required by Transport for NSW to ensure potential socio-economic impacts have been considered in the proposal's planning phase.

1.2 Proposal description

The proposal is located within the North Sydney local government area (LGA) and about three kilometres from the Sydney Central Business District (CBD). North Sydney Wharf interchange is located in Neutral Bay, at the tip of a small peninsula, to the east of the Warringah Freeway, on Sydney's Lower North Shore. North Sydney Wharf interchange sits at the water's edge of Kesterton Park. The Wharf is accessed through the park from High Street, which runs along the ridge of the peninsula terminating at the Wharf interchange.

Figure 1-1 and Figure 1-2 show the regional and local setting respectively. The Wharf is part of the F5 Ferry Service that operates between Circular Quay and Neutral Bay. The proposal is to improve access to the Wharf, and upgrade and install a gangway and floating pontoon to allow for more efficient passenger services.

The key features of the proposal are shown in Figure 1-3 and Figure 1-4, and detailed description of the water-based and land-based works are provided below.

The water-based features of the proposal would include:

- > Installation of a new 3.3-metre long by 3.3-metre wide concrete jetty, supported by three new piles, including minor modifications to the top of the seawall
- > Installation of a new 12-metre by 27-metre pontoon including weather protection, seating and information boards. The pontoon would be held in place by four new piles, with pivot piles (to assist vessel berthing) provided at either end of the pontoon
- > Installation of a new 18-metre uncovered aluminium gangway located to the north of the existing wharf to provide access between the jetty and pontoon
- > Demolition of three of the four tidal steps and associated piles and fender piles from the existing wharf
- > Safety and security features on the pontoon including an emergency help point, lighting, closed-circuit television (CCTV), ladders to the water and a life buoy, and tactile indicators where required.

The land-based features of the proposal would include:

- > One accessible parking space at the cul-de-sac end of High Street
- > One kiss-and-ride space or zone at the cul-de-sac end of High Street
- > Three new bicycle parking hoops
- > Footpath regrading to produce a *Disability Standards for Accessible Public Transport 2002* (DSAPT) compliant grade
- > Installation of a new accessible ramp between the existing footpath and the new gangway
- > One new seating bench on the waterfront and relocation of two existing seating benches in Kesterton Park
- > Installation of new wayfinding signage, information boards, and opal card readers
- > Installation of a new microwave aerial at the entrance to the gangway and removal of the existing microwave aerial on the existing shelter

> Removal and replacement of up to four trees to construct the accessible pathway.

The proposal would be constructed over a duration of up to six months starting in early 2021.

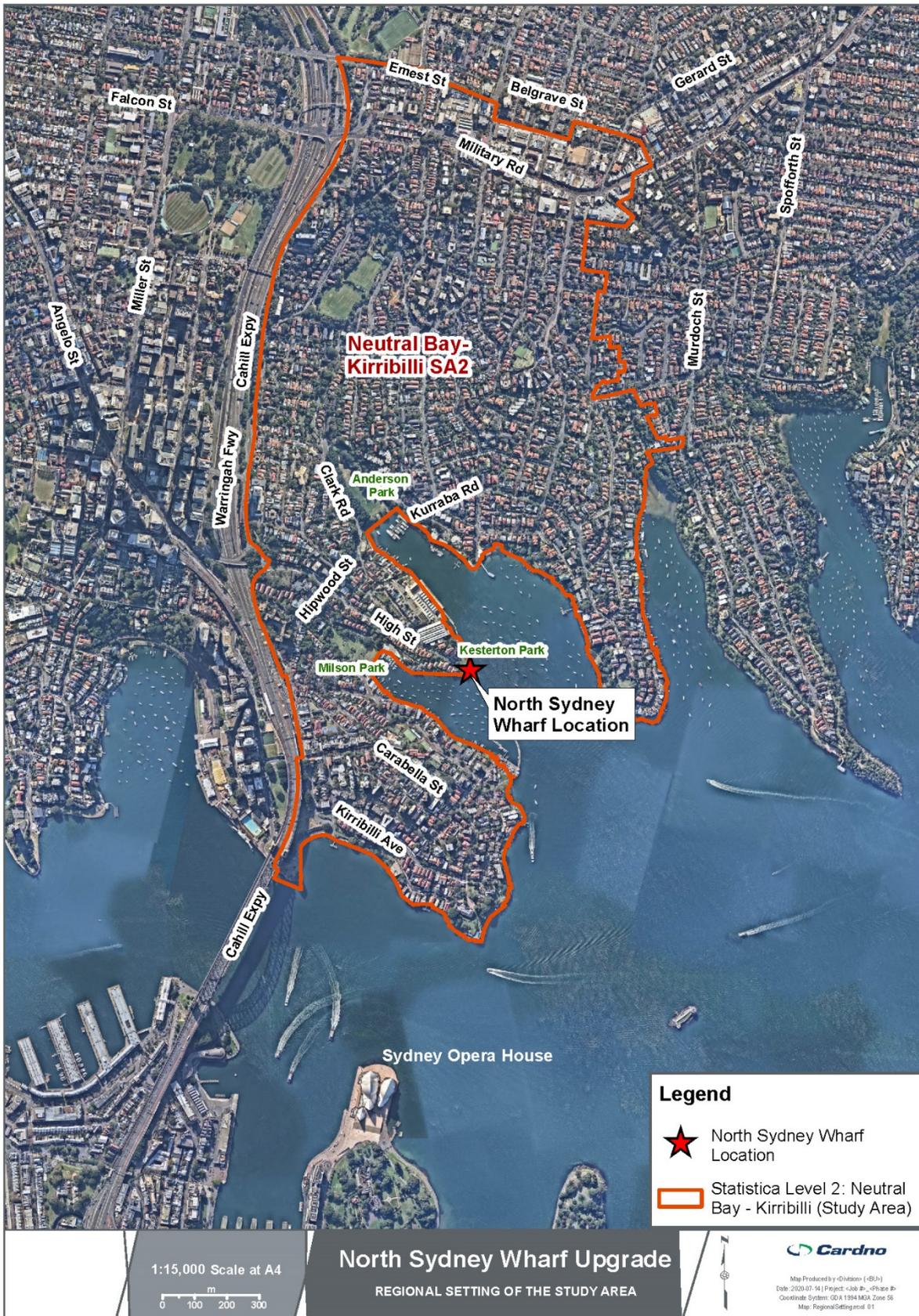


Figure 1-1 Regional setting of the North Sydney Wharf



Figure 1-2 North Sydney Wharf location and local setting

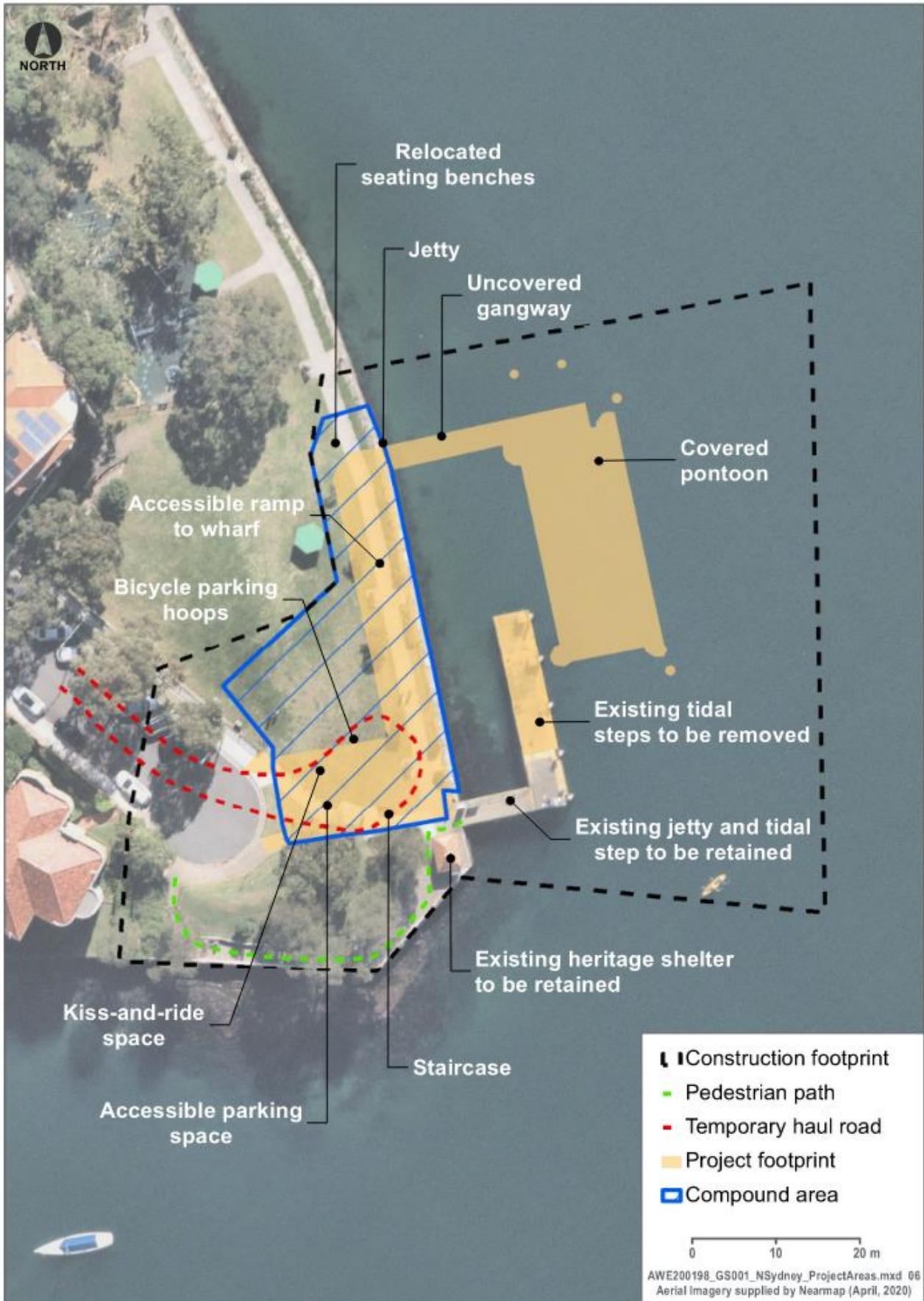


Figure 1-3 Key features of the proposal



Figure 1-4 North Sydney Wharf visualisation of proposed changes, source TfNSW 2020.

1.3 Purpose of the report

The purpose of this SEIA is to identify and assess the socioeconomic impact of the proposal and recommend management and mitigation measures to address the identified impacts. The SEIA has been prepared to inform the REF for the proposal.

This SEIA has been prepared in accordance with the Roads and Maritime Services Assessment Practice Note: Socio-economic assessment EIA-N05 (2013). The aims of this report are to:

- > Establish the baseline socio-economic conditions in the proposal area, including identifying potentially affected groups or communities, to provide a basis for predicting likely changes and future monitoring of impact management strategies
- > Identify and assess potential socio-economic benefits or impacts arising from the proposal, including the magnitude, duration and likelihood of identified benefits and impacts
- > Identify mitigation and monitoring measures, including measures to enhance the proposal's benefits and avoid, manage or mitigate its potential impacts.

1.4 Structure of this report

The structure of the report is outlined below:

- > Section 1: Introduction – introduces the proposal and scope of this report
- > Section 2: Methodology – provides a description of the study area specific to the socio-economic assessment, an overview of the socio-economic assessment methodology, and data sources used
- > Section 3: Policy setting – provides an overview of the strategic policy framework relevant to the socio-economic environment of the proposal
- > Section 4: Existing environment – provides an overview of the existing socio-economic conditions of the study area
- > Section 4: Potential impacts – provides an assessment of the potential socio-economic benefits and impacts of the proposal
- > Section 5: Safeguards and management measures – outlines the safeguards and management measures for potential socioeconomic impacts resulting from the proposal
- > Section 6: Conclusion – provides a conclusion of the findings in the socio-economic assessment
- > Section 7: References.

2 Methodology

This SEIA assesses the socio-economic impact of the proposal in accordance with Roads and Maritime Service's Environmental Impact Assessment Practice Note – Socio-economic assessment (EIA-N05) (Practice Note) (Roads and Maritime, 2013). This section provides an overview of the study area and methodology applied.

2.1 Study area

The extent of the study area for this assessment (shown in Figure 4-1) comprises the communities that have potential to experience changes due to the construction and operation of the proposal.

The local study area was defined using Australian Bureau of Statistics (ABS) geographic boundaries. The Neutral Bay – Kirribilli Statistical Area (hereafter "Study Area") has been selected to represent the Study Area for this assessment.

In practice it is clear that there are several scales of potential impact, ranging from the immediate impact to communities living close to the North Sydney Wharf, users of the Wharf and High Street, or to the broader North Sydney LGA or North Sydney region.

2.2 Data sources

The following data sources were used to define the socio-economic baseline:

- > Data on population and demography, income and employment, and business and industry were sourced from the ABS Census 2016, and Commonwealth, State and local government agencies
- > Existing socio-economic policies and strategies in the North Sydney area, including local government policies and strategies:
 - North Sydney Council Annual Report 2018/2019 (North Sydney Council, 2019a)
 - North Sydney Community Strategic Plan 2018-2028 (North Sydney Council, 2018a)
 - North Sydney Council Delivery Program 2018/19-2020/21 (North Sydney Council, 2018b)
 - North Sydney Council Operational Plan 2019/20 (North Sydney Council, 2019b)
 - Greater Sydney Harbour Estuary Coastal Management Program Scoping Study (BMT, 2018)
- > North Sydney Wharf Upgrade Concept Design Community Consultation Report – March 2020 (NSW Government, 2020). Outcomes of community consultation on the concept design of the proposal
- > Analysis of social infrastructure, based on a review of publicly available information, including Council's webpage
- > NSW Department of Planning, Industry and Environment (DPIE) population projections (DPIE, 2019)
- > Available mapping and imagery from Google maps and Cardno's spatial data store.

This assessment is informed by the following studies commissioned as part of the concept design and REF:

- > North Sydney Wharf Upgrade: Landscape character and visual impacts (Cardno, 2020a)
- > North Sydney Wharf Upgrade: Noise and vibration study (Cardno, 2020b)
- > North Sydney Wharf – Ferry Wharf Upgrade Program TAP 3 – Communications and Stakeholder Engagement Plan 2020 (Cardno, 2020c)
- > Preliminary Landscape Character and Visual Impact Assessment: Ferry Wharf Upgrade Program Package 3 North Sydney Wharf Interchange (Aurecon, 20219b).

2.3 Scope

Scoping for the proposal was undertaken in accordance with the Practice Note (EIA-N05) to identify the appropriate level of SEIA required for the proposal. After the scoping process was completed, it was concluded that a basic level of assessment would be prepared.

2.4 Consultation

The SEIA has been informed by stakeholder and community consultation undertaken for the proposal during the concept design. A summary of the consultation activities undertaken is detailed in Chapter 5 (Consultation) of the REF.

The community and key stakeholders were invited to provide feedback on the project's concept design from 2 February 2020 to 28 February 2020. Community members and stakeholders were encouraged to provide feedback, leave comments and make submissions via phone, email, or online via the project's dedicated webpage.

Two drop-in sessions were held at North Sydney Wharf on 14 February 2020 from 7am to 10am and 15 February 2020 from 11am to 2pm. The project team spoke to 55 customers, residents and local community members at these sessions.

As part of community consultation program, around 700 community updates were distributed to residents and businesses in the area.

Fifty-two submissions from individuals and one submission from an Australian Government agency were received and responses have been detailed in the North Sydney Wharf Upgrade Concept Design Community Consultation Report – March 2020 (NSW Government, 2020).

The responses have been analysed, along with local council plans, to gain insights into community identity, values and goals, and the community's perception about the potential impacts associated with the proposal.

3 Legislative and policy framework

This section provides an overview of the strategic policy framework relevant to the proposal, including State, regional and local government policies and strategies relevant to the socio-economic environment of the Study Area.

3.1 NSW legislation and policies

3.1.1 Greater Sydney Region Plan: A Metropolis of Three Cities

The Greater Sydney Region Plan, A Metropolis of Three Cities (Greater Sydney Commission, 2018a) is built on a vision of three cities where most residents live within 30 minutes of their jobs, education and health facilities, services and great places. The Greater Sydney Regional Plan consists of directions, objectives and strategies to meet the needs of a growing and changing population over the next 40 years.

To meet the needs of a growing and changing population the Greater Sydney Region Plan seeks to transform Greater Sydney into a metropolis of three cities, where the Study Area is located in the proposed Eastern Harbour City. The Harbour CBD is identified as the metropolitan centre of Eastern Harbour City, where North Sydney Wharf is part of. The Plan states that the Harbour CBD, “will focus on innovation and global competitiveness to underpin its continued growth. It will extend its capabilities with an emerging Innovation Corridor on its western edge comprising universities, a major teaching hospital, international innovation companies and fast-growing start-ups.”

Directions, objectives and strategies which are of particular importance to this proposal are discussed below in Table 3-1.

Table 3-1 Directions, objectives and strategies relevant to the proposal (Greater Sydney Commission, 2018a)

Direction 1 A city supported by infrastructure: Infrastructure and collaboration	
Objectives	Objective 1: Infrastructure supports the three cities
Strategy	Strategy 1.1: Prioritise infrastructure investments to support the vision of A Metropolis of Three Cities.
Extracts from the Plan	<p>“Providing adequate infrastructure to support population growth is essential to creating strong communities. One mechanism to better align growth with infrastructure is the growth infrastructure compact which would assess the nature, level and timing of infrastructure required for an area in light of its forecast housing and employment growth, including analysis of growth scenarios. This approach would demonstrate the correlation between growth and infrastructure, such as public transport, schools and open space, to allow for timely integration and more effective expenditure on infrastructure by location. The sequencing, optimising and adaptability of infrastructure are also considered as part of managing infrastructure delivery with growth.”</p> <p>“Planning decisions need to support new infrastructure in each city – including cultural, education, health, community and water infrastructure – to fairly balance population growth with infrastructure investment. Decisions are required to equitably enhance local opportunities, inclusion and connection to services. In this way infrastructure provision can move from a focus on network-based services to a place-based service approach.”</p>
Direction 3 A city for people: Celebrating diversity and putting people at the heart of planning	
Objectives	Objective 7: Communities are healthy, resilient and socially connected
Strategy	<p>Strategy 7.1: Deliver healthy, safe and inclusive places for people of all ages and abilities that support active, resilient and socially connected communities by:</p> <ul style="list-style-type: none"> ▪ providing walkable places at a human scale with active street life ▪ prioritising opportunities for people to walk, cycle and use public transport.
Extracts from the Plan	<p>“Mixed-use neighbourhoods close to centres and public transport improve the opportunity for people to walk and cycle to schools, local shops and services.”</p> <p>“Physical, social and spatial accessibility is important across all ages and abilities and is a key part of planning for a female-friendly region. A region that is female-friendly applies the principles of Crime Prevention Through Environmental Design and is safer and more accessible for all people. Places and transport designed to be accessible by all people, and homes that can be easily adapted to house older people and people with a disability, are increasingly required as the population grows and demographics change.”</p>

Direction 6 A well-connected city: Developing a more accessible and walkable city	
Objectives	Objective 14: A Metropolis of Three Cities – integrated land use and transport creates walkable and 30-minute cities
Strategy	Strategy 14.1: Integrate land use and transport plans to deliver the 30-minute city. Strategy 14.3 Support innovative approaches to the operation of business, educational and institutional establishments to improve the performance of the transport network.
Extracts from the Plan	“Establish a metropolitan transport network which reinforces the metropolis of three cities, particularly the delivery of a 30-minute city where most residents in each city can access their metropolitan centre or cluster within 30 minutes by public transport.” “Greater Sydney transport survey outcomes: fully accessible transport for all customers”

The proposal supports the objectives and strategies of the Greater Sydney Region Plan by:

- > Planning for the future when the population around the North Sydney Wharf is increasing and the demand for the ferry services are higher, necessitating the upgrade of the Wharf infrastructure
- > Upgrading North Sydney Wharf infrastructure to accessible platforms where the ferry services can be comfortably accessed by all customers.

3.1.2 Disability Inclusion Action Plan 2018-2022

The Disability Inclusion Action Plan 2018–2022 is Transport for NSW’s plan for delivering high quality services to all customers including those with disability, including compliance with the Federal disability standards. The Disability Standards for Accessible Public Transport (DSAPT, 2002) and Disability (Access to Premises – Buildings) Standards (2010) form part of the DDA. Each prescribe the minimum accessibility standards for disabled access to public transport services and infrastructure, including a timetable for implementation. The proposal meets the above requirements within the timeframes specified in both standards by providing suitable access for people with a disability.

3.1.3 Transport Access Program (TAP)

The Transport Access Program (TAP) is an ongoing ‘initiative to deliver modern, safe and accessible transport infrastructure’ in NSW (Transport for NSW, 2015). The focus of the program is improving access to the transport network for less mobile passengers. As a result, Roads and Maritime (now Transport for NSW) assessed the condition of all ferry wharves across the transport network in 2009 in terms of: safety and structural integrity, access for less mobile and disabled passengers and existing and predicted future patronage and use.

The aims behind the objective of the TAP are to:

- > Improve the accessibility for passengers who use wheelchairs and prams by removing stairs and supplying ramps
- > Build facilities for all transport modes to meet the needs of a growing population
- > Provide an effective and seamless interchange that supports an integrated transport network
- > Deliver safety and signage improvements to help with the customer user experience
- > Provide other aesthetic improvements.

The Ferry Wharf Upgrade Program forms part of the TAP and its objectives are to:

- > Improve access for less mobile people
- > Improve passenger amenity
- > Improve passenger embarking/disembarking times
- > Develop an iconic design across the commuting wharf network
- > Cater for current and future passenger numbers
- > Minimise customer and wharf operator impact during any refurbishment and upgrade work

- > Minimise ownership and maintenance costs
- > Ensure the design complies with current safety laws
- > Discourage inappropriate activities on public wharves
- > Aim to comply with the DDA by 2022.

The proposal meets the TAP objectives within the timeframes specified above by providing suitable access for people with a disability.

3.1.4 Our Greater Sydney 2056: North District Plan

The North District Plan (Greater Sydney Commission, 2018b) sets out the NSW Government's strategy for accommodating Sydney's future population growth in the northern part of Sydney over the next 20 to 40 years.

The North District forms a large part of the Eastern Harbour City, and its economy leans to the Harbour CBD, which is the North District's metropolitan centre. The Harbour CBD includes North Sydney and contains half a million jobs, making it the largest office market in the region. The North District Plan addresses issues influencing Greater Sydney to 2056 with one of the overarching priorities for a productive North District including improved access to local jobs, goods and services within a 30-minute commute via public transport.

Planning Priority N3 includes providing services and social infrastructure, which mainly focus on people's changing needs and accessibility. The North District has over 27,500 people with disability. Therefore, public places such as streets, parks, shopping precincts and community facilities should be designed so that people of all ages and abilities can participate in community life.

The Plan focusses on accessibility, inclusion and safety when designing and building neighbourhoods, public transport and transport interchanges, places and homes, to encourage a greater cross-section of people to lead physically active and socially connected lives. This is especially important to the health of people ageing in community and also benefits people with a disability and families.

The proposal supports the priorities and actions of the North District Plan by improving and modernising North Sydney Wharf infrastructure and making the ramps accessible to people with mobility issues.

3.1.5 Sydney's Ferry Future: Modernising Sydney's Ferries 2013

Published in 2013, the Sydney's Ferry Future plan acknowledges, and builds on, the TAP and the ferry wharf upgrade program by outlining the short and long-term initiatives for getting the most out of the "ferry network today while investing in the infrastructure and services to attract more passengers in the future" (NSW Government, 2013). The plan:

- > Focuses on short-term timetable, service and infrastructure improvements and the long-term expansion of the network
- > Reinforces the need to upgrade wharf infrastructure and make it more accessible in line with the TAP.

This proposal responds to this plan by improving and modernising infrastructure, responding to efficiencies by creating accessible pathways, and increasing the available car parking spaces.

3.1.6 NSW Long Term Transport Master Plan (2012)

The Long Term Transport Master Plan (NSW Government, 2012) provides the framework for delivering an integrated, modern transport system across NSW over the next 20 years. It identifies transport actions and investment priorities over the short, medium and long-term that have emerged in response to six identified transport challenges. The master plan is clear in identifying the need to:

- > Cater for a 31 per cent increase in people travelling into and out of Sydney city centre during peak periods by 2031 from 2021
- > Provide improvements in public transport services and accessibility across the network to cater for the expected increase in the commuting population.

Upgrading and expanding the ferry wharf network are two recognised ways that support meeting the above objectives. As such, the proposal directly responds to this by providing improved and safer access for ferry passengers at North Sydney Wharf, and improving the capacity of the ferry network.

3.2 North Sydney Council

The North Sydney Council strategic plans relevant to the proposal are discussed below in Table 3-2.

Table 3-2 The North Sydney Council strategic plans relevant to the proposal

North Sydney Community Strategic Plan 2018-2028	<p>The North Sydney Community Strategic Plan 2018-2028 sets the future direction for the community of North Sydney. For enforcing Community Strategic Plan into practice, Council has prepared North Sydney Council Delivery Program 2018/19-2020/21.</p> <p>The Community Strategic Plan has reflected that North Sydney is a connected, inclusive, healthy and safe place and therefore, under the Delivery Program, one of the key strategy components is to implement the NSW Disability Inclusion Action Plan via the Access and Inclusion Officer.</p>
North Sydney Local Strategic Planning Statement (LSPS) 2020	<p>The LSPS sets out Council's land use vision, planning principles, priorities, and actions for the next 20 years. It outlines the desired future direction for housing, employment, transport, recreation, environment and infrastructure for the North Sydney LGA.</p>
North Sydney Foreshore Access Strategy 2007	<p>Identifies opportunities to improve access to North Sydney's foreshore for a range of recreational users including pedestrians, cyclists and recreational boaters. The strategy also identifies an access plan and establishes priorities for ongoing implementation and enhancement of existing access.</p>

The proposal supports the priorities and actions sets out in North Sydney Council's strategic plans by improving and modernising North Sydney Wharf infrastructure and making the ramps accessible to people with mobility issues.

4 Existing socio-economic environment

The section provides an overview of the socio-economic characteristics of the Study Area. This background study was informed by the Australian Census of Housing and Population (ABS) Census 2016 and the NSW Government's Transport and Performance Analytics (TPA) data.

For the purpose of defining a boundary for assessing social and economic characteristics, ABS geographic boundaries referred to as Statistical Areas Level 2 (SA2s) have been used (identified in section 4.1.2), and the North Sydney LGA was used as a comparison.

4.1 Overview of the regional and local socio-economic context

4.1.1 Regional context

The proposal is located within the North Sydney LGA. The LGA is about 1050 hectares. In the 2016 Census, there were 67,658 people in the LGA. Of these 47.2 per cent were male and 52.8 per cent were female. Aboriginal and/or Torres Strait Islander people made up 0.3 per cent of the population. The median age of people in the North Sydney LGA was 37 years. Children aged 0 - 14 years made up 12.6 per cent of the population and people aged 65 years and over made up 14.4 per cent of the population. The North Sydney LGA is predominantly a residential area, but also has substantial commercial areas. Over two-thirds of housing is medium-density units, townhouses, semi-detached dwellings and terrace houses. There were 42,004 people who reported being in the labour force and of these 71.3 per cent were employed full time, 21.1 per cent were employed part-time and 3.7 per cent were unemployed.

4.1.2 Study Area

The proposal is situated in the Neutral Bay – Kirribilli Statistical Area (refer Figure 4-1). It is an area of 220 hectares within the North Sydney LGA. The Neutral Bay – Kirribilli Statistical Area (the Study Area) includes the suburbs of Kirribilli, Neutral Bay, Kurraba Point and North Sydney (eastern section only). The proposal is located in the suburb of North Sydney.

The Study Area is bounded by Ernest Street, Grosvenor Street and Martens Lane in the north, the Warringah Freeway, Sydney Harbour Tunnel and Cahill Expressway in the west, the suburb of Kirribilli and Neutral Bay in the south and Military Road, Rangers Road, Yeo Street, Rangers Lane, Bennett Street, Burroway Street, Bannerman Street, Milson Road, Bogota Avenue and Mosman Bay in the east.

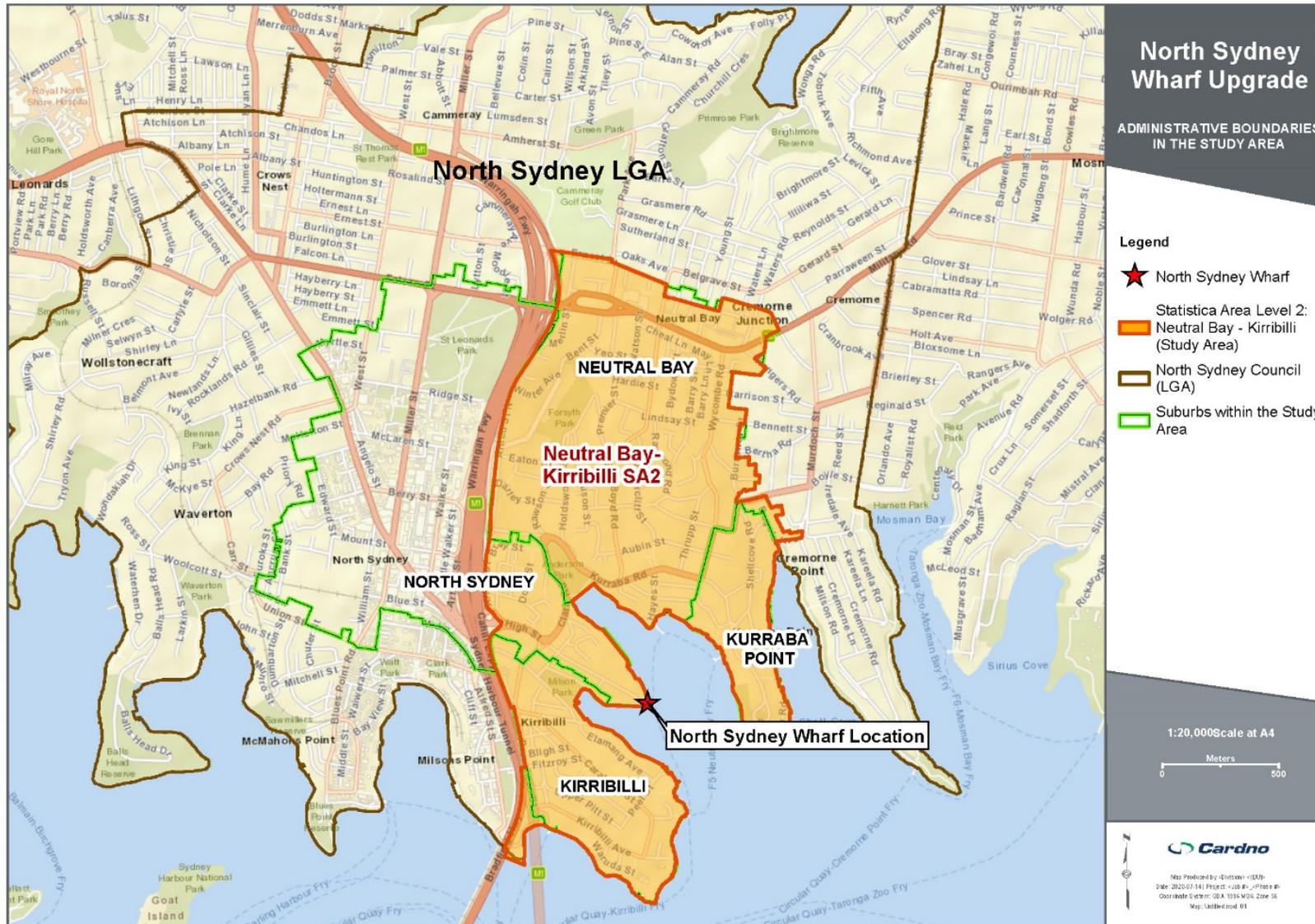


Figure 4-1 Administrative boundaries of the Study Area: Neutral Bay – Kirribilli Statistical Area (SA2-121041416)

4.2 Population and demography

A demographic profile for the Study Area and North Sydney LGA (Table 4-1) was developed based on a review of ABS Census Data (2016).

Table 4-1 Demographic and social characteristics of the Neutral Bay – Kirribilli Statistical Area (ABS 2016 Census)

Sub-category	Indicator	Neutral Bay – Kirribilli Statistical Area	North Sydney LGA
Population size	Population Total	17,852	67,658
	Male	8,366 (47%)	31,910 (47.2%)
	Female	9,494 (53%)	35,744 (52.8%)
Age	Babies and pre-schoolers (0-4)	5%	6%
	Primary and secondary schoolers (5-19)	8%	10%
	Tertiary education and independence (20 to 24)	5%	5%
	Young workforce (25 to 34)	25%	24%
	Parents and homebuilders (35 to 54)	30%	30%
	Older workers and pre-retirees (55 to 64)	11%	11%
	Empty nesters and retirees (65 to 74)	9%	9%
	Seniors (75 to 84)	5%	4%
	Elderly aged (85 and over)	3%	2%
	Median age of persons	38	37
	Average household size	1.9	2
Cultural Diversity	Aboriginal and Torres Strait Islander population	0.3%	0.3%
	Proportion of people who speak a language other than English at home	28%	25%
	Top three languages other than English spoken in the home	Mandarin, Cantonese and French	Mandarin, Cantonese and Japanese
People with disability	People with need for assistance (percentage of the total population)	3%	2%
Dwelling Structures	Separate house	8%	11%
	Semi-detached, row or terrace house, townhouse etc	10%	14%
	Flat or apartment	82%	74%
	Other dwelling	0.2%	0.2%
Tenure Type	Median mortgage repayment (per monthly)	\$2500	\$2600
	Home owners (outright)	24%	25%
	Home owners (with a mortgage)	18%	22%
	Renters	55%	51%
Primary methods of travel to work	People who travelled to work by public transport	40%	39%
	People who travelled to work by car as driver or passenger	34%	33%
	Walked only	11%	11%
	Worked at home	6%	6%
	Ferry as the primary method of travel to work	2%	2%
	Train as the primary method of travel to work	14%	17%

Sub-category	Indicator	Neutral Bay – Kirribilli Statistical Area	North Sydney LGA
	Bus as the primary method of travel to work	16%	16%
People who use multiple methods to travel to work	Combination of train and ferry as method of travel to work	1%	1%
	Combination of bus and ferry as method of travel to work	0.4%	0.3%

4.2.2 Population and growth

At the time of the 2016 Census, the Study Area had an estimated residential population of about 17,852 people, of these 47 per cent were male and 53 per cent were female. Aboriginal and/or Torres Strait Islander people made up 0.3 per cent of the population.

About 795 people live in the neighbourhoods closest to the North Sydney Wharf (Figure 4-2 and Figure 4-3). In 2016, about 495 were recorded to live in the area (SA1–1141619) north of the High Street and 300 people live south of the High Street (SA1–1141608).



Figure 4-2 Level 1 Statistical Area (SA1) 1141619 north of the High Street

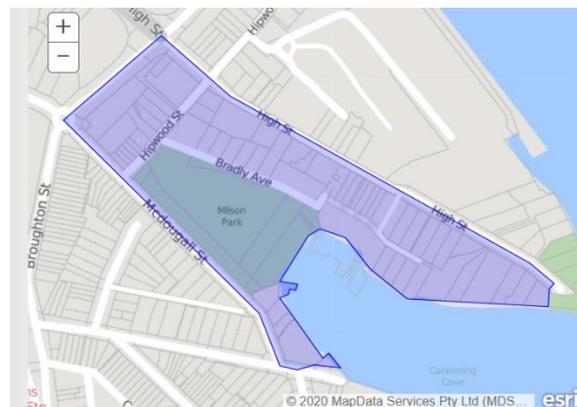


Figure 4-3 Level 1 Statistical Area (SA1) 1141608 south of the High Street

Source: Australian Bureau of Statistics 2016

The Study Area experienced a seven per cent population growth between 2011 and 2016. This is lower than the rate of population growth in the North Sydney LGA (9%) and Greater Sydney (10%) for the same period.

In 2018 North Sydney LGA estimated population was 74,172. By 2036, the population of North Sydney LGA is forecast to grow by 11%, which is 84,422 people (North Sydney Council, 2019).

4.2.3 Age and cultural diversity

In 2016 the median age of the Study Area population was 38 years. In 2016, Study Area had a relatively high proportion (25%) of young workforce when compared to North Sydney LGA (24%). However, in 2016 North Sydney LGA had a considerably low primary and secondary schoolers when compared to North Sydney LGA and State. Young workforce population in 2016 were higher in both Study Area and North Sydney LGA when compared to the State.

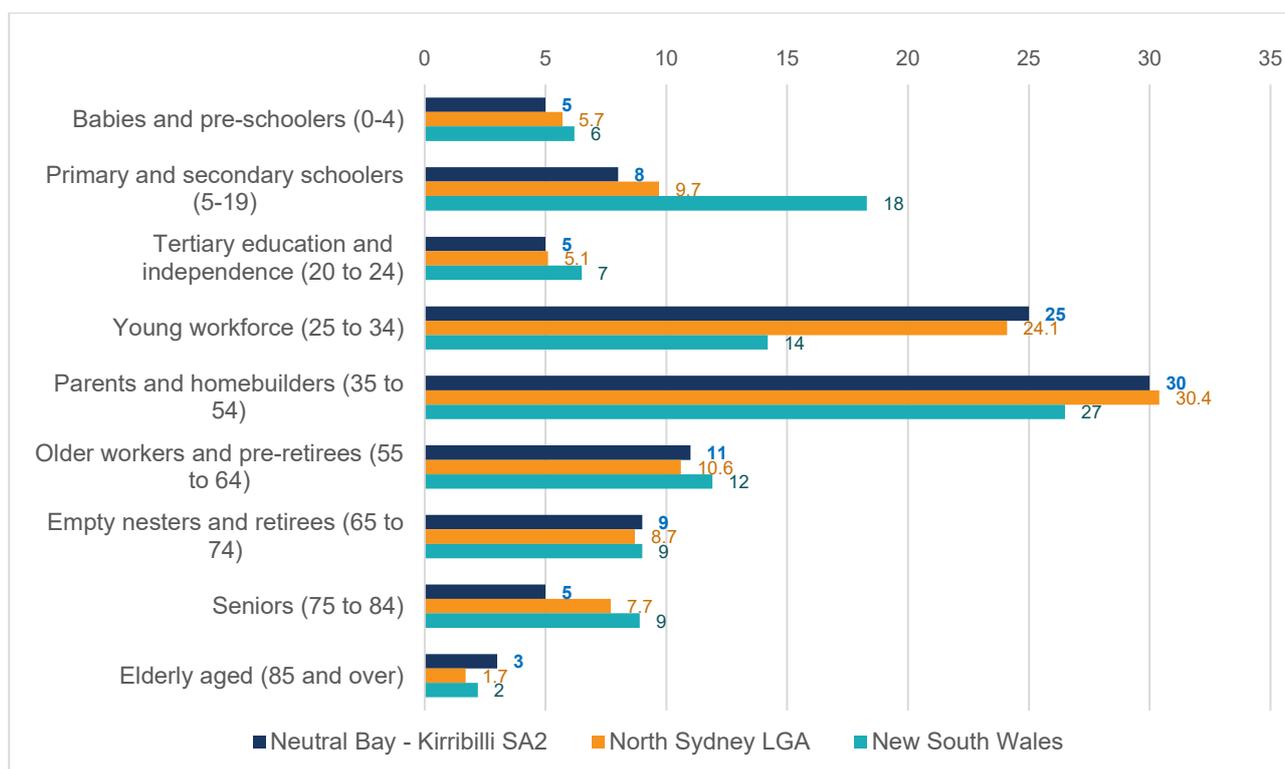


Figure 4-4 Age distribution of population in the Study Area (Neutral Bay – Kirribilli SA), compared with North Sydney LGA and NSW in 2016

Source: Australian Bureau of Statistics 2016

Most of the Study Area’s residents were born in Australia (55%) with majority of the remaining population were born in England, New Zealand, China (excludes Hong Kong, Macau and Taiwan), United States of America and India. The Study Area is culturally diverse with descendants from various countries. The most common ancestries in the Study Area were English 26 per cent, Australian 16 per cent, Irish 10 per cent, Scottish 8 per cent and Chinese 5 per cent.

About 28 per cent of residents speak another language other than English at home, with other languages including Mandarin, Cantonese and French. Comparatively there is a low proportion of Aboriginal residents (0.3%) in both Study Area and North Sydney LGA, when compared to Greater Sydney (1%).

4.2.4 Families and households

When compared to the North Sydney LGA, the Study Area generally had a low proportion of couple families with children, with this group comprising about 31 per cent of families compared to about 34 per cent in North Sydney LGA. In 2016, 54 per cent were couple families without children and 10 per cent were one parent families in the Study Area. Majority of one parent households consists of single female parent households (81%) in the Study Area.

4.2.5 Housing

In 2016, the majority of residents of the Study Area lived in flats or apartments (82%) and eight per cent lived in separate houses. Of the occupied private dwellings, the majority of them consists of 1 bedroom (26%). About 24 per cent of dwellings in the Study Area were owned outright, 18.4 per cent were owned with a mortgage and 54.9 per cent were rented. In 2016, North Sydney LGA had a slightly high house ownership than in the Study Area and this reflects in the high number of renters in the Study Area. When compared to North Sydney LGA, the Study Area had a low percentage of family households, about 54 per cent, versus 58 per cent in North Sydney LGA.

4.2.6 Socio-economic Indices for Areas (SEIFA)

Socio-Economic Indexes for Areas (SEIFA) is developed by the ABS to ranks areas in Australia according to relative socio-economic advantage and disadvantage based on Census data. SEIFA can help governments, communities and businesses determine areas needing additional funding and improved services, identify potential business opportunities, and research the relationship between health and education outcomes and the socio-economic conditions of an area.

SEIFA 2016 has been created from Census 2016 data and consists of four indices: The Index of Relative Socio-economic Disadvantage (IRSD); The Index of Relative Socio-economic Advantage and Disadvantage (IRSAD); The Index of Education and Occupation (IEO); The Index of Economic Resources (IER). IRSAD and IER have been used for this assessment.

The IRSAD summarises information about the economic and social conditions of people and households within an area, including both relative advantage and disadvantage measures.

Table 4-2 shows the SEIFA indices for the Study Area in 2016. The Study Area has IRSAD score of 1,148, indicating a relative lack of disadvantage and greater advantage in general. This may indicate there are many households with high incomes, or many people in skilled occupations, and few households with low incomes, or few people in unskilled occupations.

Table 4-2 SEIFA scores for the Study Area (ABS, 2016)*

2016 Statistical Area Level 2 (SA2) Name	Index of Relative Socio-economic Disadvantage		Index of Relative Socio-economic Advantage and Disadvantage		Index of Education and Occupation		Usual Resident Population
	Score	Decile	Score	Decile	Score	Decile	
Neutral Bay - Kirribilli	1098	10	1148	10	1190	10	17,852

* SEIFA 2016 scores created from Census 2016:

[https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~SOCIO-ECONOMIC%20INDEXES%20FOR%20AREAS%20\(SEIFA\)%202016~1](https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~SOCIO-ECONOMIC%20INDEXES%20FOR%20AREAS%20(SEIFA)%202016~1)

4.2.7 Transport and access

The majority of the employed residents (40%) of the Study Area used public transport (train, bus, ferry, tram/light rail) as at least one of their methods of travel to work and 34 per cent travelled by car (either as driver or as passenger). The majority of residents travel to work via bus (16%) and 2 per cent of residents travel to work via ferry. When compared to Greater Sydney (20%), a high proportion of residents rely on public transport to reach work in the Study Area (40%). This reflects the Study Area's high level of access to bus, rail and ferry services.

Road network

North Sydney Wharf is located to the east of the Warringah Freeway and can be accessed through the Kesterton Park from High Street, which runs along the ridge of the peninsula terminating at the Wharf. The road network within the vicinity of the Wharf is characterised by residential streets with on-street and off-street parking.

Bus network

There are three bus stops within a 500 metres radius of the Wharf (around five minutes walking time); two are located on Clark Road and one on High Street on the northern side of the intersection of High Street and Clark Road. There are two bus routes that travel along Clark Road: routes 263 and 269.

Route 263 (refer to Figure 4-5) travels between Crows Nest and the CBD passing through the suburbs of Cammeray, Cremorne, Neutral Bay, North Sydney and Milsons Point. The route caters to public transport users who live in residential areas away from the arterial Military Road movement corridor. The service frequency ranges between 15 minutes and 45 minutes from Monday to Friday, and 45 minutes and 70 minutes on weekends.

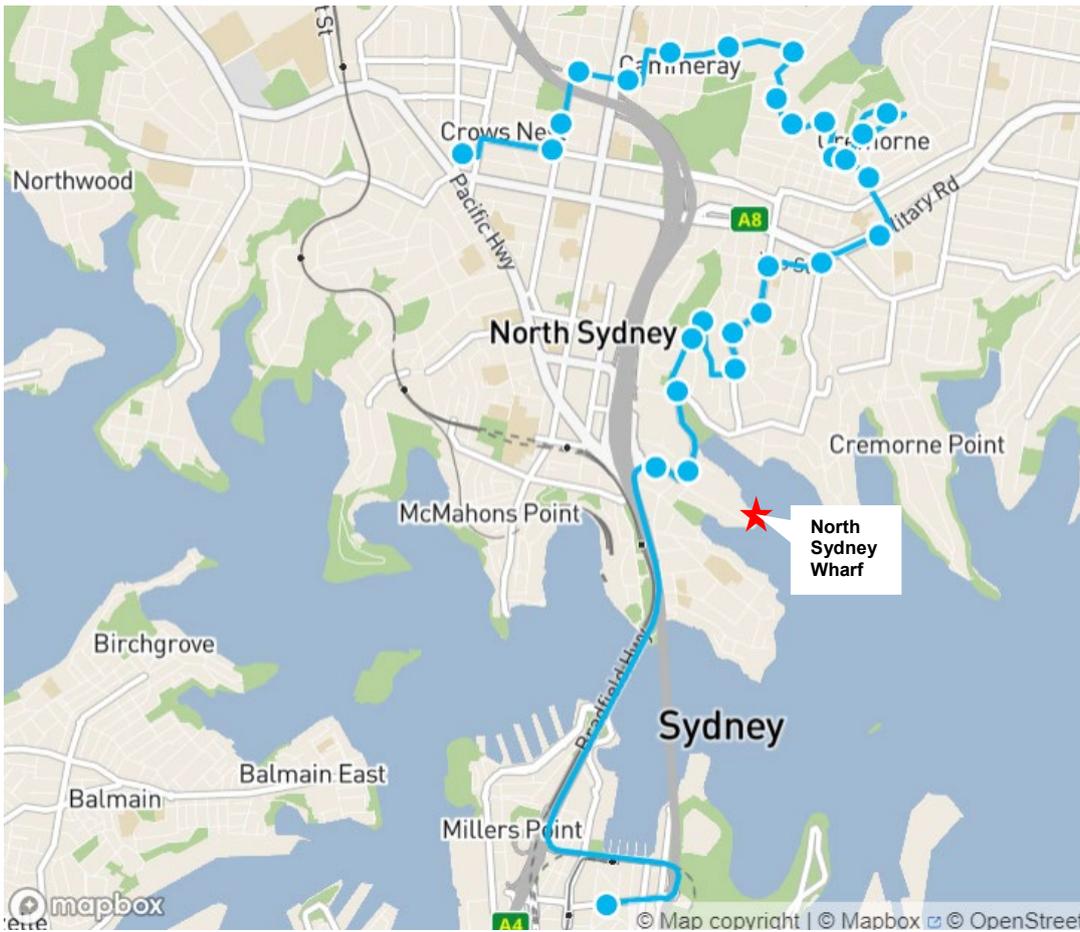


Figure 4-5 Sydney Buses Network – Route 263 (Transport for NSW website <https://transportnsw.info/routes/details/sydney-buses-network/263/28263>)

Route 269 (refer to Figure 4-6) follows a circular route between McMahon's Point through North Sydney, Kirribilli, Milsons Point and back through North Sydney to terminate at McMahon's Point. It is designed as a local route connecting passengers between four ferry wharves and two train stations along Sydney's Lower North Shore. The circular route is segmented into two components. The first connects McMahon's Point to North Sydney Station through Kirribilli and Milsons Point. The second conducts the return journey from North Sydney Station back to McMahon's Point. This route 269 runs hourly Monday to Friday (between 8.30am to 5.15pm) and does not operate on the weekend or public holidays.

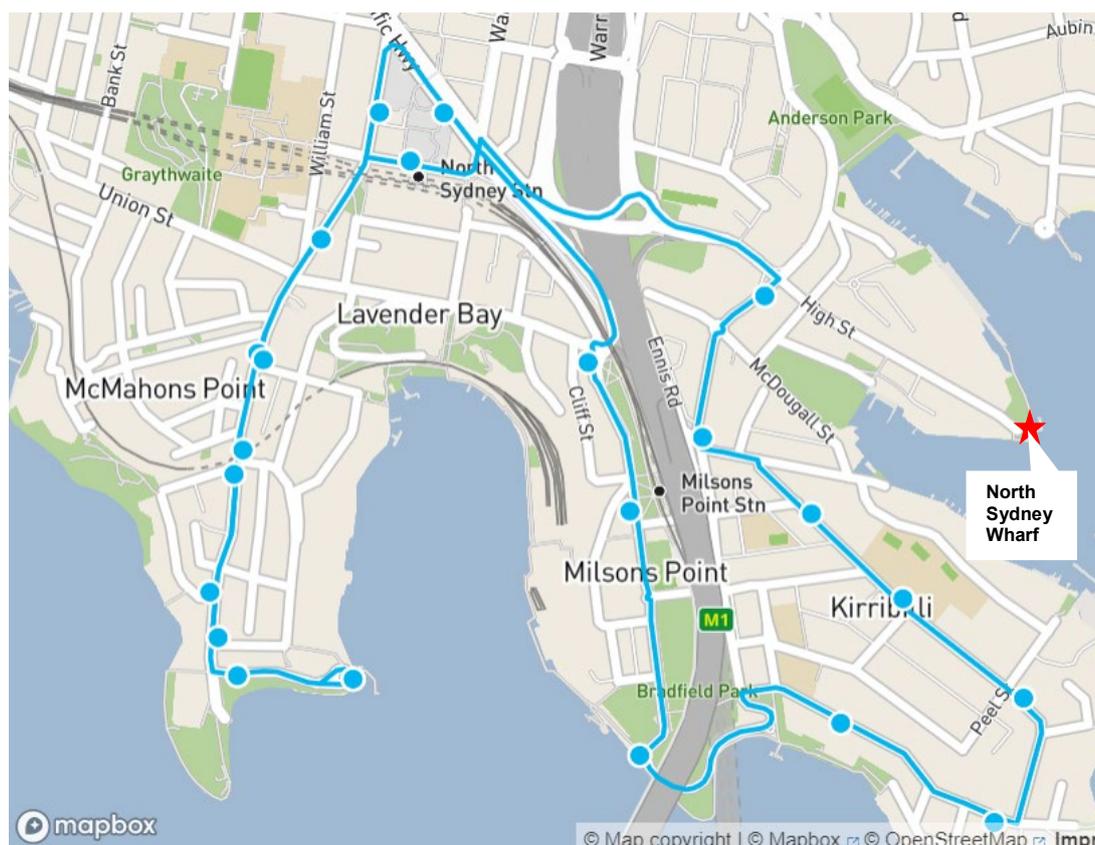


Figure 4-6 Sydney Buses Network – Route 269 (Transport for NSW website <https://transportnsw.info/routes/details/sydney-buses-network/269/26269>)

Train network

Milsons Point station and North Sydney station are located 1.1 kilometres and 1.2 kilometres (walking distance) away from the Wharf, respectively. Both stations are on the T1 North Shore, Northern and Western Line, providing connectivity to Hornsby, Epping, Penrith and Richmond. The frequency of services along this line ranges from three minutes between trains during peak period and 10 minutes during off-peak periods.

Bicycle network

Unmarked bicycle routes established by North Sydney Council are signposted along Clark Road, Alfred Street, Broughton Street and the Pacific Highway. These bicycle routes provide connectivity to Milsons Point and North Sydney stations and towards Military Road in the north. Access for cyclists travelling to and from the Wharf requires connectivity to the local bicycle network via High Street. No bicycle parking hoops or secure lockers are currently provided at the Wharf.

Pedestrian access

Pedestrian access to the Wharf is along High Street with local streets branching off into low-density residential areas. A concrete footpath is available along both sides of High Street from Kesterton Park to Clark Road. High Street has an average slope of 2.5 per cent between the Wharf and Clark Road, making it wheelchair accessible.

Ferry network

North Sydney Wharf forms part of Sydney’s extensive ferry network which consists of 28 vessels serving eight routes and 39 wharves around the Sydney harbour and along the Parramatta River (TfNSW, 2013). Neutral Bay ferry service operate from Kirribilli, North Sydney and Neutral Bay wharves to Circular Quay in the city (Figure 4-7).

According to the Household, Income and Labour Dynamics in Australia (HILDA) survey, Sydney had the longest average daily commutes, reaching approximately 71 minutes in 2017 (Wilkin et al, 2019). The ferry

network in Sydney provide important cross harbour links, extra capacity and often provide much faster access to the City than busses.

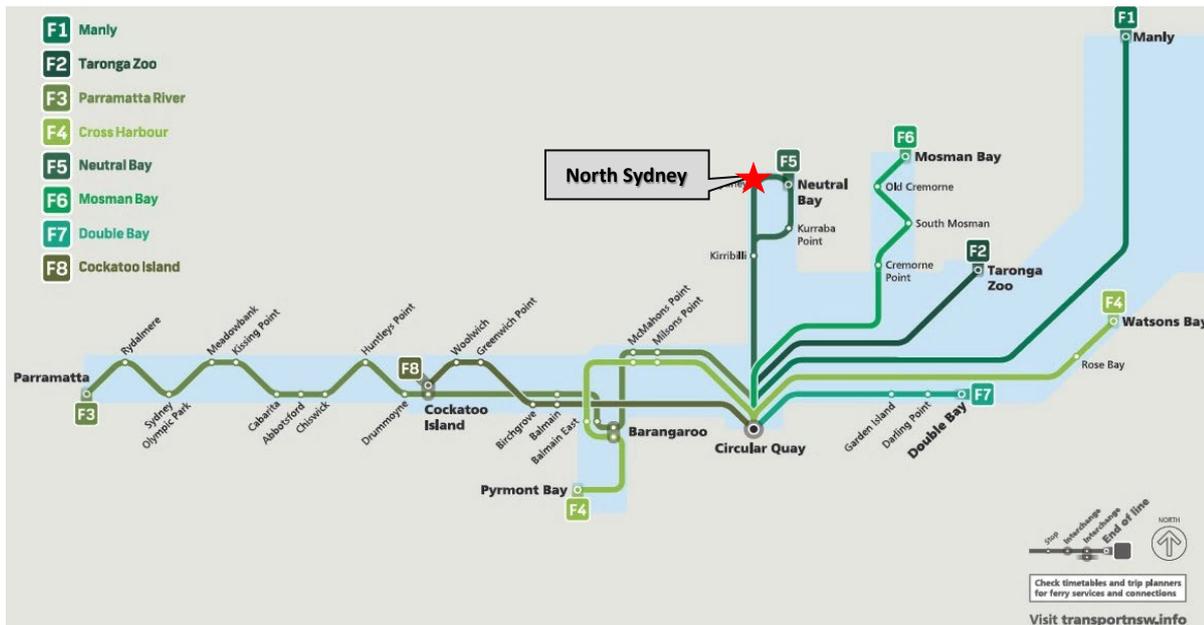


Figure 4-7 Sydney Ferries Network map with North Sydney Wharf highlighted
Source: TfNSW 2017.

Around 16 million trips were made on the Sydney ferries network in 2019 (calculated using Opal Ferry Trips) and both Manly (F1) and Cross Harbour (F4) are the most popular routes. Neutral Bay line (F5) made about 565,000 trips in 2019 which represents four per cent of the total trips made on the ferry network (TfNSW, 2020).

North Sydney Wharf had the lowest number of total passengers boarding and alighting compared with the other wharves in 2017 (Aurecon, 2019a). Using 2017 opal card data, the maximum number of boarding and alighting passengers in an hour over a 10-month in 2017 was 38, which is much lower than the other wharves.

Table 4-3 Peak hour patronage at North Sydney Wharf in 2017 (Aurecon, 2019a)

Peak hour of week (day and hour)	2017 patronage/hour			Special events maximum patronage (total boarding and alighting)
	Boarding	Alighting	Total	
Friday, 08:00-09:00	10	1	11	38

Future patronage forecasted for the North Sydney Wharf is shown in Table 4-4. The future patronage was calculated using the information on population and employment forecasts for areas surrounding the Wharf and adding a further 15 per cent to the highest average forecasted for 2036 (Aurecon, 2019a).

Table 4-4 Future patronage forecasted for the North Sydney Wharf (Aurecon, 2019a)

Peak hour of week	2036 + 15per cent patronage/hour			Special events maximum patronage
	Forecast opal activity in highest average one hour period in year			Maximum patronage/ hour 2036 +15%
Day and hour	Boarding	Alighting	Total	Total boarding + alighting
Friday 8am – 9am	15	2	17	58

Currently, North Sydney Wharf functions simply as a local wharf with minimal connectivity to other public transport modes due to its proximity to strategic corridors and hubs and the predominantly residential character of surrounding land use. This, combined with the steep topography of the surrounding area, constrains the Wharf's patronage potential. However, since Sub Base Platypus opened for public this may attract further visitors to the area.

4.3 Economic profile

Table 4-5 summarises the employment profile of the Study Area.

Table 4-5 Economic profile of the Neutral Bay – Kirribilli Statistical Area (ABS 2016 Census)

Sub-category	Indicator	2016 census
Income	Median total household income (\$/weekly)	2,265
	Median total personal income (\$/weekly)	1,366
Employment	Worked full-time	71%
	Worked part-time	21%
	Away from work	4%
	Unemployed	4%
	Top three industries of employment	Professional, Scientific and Technical Services - 21% Financial and Insurance Services - 13% Health Care and Social Assistance - 9% Computer System Design and Related Services – 5% Banking – 4% Legal Services – 3.8%
	Top three professions	Professionals - 43% Managers – 21% Clerical and administrative workers – 13%

4.3.2 Income and employment

In 2016 the median weekly household income in the Study Area was \$2,265. This was slightly lower than that of the North Sydney LGA (\$2,360).

About 71 per cent of the Study Area's labour force was employed full time and about 21 per cent were employed part time. This correlates with the relatively high proportion (25%) of young workforce in the Study Area. The most common occupations in the Study Area include professionals (43%), managers (21%) and clerical and administrative workers (13%). People in the Study Area mainly worked for the professional, scientific and technical services and financial and insurance industry sectors.

4.3.3 Local business and services

The Study Area is comprised of large (2,969) (ABS 2016 data) number of local businesses due to the close proximity to the Sydney Central Business District. The largest employing industries are: Professional, Scientific and Technical Services.

The only local business within close proximity to the Wharf is Sub Base Platypus centre.

The historic Sub Base Platypus High Street entrance is located 250 metres from the North Sydney Ferry Wharf. The Sub Base Platypus a former Royal Australian Navy submarine base is located at 118 High Street with moorings in Neutral Bay, and travel between the base and Wharf is possible for pedestrians along the waterfront via Kesterton Park (Kesterton Boardwalk). The Sub Base Platypus site which extends over a large portion of the waterfront dominate the western shore of Neutral Bay (Harbour Trust, 2020).

The HMAS Platypus submarine base was decommissioned in 1999 and subsequently transferred to the Sydney Harbour Federation Trust in 2005 (Harbour Trust, 2020). Since mid-2018 the site was formally renamed as Sub Base Platypus and open to public for various uses "providing a range of facilities and venues for cultural performances, function areas, cafés and restaurants, as well as offices and commercial

spaces" (Tan, 2017). Sub Base Platypus has been designed for accessibility from the North Sydney Wharf (via Kesterton Boardwalk) and from the High Street entrance.

Local businesses and service providers within 500 metres of the proposal are shown in Figure 4-8. Main types of local businesses and service providers within 500 metres include:

- > Loreto Kirribilli School
- > Ensemble Theatre – performing arts theatre
- > Lansdowne Gardens – Aged care services.
- > Carnarvon Lodge Kirribilli – guest house
- > Glenferrie Lodge – guest house
- > Various café's and restaurants
- > Various marinas and other boating clubs:
 - Kirribilli Marina
 - Sydney Flying Squadron Ltd
 - Royal Sydney Yacht Squadron.

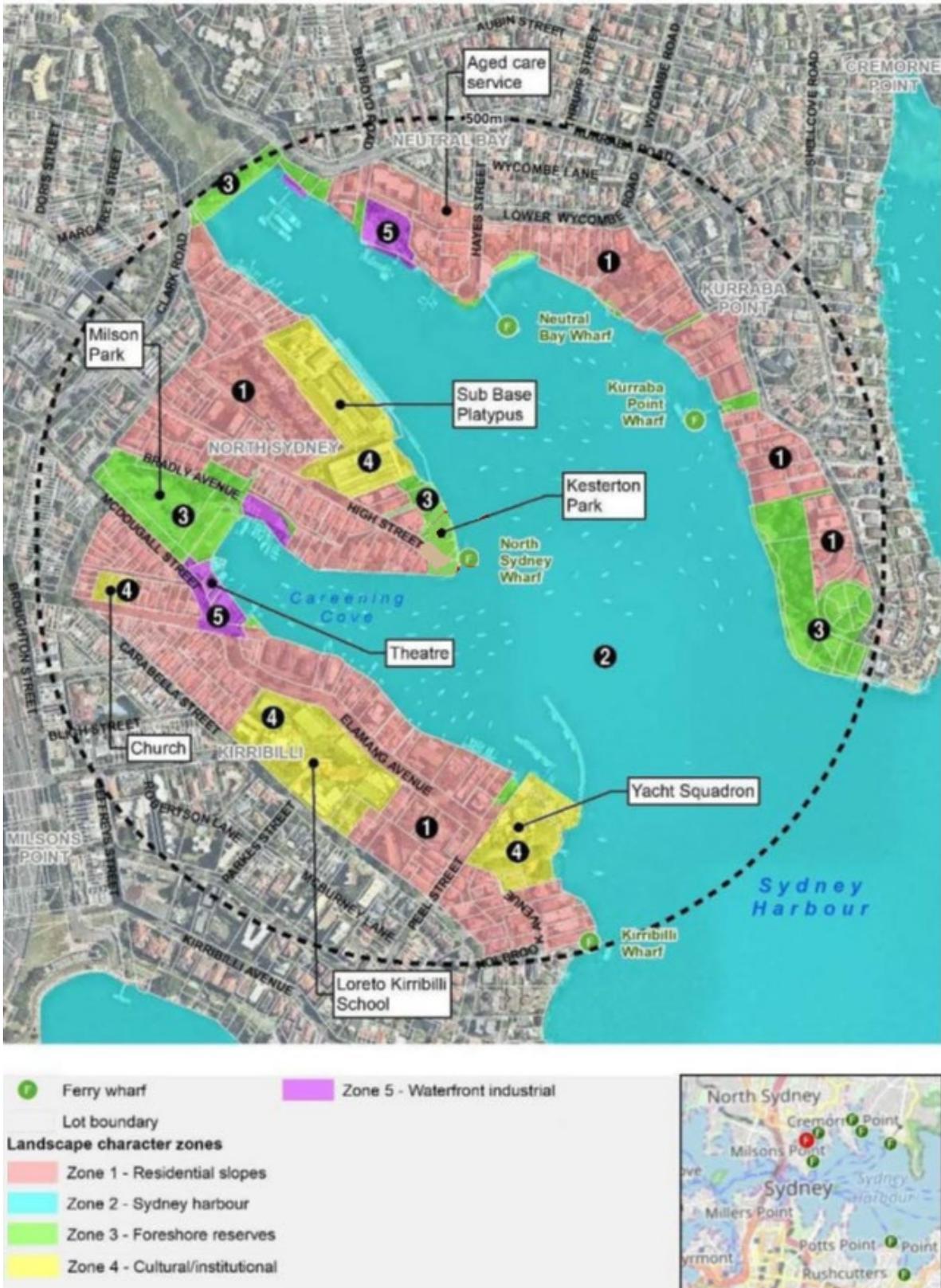


Figure 4-8 Local businesses and service providers within the Study Area (Aurecon, 2020a)

4.4 Social infrastructure

Social infrastructure refers to community facilities, services and networks which help individuals, families, groups and communities meet their social needs, maximise their potential for development and enhance community well-being.

Social infrastructure located within the Study Area, close to the proposal includes:

- > Local Parks including:
 - Kesterton Park
 - Submariners' Memorial inside the HMAS Platypus site
 - Milson Park
 - Wrixton Park
 - Miss Gladys Carey Reserve
 - Colindia Reserve
- > Public transport facilities such as bus stops operating in the Clark Street and Carabella Street
- > Our Lady Star of the Sea Catholic Church
- > Loreto Kirribilli, an independent Roman Catholic single-sex primary and secondary day school for girls
- > North Sydney Wharf waiting shelter - It was noted during consultation for the proposal that the waiting shelter is considered by the community an important heritage site.

4.5 Community values

Community values are those socio-economic aspects considered to be important to quality of life and well-being. They include social factors such as a sense of safety, well-being, belonging and community diversity, as well as physical assets, such as parks and recreational areas.

Community values with the Study Area have been informed by the review of North Sydney Wharf Upgrade Concept Design Community Consultation Report – March 2020 (NSW Government, 2020), social policies and strategies relevant to the North Sydney LGA and observations of the study area.

A survey conducted in 2020 by the North Sydney Council (Jetty Research, 2020) reveals that the residents generally appreciate:

- > Maintaining parks, ovals and bushland areas
- > Access to/provision of recreation facilities
- > Feeling safe in the neighbourhood (crime, road safety, pedestrians, cyclists, street lighting etc.)
- > Maintaining waste management and recycling services
- > Maintaining the visual amenity and character of the area
- > Cleanliness of the neighbourhood.

There is a high level of community value associated with the existing Wharf and Kesterton Park. North Sydney Wharf Upgrade Concept Design Community Consultation Report – March 2020 (Roads and Maritime, 2020) indicates that the community surrounding the Wharf value:

- > Increased accessibility in the new Wharf design, including accessible parking
- > Maintaining landscape character and visual amenity in the area
- > Protection from the weather and safety for the commuters
- > Catering towards the recreational boating and maintaining access to the existing navigational channel
- > Controlled fishing activities at the Wharf including consideration of nearby residents.

4.6 Landscape character and visual amenity

The proposal sits at the water's edge at Kesterton Park, an open space public foreshore area. North Sydney Wharf is accessed through Kesterton Park from High Street.

The Neutral Bay foreshore is protected by a sandstone seawall and sits above the mean high water mark. The end of High Street is separated from the water by a turf mound and series of sandstone retaining walls. There are a number of native trees planted in the mound.

The topography rises steeply to the north-west where Kesterton Park and series of pedestrian paths link back to High street and to Sub Base Platypus. The surrounding landscape is largely developed consisting of residential buildings approximately four to six storeys high. The NSW Government leased private vessel moorings are present in the Wharf area (Figure 4-9). Local community fishing activity is conducted from the Wharf as well. North of the proposal area, the former submarine base HMAS Platypus, occupies a significant part of the foreshore. Sub Base Platypus is currently undergoing remediation works with the land subject for redevelopment for public open space, access improvements and building renovations.

The Figure 4-9 shows the North Sydney Wharf surrounding land and water uses.



Figure 4-9 Location of North Sydney Wharf and surrounding land (top) and water uses (bottom) (Source: TfNSW)

Before and after views for the upgrade of the North Sydney Wharf looking north-east from Kesterton Park are provided in Figure 4-10 and Figure 4-11.



Figure 4-10 View from the Kesterton Park – Existing View (Source: TfNSW)



Figure 4-11 Post-upgrade North Sydney Wharf view from the Kesterton Park (Source: TfNSW)

Before and after upgrade of the North Sydney Wharf view from the Kesterton Park, adjacent existing footpath looking south-east is provided below (Figure 4-12 and Figure 4-13).



Figure 4-12 View from the Kesterton Park adjacent existing footpath looking south-east (Source: TfNSW)



Figure 4-13 Post-upgrade North Sydney Wharf view from the Kesterton Park adjacent existing footpath looking south-east (Source: TfNSW)

North Sydney Wharf is located in an area surrounded by local non-Indigenous heritage sites (Table 4-6) listed under the *North Sydney Local Environmental Plan 2013* (North Sydney LEP). These include Kesterton Park (including the heritage listed shelter) and various buildings and bus shelters. Heritage conservation area C10 – Careening Cove is also located near Kesterton Park.

There are no known Aboriginal heritage sites within the Wharf upgrade area and impacts to Aboriginal cultural heritage are unlikely.

These potential heritage impacts are further assessed in the REF.

Table 4-6 Non-Aboriginal heritage sites within the proposal vicinity

Item number	Site	Address	Distance from project boundary (metres)
I0407	North Sydney bus shelters	High Street, North Sydney (southernmost end)	Within project boundary
I0858	Kesterton Park	High Street, North Sydney (southernmost end)	Within and adjacent to project boundary
I0853	Rockcliff Mansions	144 High Street, North Sydney	Approximately 50
I0854	House	145 High Street, North Sydney	Approximately 100
I0855	House	165 High Street, North Sydney	Approximately 155
I0184	Careening Cove slipways and seawall, east end	1 Bradly Avenue, Kirribilli	Approximately 183
I0859	Gaswork remains, HMAS Platypus	1 Kiara Close and 118-138 High Street, North Sydney	Approximately 113
I0850	"Heatherlie"	116 High Street, North Sydney	Approximately 245
CA10	Careening Cove	Kirribilli	Approximately 12

5 Potential impacts

The proposal has the potential for both wider regional and local benefits in the medium to longer term through reduced traffic congestion and improved access and connectivity for users of the ferry service. However, the proposal would also result in some negative impacts and changes to the existing socio-economic environment for communities and businesses in North Sydney and the wider region.

This section describes the potential benefits and impacts of the proposal's design, construction and operation for local and regional communities.

5.1 Construction impacts

The proposal would be constructed over a duration of up to six months starting in early 2021. North Sydney Wharf would be closed throughout the construction period. Ferry passengers would be notified ahead of construction and updated whilst the proposal is built. Local bus services, North Sydney train station and Neutral Bay wharf are possible alternatives for some customers in the catchment area of North Sydney Wharf.

Existing bus services would be used to support access to Sydney CBD as bus transport would remain operational. Ferry users travelling to or from the city could catch the existing 263 bus service along the Clark Street to travel to Sydney CBD or can catch the 269 bus service along Carabella Street to reach Milsons Point train station.

A maritime exclusion zone may be required around the proposal footprint during construction to prevent commercial and recreational traffic entering the area. This would also include changes to the F5 Neutral Bay ferry route to avoid the construction site. The closure of the Wharf would cause disruption to approximately 38 passengers daily due to the requirement to switch transport modes. Disruptions could potentially involve increased travel times by using bus or combination of bus and train compared to travelling by ferry. Some commuters may also use private vehicles during the construction which may result in additional commuter traffic and increased travel times during peak hours. Any disruption would be minimised through notification ahead of construction, and consequent updates. In addition, the short-term impacts during construction described above would be offset by the benefits of the upgraded Wharf and interchange during operation (refer Section 5.2).

The NSW Government leased private vessel moorings as well as water-based activities and fishing conducted from the Wharf would be impacted by restricting access and marine exclusion zone.

There would be a number of heavy vehicles accessing the proposal site via High Street during the earthworks, retaining wall and ramp construction. It is anticipated that most materials and equipment required for land-based elements of the proposal would be delivered by road. Temporary traffic lights or stop-go provisions on High Street may be required if major deliveries take place by road. The additional construction traffic expected within the area is considered minor and would be unlikely to affect the capacity of the road network. Any potential impact associated with construction vehicles at the site would be mitigated through the preparation and implementation of a traffic management plan.

The southern area of Kesterton Park would be closed to the public during construction of the land side works of the Wharf. A site compound is likely to be required within the park. A land exclusion area may also need to be established for the safety of people using the park and other recreational activities during construction. As a result, local clubs and recreational users may potentially be impacted during the construction period. At the end of construction, the exclusion zones would be removed and the area would be landscaped and made accessible again.

The existing heritage listed waiting shelter on the foreshore would not be removed as part of the North Sydney Wharf Upgrade, however access would be restricted for a period of time. This area is utilised as a resting area for recreational users, and closure during construction may cause disruption to these users. However, Kesterton Park is well serviced by other seating and sheltered areas, and the temporary loss of use of the existing waiting shelter is not considered to be significant, as alternative locations in close vicinity would be able to be utilised.

Noise, air quality and visual impacts from construction activities would disrupt the amenity of the area. This would directly impact residents surrounding the Wharf, and any residents accessing the Kesterton Park and playground area. There would be temporary loss of amenity in the area surrounding the Wharf due to the construction works and presence and use of barge mounted cranes and other plant and equipment. Landside construction would result in a temporary loss of amenity near the Kesterton Park. The temporary

loss of amenity, along with restrictions on pedestrian access, may discourage the use of these areas in the vicinity of the Wharf during construction.

Some construction activities may require work to be carried out during early mornings when the water is calm and the harbour is least busy, a time of day where residents may be more likely to be at home and therefore disrupted by the activities. Construction activities conducted at night time or the general high voltage lighting used during construction may also disrupt nearby residents. The management measures described in Chapter 6 would aim to minimise these impacts on local amenity.

Indirect impact to local businesses in the broader area may occur due to noise, air quality and visual impacts, as well as the decline in patronage of the Wharf and general decline in local amenity. Further consultation with the community would be undertaken to determine sensitive periods for surrounding businesses and other receivers. This may include consultations with the surrounding businesses to understand their peak hours. Management measures described in Chapter 6 would aim to minimise these impacts.

The proposal would also generate some opportunities for employment of local people and to buy resources, potentially from businesses in the region.

5.2 Operational impacts

The proposal would provide a range of long term socio-economic benefits for the Study Area community, as well as communities and businesses in the wider region.

Currently, customers with mobility needs are unable to access High Street from North Sydney Wharf. The proposed Wharf design includes a new floating pontoon which would improve the efficiency and safety of wharves for customers getting on and off ferries that stop at the Wharf. An accessible ramp would be installed along the foreshore to access High Street. The footpaths around the Wharf would also be widened to meet DDA and BCA standards, improving accessibility to the Wharf from High Street. This also would improve access to customers with prams.

The existing Wharf at North Sydney includes an uncovered jetty and tidal steps for ferries to pickup and drop-off customers. The new pontoon would have a waiting area with a curved roof, seating and glass weather protection panels to provide passengers with a comfortable place to wait for their ferry.

The proposal includes improved access to the Wharf via High Street through providing a kiss and ride zone at the Wharf, as well as with the installation of new bike hoops and additional car spaces. Accessible parking at the primary Wharf entry would also be provided.

Ferry services would recommence once the new Wharf is operational. The proposal would result in the improvement of efficiency and an improved customer experience of ferry services from the Wharf. This may result in an increase to patronage of the ferry service and additional commuter traffic travelling to and from the Wharf. However, this is not considered to be significant based on the existing patronage of the Wharf.

The new Sub Base Platypus development to the north of the Wharf is anticipated to attract visitors to the area and is expected to increase future patronage.

The proposal would potentially increase access to goods, services, and economic opportunities for locals by upgrading and improving accessibility to the Wharf.

Part of the existing Wharf would be retained as part of the proposal. Recreational berthing and fishing would be allowed at the existing structure.

The overall visual impact of the proposal once operational is moderate. The design would incorporate surrounding elements to tie in to the area, such as the landside upgrade has been designed to fit in with the urban landscape of Kesterton Park. The Wharf design aims to unify and identify the harbour wharves and the ferry commuter transport system. This impact would be minimised through the use of glass walls for wind protection and curved roof is designed to be low profile and minimise the impact on the views to and from the water. More detailed assessment of the visual impact during operation are described in the North Sydney Wharf Upgrade: Landscape Character and Visual Impact Assessment (Cardno, 2020).

During operation, the extra lighting and security cameras at the Wharf would deter antisocial behaviour from occurring and provide a safer night-time environment for ferry users. Generally, the design of the ferry wharf creates a clear hierarchy of space, enable safe access/egress, and enables formal and passive surveillance. There would be an emergency button on the pontoon for the security of waiting passengers.

6 Safeguards and management measures

The management and mitigation measures recommended in the SEIA focuses on avoiding or reducing negative social impacts, and enhancing potential benefits. Stakeholder and community involvement in program planning and ongoing environmental management would be key to avoiding, minimising and mitigating the social impact of the proposal.

Strategies to manage potential socio-economic impacts during construction and operational phases are outlined in Table 6-1. Strategies to manage amenity impacts (such as noise, air quality and visual impacts) are outlined in chapter 7 of the REF.

Table 6-1 Socio-economic safeguards and management measures

Impact	ID	Environmental safeguards	Responsibility	Timing
General Socio-economic impacts	SE1	<p>A Communications and Stakeholder Engagement Plan will be developed prior to the commencement of construction and will be implemented during construction to provide timely and accurate information to stakeholders. It would include (as a minimum):</p> <ul style="list-style-type: none"> ▪ Mechanisms to provide details and timing of proposed activities to affected residents and local businesses, including changes to traffic, public transport services and access ▪ A contact name and telephone number for complaints <p>The Plan will be prepared in accordance with the Community Involvement and Communications Resource Manual (RTA, 2008).</p>	Transport for NSW	Pre-construction/ Construction
General Socio-economic impacts	SE2	<ul style="list-style-type: none"> ▪ A webpage and free-call number will be established for enquiries regarding the proposal, and will remain active for the duration of construction. ▪ Contact details will be clearly displayed at the entrance to the site. ▪ All enquiries and complaints will be tracked through a tracking system, and acknowledged within 24 hours of being received. 	Contractor	Pre-construction/ Construction
Socio-economic benefits	SE3	Investigate opportunities to encourage the Construction Contractor to purchase goods and services locally.	Contractor	Pre-Construction / Construction
Socio-economic benefits	SE4	Investigate opportunities to incorporate community health and wellbeing initiatives in the design and construction of the project.	Transport for NSW / Contractor	Detailed design / Construction
Land transport and parking	T2	Where possible, the preferred means of transporting equipment and materials to the site will be via boat and barge over land transport so as to limit impacts to the local road network.	Contractor	Construction
Land transport and parking	T3	Public transport passengers will be notified of any impacts to services and alternative transport arrangements prior to the commencement of construction. This will include updates to the timetable (online and Opal app) indicating the temporary closure of the North Sydney Wharf.	Transport for NSW	Pre-construction / construction
Maritime transport	T4	<ul style="list-style-type: none"> ▪ A maritime navigation exclusion zone will be established during construction to prevent unauthorised vessels entering the area. ▪ This zone will be clearly defined to communicate access for other water users. 	Contractor	Construction

7 Conclusion

The NSW Government is progressively upgrading ferry wharves across Sydney Harbour to improve Sydney's ferry service for customers. Upgraded commuter wharves are being delivered as part of the NSW Government's TAP. TAP is an initiative to deliver modern, safe and accessible transport infrastructure across NSW.

Customers with mobility needs are currently unable to access ferry services from North Sydney Wharf. The existing wharf at North Sydney includes an uncovered jetty and tidal steps for ferries to pick-up and drop-off customers. The Transport for NSW planning to upgrade the Wharf at North Sydney to improve accessibility. The proposed Wharf design includes a new floating pontoon to improve the efficiency and safety of wharves for ferries to pick-up and drop-off passengers. The pontoon would have a waiting area with a curved roof, seating and glass weather protection panels to provide passengers with a comfortable place to wait for their ferry. The pontoon would be connected to land by an uncovered gangway and jetty. An accessible ramp would be installed along the foreshore to access High Street.

This SEIA has assessed the potential socio-economic impacts associated with the design, construction and operation of the proposal. The assessment has had regard to the existing context of the proposal, the contribution of other specialist studies, outcomes from community consultation and the adoption of appropriate mitigation measures.

In the long term, the proposal is expected to provide a range of socio-economic benefits for both the local and broader community including:

- > improved access for customers with assisted and unassisted mobility needs and customers with prams
- > improved protection from the weather
- > improved seating and waiting areas
- > improved safety for customers and staff
- > quicker and more efficient ferry pick-up and drop-off
- > improved pedestrian access around the Wharf interchange.

While the concept design has sought to minimise the impact of proposal to the extent possible, the proposal is expected to have some negative impacts. During construction, a degree of disruption and negative impact on the socio-economic environment would be expected. These would include noise, vibration and dust intrusions, disruption to the recreation activities conducted at the Wharf, and some reduction in visual amenity. These impacts on the amenity of the locality would need to be carefully and proactively managed with businesses, social infrastructure providers and local residents being notified and effectively engaged with throughout the process. This would be managed and mitigated through mitigation measures, and the implementation of the Communications and Stakeholder Engagement Plan would manage the ongoing consultation and notification activities during construction.

It is considered that the negative impacts of the proposal can be effectively managed with the implementation of mitigation measures identified in this report. It is anticipated that the proposal would have an overall beneficial impact on the Study Area and the wider North Sydney LGA in terms of socio-economic outcomes.

8 References

- Aurecon (2019a). Ferry Wharf Upgrade Program, North Sydney wharf interchange: Concept design report.
- Aurecon (2019b). Preliminary Landscape Character and Visual Impact Assessment Ferry Wharf Upgrade Program Package 3 North Sydney Wharf Interchange
- BMT (2018). Greater Sydney Harbour Estuary Coastal Management Program Scoping Study. Developed by BMT, in partnership with the Greater Sydney Local Land Service, Office of Environment and Heritage and City of Sydney. Available at: <https://www.sydneycoastalcouncils.com.au/wp-content/uploads/2018/10/Greater-Sydney-Harbour-Coastal-Management-Plan-Scoping-Study.pdf>
- Cardno (2020a). North Sydney Wharf Upgrade: Landscape Character and Visual Impact Assessment
- Cardno (2020b). North Sydney Wharf Upgrade: Noise and vibration study
- Cardno (2020c). North Sydney Wharf – Ferry Wharf Upgrade Program TAP 3 – Communications and Stakeholder Engagement Plan 2020
- Greater Sydney Commission (2018a). Greater Sydney Region Plan: A Metropolis of Three Cities. Available at: <https://www.greater.sydney/metropolis-of-three-cities>
- Greater Sydney Commission (2018b). Our Greater Sydney 2056: North District Plan
- Harbour Trust (2020). The History of Sub Base Platypus. Available at: <https://www.harbourtrust.gov.au/en/our-story/harbour-history/history-of-sub-base-platypus/>
- Jetty Research, May 2020. North Sydney Council Customer Satisfaction Survey 2020. Available at: https://www.northsydney.nsw.gov.au/Council_Meetings/Community_Engagement/Customer_Satisfaction
- NSW Department of Planning, Industry and Environment, DPIE (2019). North Sydney Council 2019 NSW Population Projections. Available at: <https://www.planning.nsw.gov.au/-/media/Files/DPE/Factsheets-and-faqs/Research-and-demography/Population-projections/2019-North-Sydney.pdf>
- NSW Government (2012). NSW Long Term Transport Master Plan. Available at: <https://www.transport.nsw.gov.au/newsroom-and-events/reports-and-publications/nsw-long-term-transport-master-plan>
- NSW Government (2013). Sydney's Ferry Future: Modernising Sydney's Ferries. Available at: <https://www.transport.nsw.gov.au/newsroom-and-events/media-releases/sydneys-ferry-future-new-vessels-new-wharves-and-more-services>
- NSW Government (2020). North Sydney Wharf Upgrade Concept Design Community Consultation Report. Available at: <https://www.rms.nsw.gov.au/projects/01documents/north-sydney-wharf-upgrade/north-sydney-wharf-consultation-report-2020-03.pdf>
- North Sydney Council (2007). North Sydney Foreshore Access Strategy 2007. Available at: https://www.northsydney.nsw.gov.au/files/assets/public/docs/1_council_meetings/policies_plans/plans_of_management/final_foreshore_access_strategy_0704301.pdf
- North Sydney Council (2018a). North Sydney Community Strategic Plan 2018-2028. Available at: https://www.northsydney.nsw.gov.au/files/assets/public/docs/1_council_meetings/policies_plans/strategic_plans/communitystrategicplan_2018-2028_final_lr.pdf
- North Sydney Council (2018b). North Sydney Council Delivery Program 2018/19-2020/21 Available at: https://www.northsydney.nsw.gov.au/Council_Meetings/Policies_Plans/Integrated_Planning_Reporting/Delivery_Program_Operational_Plan
- North Sydney Council (2019a). North Sydney Council Annual Report 2018/19. Available at: https://www.northsydney.nsw.gov.au/Council_Meetings/Policies_Plans/Annual_Report
- North Sydney Council (2019b). North Sydney Council Operational Plan 2019/20. Available at: https://www.northsydney.nsw.gov.au/Council_Meetings/Policies_Plans/Integrated_Planning_Reporting/Delivery_Program_Operational_Plan
- North Sydney Council (2020). North Sydney Local Strategic Planning Statement (LSPS) 2020. Available at: https://shared-drupal-s3fs.s3-ap-southeast-2.amazonaws.com/master-test/fapub_pdf/Local+Strategic+Planning+Statements/LSPS+2020/North+Sydney+LSPS_Master+Copy_Version+21_2020+03+16.pdf

Roads and Maritime Services (2013). Environmental Impact Assessment Practice Note: Socio-economic assessment, EIA-N05.

Tan, S (2017). Financial Review: Commercial leases available at North Sydney's ex-HMAS Platypus submarine base. Available at: <https://www.afr.com/property/commercial-leases-available-at-north-sydneys-exhmas-platypus-submarine-base-20170831-gy86a2>

Transport for NSW (2015). Transport Access Program (TAP)

Transport for NSW (2017a). Sydney Ferries Network map: <https://transportnsw.info/sydney-ferries-network-map>

Transport for NSW (2017b). Disability Inclusion Action Plan 2018–2022. Available at:

<https://www.transport.nsw.gov.au/system/files/media/documents/2018/tfnsw-disability-inclusion-action-plan-2018-2022.pdf>

Transport for NSW (2020), Ferry Patronage - Top Level Chart: Monthly Opal Trips. Available at: <https://www.transport.nsw.gov.au/data-and-research/passenger-travel/ferry-patronage/ferry-patronage-top-level-chart>

Wilkins, Roger., Laß, Inga., Butterworth, Peter., and Vera-Toscano, Esperanza (2019). The Household, Income and Labour Dynamics in Australia Survey: Selected Findings from Waves 1 to 17. Melbourne Institute: Applied Economic & Social Research, University of Melbourne.