Review of Environmental Factors

Construction and operation of a temporary overflow relief structure at Clontarf Syphon House, Clontarf

1 Determination

This Review of Environmental Factors (REF) assesses potential environmental impacts of the proposal to construct and operate a temporary overflow relief structure at the Clontarf Syphon House as part of the broader Northern Sydney Ocean Outfall Sewer (NSOOS) desilting and rehabilitation program. The REF was prepared under Division 5.1 of the ***Environmental Planning and Assessment Act 1979*** (EP&A Act), with Sydney Water both the proponent and determining authority.

The Sydney Water Project Manager is accountable for ensuring the proposal is carried out as described in this REF. Additional environmental impact assessment may be required if the scope of work or work methods described in this REF change significantly following determination.

Decision Statement

The main potential construction environmental impacts of the proposal include impacts such as soil, water and heritage. During operation, the main potential environmental impacts are associated with water quality. The proposal would not be carried out in a declared area of outstanding biodiversity value and is not likely to significantly affect threatened species, populations or ecological communities, or their habitats. Therefore, a Species Impact Statement (SIS) and/or Biodiversity Development Assessment Report (BDAR) are not required.

Given the nature, scale and extent of impacts and implementation of the mitigation measures outlined in this REF, the proposal is unlikely to have a significant impact on the environment. Therefore, we do not require an Environmental Impact Statement (EIS) and the proposal may proceed.

Certification

I certify that I have reviewed and endorsed this REF and, to the best of my knowledge, it is in accordance with the EP&A Act and the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation). The proposal has been considered against matters listed in section 171 (Appendix A) and the guidelines approved under section 170 of the EP&A Regulation. The REF considers how the proposal aligns with the principles of ecologically sustainable development (Appendix B). The information it contains is neither false nor misleading.

Prepared by:	Reviewed by:	Endorsed by:	Approved by:
[redacted]	[redacted]	[redacted]	[redacted]
Ben Groth REF author Sydney Water Date: 11.12.2024	Sally Spedding Environmental Assessment Team Manager Sydney Water Date: 11.12.2024	Colin Burrell Delivery Program Leader Sydney Water Date: 13.12.2024	Murray Johnson Senior Manager Environment & Heritage Sydney Water Date: 17.01.2025

2 Proposal description

Table 1 Description of proposal

Aspect	Detailed description
Proposal need and objectives	The proposal is part of the Critical Sewer Program, to meet Sydney Water's commitment to reducing uncontrolled overflows from the Clontarf Syphon House (CSH). The CSH is part of the Northern Suburbs Ocean Outfall Sewer (NSOOS) which is a pipeline up to 90 m deep that transports wastewater from Blacktown in the west to North Head Water Resource Recovery Facility (WRRF) for treatment and discharge in the east. In recent months there have been multiple uncontrolled wastewater overflow events from the CSH to Middle Harbour during wet weather events (8 occurrences from April-June 2024). The overflows have resulted in a range of complaints being lodged by nearby residents to Northern Beaches Council, NSW Government Ministers and Sydney Water. The ongoing overflow occurrences are causing erosion at the beach, restricting public access around the foreshore, inhibiting the use of Clontarf Beach. The overflows are a result of reduced hydraulic capacity within the NSOOS arising from partial collapses of the roof causing debris and siltation. The proposal is being undertaken as an immediate solution to reduce the likelihood of uncontrolled overflows to Middle Harbour to <2 occurrences per year (on average), providing an interim arrangement (in place for 5-7 years) until the underlying cause of overflows can be addressed by longer term works as part of the NSOOS De-silting and Rehabilitation program.
Consideration of alternatives/options	The root cause of the overflows is the current diminished capacity within Section 1 of the NSOOS (Clontarf to North Head) due to the accumulation of debris and silt within the tunnel. Three concurrent programs to address the overflows are being pursued (either in delivery or under consideration) as detailed below. **1) Long-term solution** This involves the removal of accumulated silt and rehabilitation work of the interior of the NSOOS Section 1 under the Critical Sewer Program, restoring capacity and almost eliminate the likelihood of occurrence over the long term. These works are currently scheduled to commence in late 2025 following the construction of an access cavern at North Head Resource Recovery Facility (WRRF) and be complete within 5-7 years. **2) Medium-term solution** Sydney Water is currently investigating ways to bring forward discrete portions of the desilting work to accelerate the recovery of capacity within Section 1 of the NSOOS. This will focus on the removal of the very deep silt banks (up to 1.4 m) in Section 1 of NSOOS between Ashburner Street, Manly and North Head WRRF. The removal of these large obstructions would substantially reduce the likelihood of wastewater overflows at CSH and take approximately 2 years to complete.

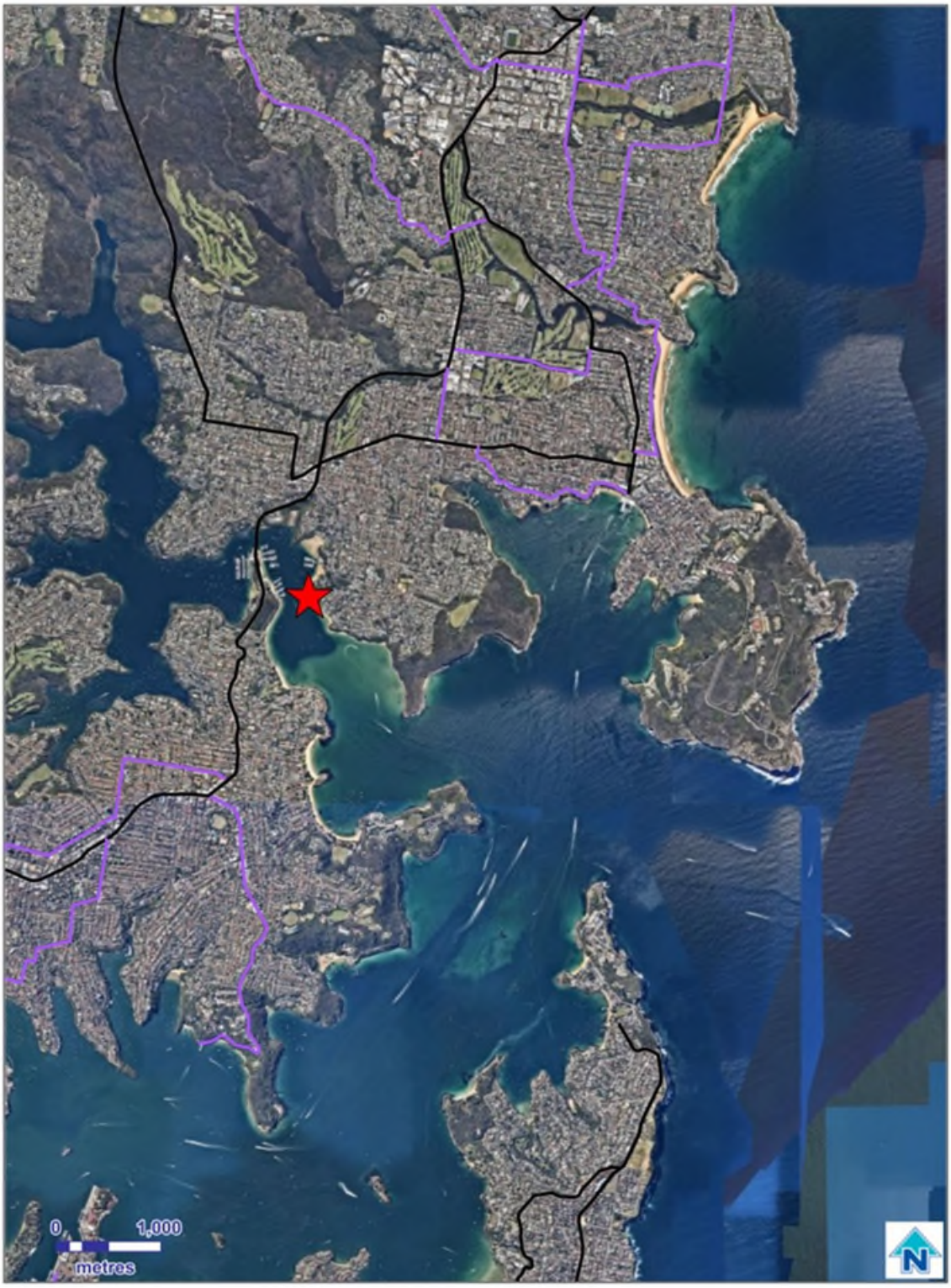
Aspect	Detailed description
	3) Immediate response The immediate response considers two options in response to the existing uncontrolled wet weather overflows, namely: Option A: Construction of a temporary overflow relief structure from the CSH to a nearby existing subtidal overflow outlet Option B: "Do Nothing". Option A would deliver immediate action to minimise wastewater overflows across the Clontarf Beach foreshore until such time as the benefits of the medium and long-term works take effect. The temporary overflow relief structure broadly comprises the following elements: • construction of wastewater collection infrastructure within the CSH • installation of an overflow diversion pipe from the CSH to Clontarf Beach to connect into the existing maintenance hole on Clontarf Beach. This will alleviate erosion of the beach from the overflow events and reduce the occurrence of public access restrictions around the foreshore. **Preferred option** Of the two identified options, only Option A would achieve the needs and objectives of the proposal described above and has been therefore selected as the preferred option. This REF considers the environmental impacts associated with construction and operation of Option A.
Proposal description and methodology	A description of the proposal and construction methodology is provided below. Key construction activities for the proposal include: • site establishment adjacent to CSH (erect site temporary fencing/hoarding, tree protection zones, site offices, amenities and plant/material storage areas etc) • install protection measures/relocate existing utilities where required • undertake removal/trimming of vegetation to be impacted • install additional door fixtures at western entrance of CSH (inclusive of pathway for the exit of the overflow diversion pipe from the syphon house). Note: the fabric of the existing sliding doors of the State Heritage Listed Clontarf Syphon House will not be impacted) • install water collection structures within the CSH • undertake cut out through existing CSH stair kickboard to provide passage for overflow diversion pipe • install 600 mm above ground diversion pipework from the western entrance of the CSH, down and alongside the existing stairway

<table>
<tr><th>Aspect</th><th>Detailed description</th></tr>
<tr><td></td><td>

install 375mm overflow diversion pipe by open trenching (approximately 2.5m wide x 20 m long x 2 m deep) from the bottom of the CSH stairway to the existing maintenance hole on Clontarf Beach. Note shoring boxes and spear-point dewatering system may be required to dewater groundwater as needed
modify or rebuild the existing maintenance hole, involving excavation approximately 4 m x 4 m wide around existing maintenance hole to connect in the new 375 mm pipe
clear out existing outfall pipe - remove silt/debris from existing outfall pipe using a water jet/ vacuum truck from existing maintenance hole
install operational monitoring telemetry equipment
undertake commissioning of overflow diversion pipe
implement site stabilisation/revegetation measures in accordance with final design
site demobilisation (including removal of all temporary facilities and waste).

</td></tr>
<tr><td>Location and land ownership</td><td>
The street address of the proposal site is Sandy Bay Road, Clontarf within the Northern Beaches LGA. Details of the land parcels affected by the proposal are as follows:
<table>
<tr><th>Lot/Deposited Plan</th><th>Owner</th><th>Land Zoning</th></tr>
<tr><td>Lot B / DP434649</td><td>Sydney Water</td><td>SP2 (Infrastructure)</td></tr>
<tr><td>Lot A / DP434649</td><td>Crown Land (under the control of Northern Beaches Council)</td><td>RE1 (Public Recreation)</td></tr>
<tr><td>Lot 1 / DP519063</td><td>Crown Land (under the control of Northern Beaches Council)</td><td>RE1 (Public Recreation)</td></tr>
<tr><td>Lot 2 / DP1224641</td><td>Crown Land (under the control of Northern Beaches Council)</td><td>RE1 (Public Recreation)</td></tr>
</table>
The location of the proposal site is shown in Figure 1, with the proposed works and environmental constraints shown in Figure 2. Areas surrounding the site comprise public recreation, a restaurant/hospitality venue and residential land uses.
</td></tr>
<tr><td>Site establishment and access tracks</td><td>Access to/from the site will be via Sandy Bay Road, Clontarf, using the existing vehicular accessway through Clontarf Reserve to reach the proposal location (see Figure 2).</td></tr>
</table>

Aspect	Detailed description
Ancillary facilities (compounds)	A construction compound/ laydown area will be required to house construction amenities and materials laydown. An indicative location for the compound site is shown in Figure 2.
Work hours	Work and deliveries will be scheduled during the following hours: • 7 am to 6 pm, Monday to Friday • 7 am to 4 pm, Saturdays. The proposal is not expected to require construction work outside these hours. However, Sydney Water's Project Manager can approve work outside of the nominated construction hours. The approval process is described in the mitigation measures in Section 6.
Proposal timing	Construction is expected to start in early 2025 and take about 3 months to complete.



Project location

Sydney WATER

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Date Created: 28/10/2024

Figure 1 Location of the proposal

Figure 2 Construction footprint and environmental constraints

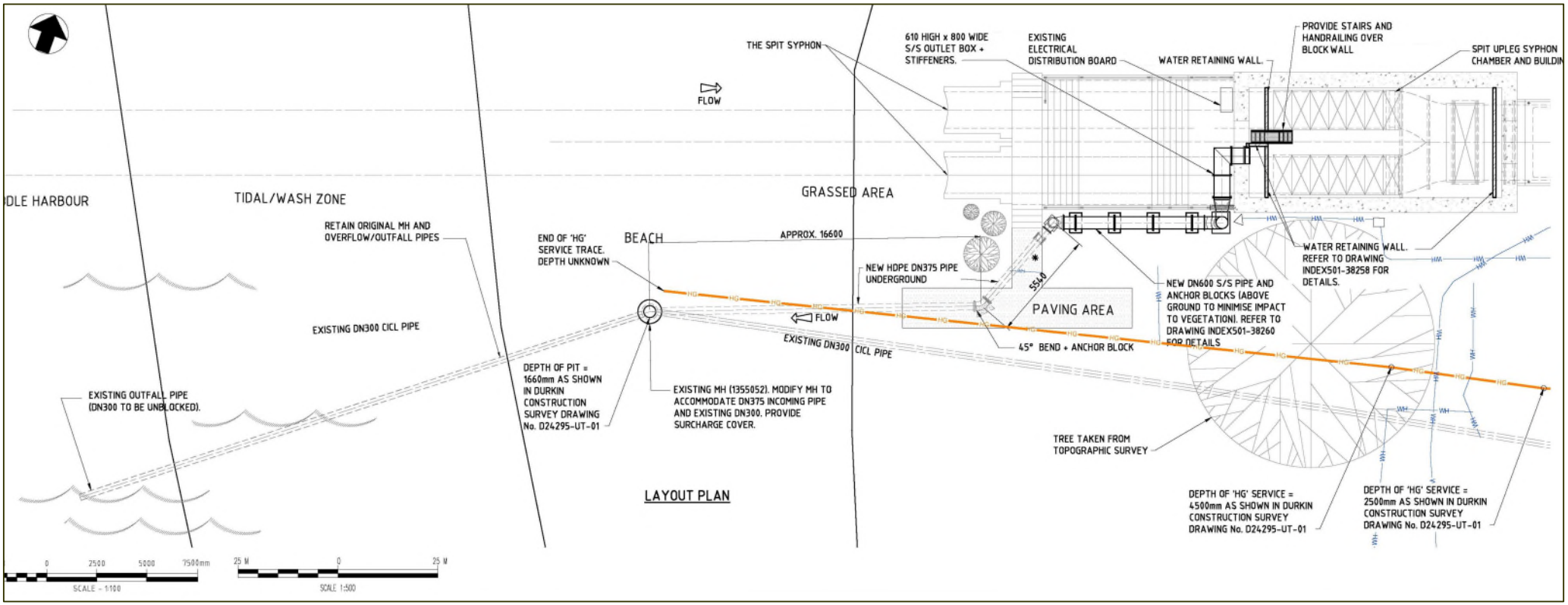

Figure 3 Overview of proposed works - Plan view (indicative)

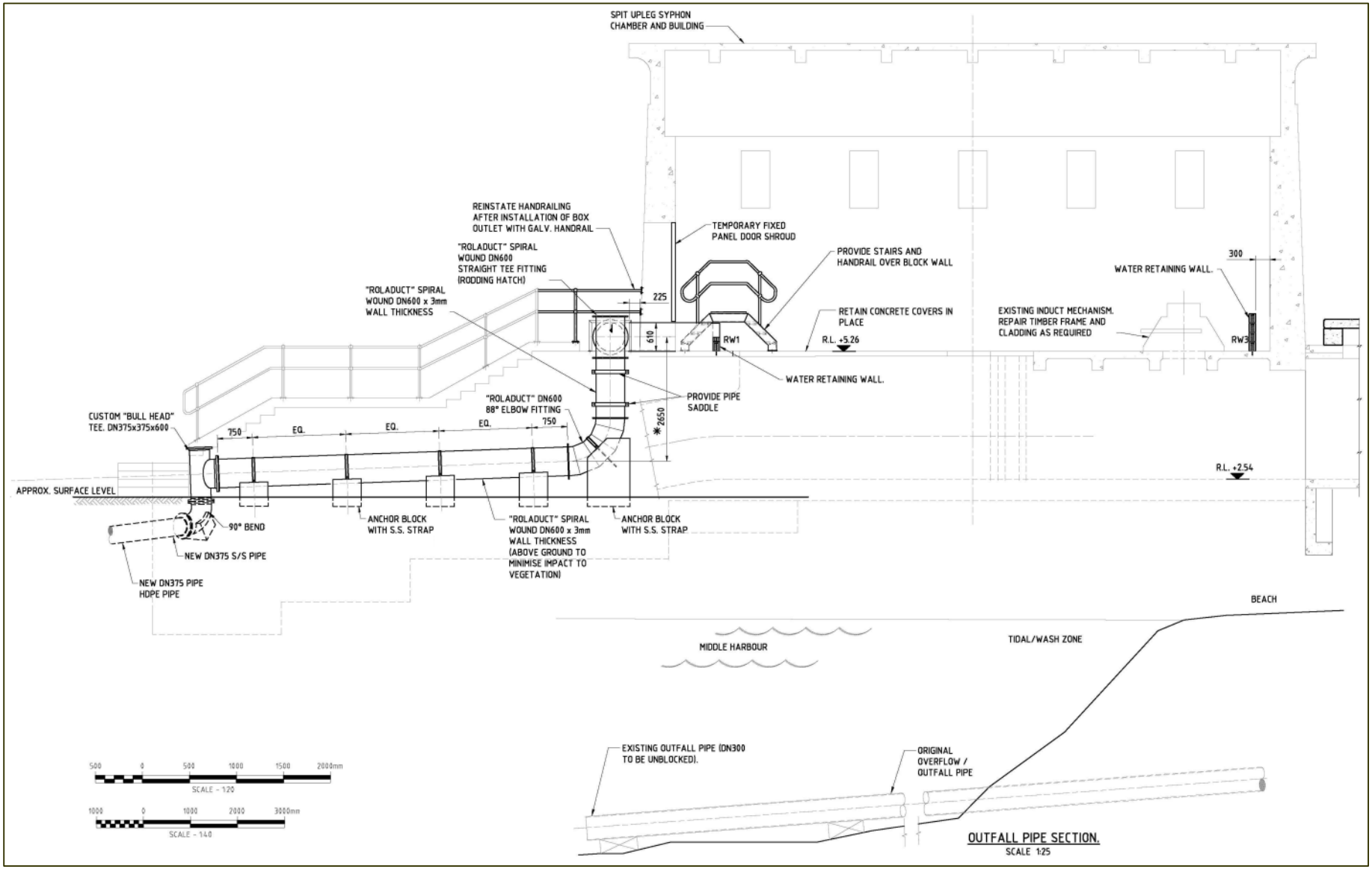

Figure 4 Overview of proposed works – Cross section view (indicative)

3 Consultation

Community and stakeholder consultation

Our approach to community and stakeholder consultation is guided by Sydney Water's community and stakeholder engagement guidelines.

Stakeholder and community engagement is a planned process of initiating and maintaining relationships with external parties who have an interest in our activities. Community and stakeholder engagement:

- enables us to explain strategy, policy, proposals, proposal or programs
- gives the community and stakeholders the opportunity to share their knowledge, issues and concerns
- enables us to understand community and stakeholder views in our decision-making processes alongside safety, environment, economic, technical and operational factors.

The nature, scale and extent of the proposal's potential impact has been evaluated in this REF. If our work impacts the community in some way, we will consult with affected groups throughout the proposal. This includes engaging the broader community and stakeholders during plan or strategy development or before making key decisions.

Sydney Water will ensure that Council, elected officials, community groups, impacted residents, users of the Clontarf beach, the general public and key stakeholders are aware of the works that we will be undertaking.

We have provided Northern Beaches Council the proposed scope and indicative proposal duration; Council will be consulted about matters identified in environmental planning instruments (refer Section 4 below) which includes public safety issues, temporary works on council/council managed land, and full or partial road closures of council roads.

The local representatives have been kept updated by the Sydney Water Government Relations team on the progress of the works.

Community and resident groups (including the Clontarf Community Forum and Clontarf Locally Impacted Community) have been meeting with Sydney Water representatives on the immediate, medium-term and long term approaches to address wet weather overflows at Clontarf Syphon House.

There is an existing restaurant/hospitality business within Clontarf Reserve (Bosk Café and Restaurant) which may be sensitive to construction noise impacts during certain times. Further details regarding these impacts and proposed consultation to be undertaken with the operators of this business are provided in Section 5 (Noise and Vibration).

We have been providing monthly updates to the NSW EPA on the status of the proposal, which will continue until completion of construction for the proposal.

We will also attend community meetings and organise letterbox drops to inform surrounding residents on the scope, impact and duration of our works as well as how we will mitigate the impact of our works.

Consultation required under State Environmental Planning Policy (Transport and Infrastructure) 2021

Sydney Water must consult with councils and other authorities for work in sensitive locations or where the work may impact other agencies' infrastructure or land. This is specified in State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP).

Specifically, section 2.10 of the TISEPP provides that:

> ***2.10 Consultation with councils—development with impacts on council-related infrastructure or services***
>
> ***(1) This section applies to development carried out by or on behalf of a public authority that this Chapter provides may be carried out without consent if, in the opinion of the public authority, the development –***
>
> ***…***
>
> ***(e) involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential***
>
> ***…***
>
> ***(2) A public authority, or a person acting on behalf of a public authority, must not carry out development to which this section applies unless the authority or the person has -***
>
> ***(a) given written notice of the intention to carry out the development (together with a scope of works) to the council for the area in which the land is located, and***
>
> ***(b) taken into consideration any response to the notice that is received from the council within 21 days after the notice is given.***
>
> **[emphasis added]**

Based on the requirements specified in the TISEPP, it is considered that the following activities trigger the consultation requirement under Section 2.10(1)(e):

- works in the vicinity of the Manly to Spit Walk, and
- the proposed construction compound location occupying an area within a Council managed reserve (Clontarf Reserve - immediately north of CSH)

Sydney Water subsequently provided written notification under the TISEPP to Northern Beaches Council on 6 September 2024. A response was not received prior to the finalisation of the REF, however Sydney Water will continue to liaise with Northern Beaches Council throughout the delivery of the proposal.

Further detail regarding TISEPP consultation requirements is provided in Appendix C.

Consultation within NSW Environment Protection Authority

The NSW Environment Protection Authority (EPA) were provided with ongoing project updates relating to matters regulated under the ***Protection of the Environment Operations Act 1997***. Written feedback on these matters was received from the EPA on 30 October 2024. A summary of the feedback received, including Sydney Water's response is provided in Table 2.

Table 2 NSW EPA feedback summary

Issue/matter	Sydney Water response
The EPA notes and concurs with the proposed construction working hours of • 7am – 6pm Monday to Friday • 7am – 4pm Saturdays	Noted
While removal of three trees does not require permission from Northern Beaches Council under the TISEPP, the EPA suggests Sydney Water inform Northern Beaches Council and the local community.	Sydney Water will provide details of the proposed tree removal to Northern Beaches Council and adjacent local community as part of ongoing consultation and project updates.
The EPA notes and concurs that erosion and sediment controls and silt curtains will be installed and maintained for the duration of all relevant works	Noted
The EPA suggests Sydney Water liaise closely with impacted receivers (residents, users of Clontarf Reserve and Northern Beaches Council) and ensure appropriate notification is given and signage is present where noisy short-term works (eg concrete cutting) are proposed to be undertaken.	Sydney Water will provide regular project updates to Northern Beaches Council and adjacent sensitive receivers, including upcoming noisy work activities.
The EPA recommends Sydney Water use appropriate dust control methods (source control, water/mist sprays to ensure dust generation is kept to a minimum).	Appropriate dust management measures for the proposal have been identified and included in Table 8
All waste generated by the proposal should be classified in accordance with the EPA Waste Classification Guidelines and either recovered in accordance with the Resource Recovery Framework or disposed of in accordance with its classification and the POEO Act.	Waste mitigation measures have been identified and included in Table 8 to ensure that any waste/excess spoil are managed in accordance with the NSW EPA Resource Recovery Orders and Exemptions (if applicable) and / or the EPA Waste Classification Guidelines.
The EPA notes and agrees with the proposed development and implementation of a Construction Environmental Management Plan (CEMP). It is suggested Sydney Water communicate with Northern Beaches Council around any beach closures and/or potential impacts to the usage of the beach (and Clontarf baths nearby) from the work, including timeframes so that this information can be made available to the public.	Noted. Consultation with Northern Beaches Council will be ongoing, including potential need for any beach closures/access restrictions.

Issue/matter	Sydney Water response
The EPA advises that the proposed works are consistent with changing the location of an emergency relief structure and do not constitute a new discharge point that requires regulation under Environment Protection Licence No. 378. Accordingly, a variation to the Licence is not required.	Noted

4 Legislative requirements

Table 3 Environmental planning instruments relevant to the proposal

Environmental Planning Instrument	Relevance to proposal
Manly Local Environmental Plan 2013 (Manly LEP)	The CSH site is located on land zoned RE1 (Public Recreation) and SP2 (Infrastructure). Sections of the proposal would be within or adjacent to the curtilages of the following heritage items listed in Schedule 5 of the Manly LEP. • Harbour Foreshores – ID I1 • Clontarf Park ID - I42 • Norfolk Island Pine commemorative tree (***Araucaria heterophylla***) - ID I43 • Middle Harbour Submarine Syphon (NSOOS) – ID I44 • Middle Harbour Syphon (NSOOS) – ID I45 Potential heritage impacts are addressed in Section 5.
State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP)	Under Division 18, various development for the purposes of sewerage systems can either be carried out by or on behalf of a public authority without consent on any land, or land in a prescribed zone (and/or under the prescribed circumstances). As Sydney Water is a public authority, the works associated with the proposal are permissible without consent. The proposal comprises construction activities being undertaken for Sydney Water's wastewater (sewerage) assets. Under sections 2.126(10)(g) of the TISEPP, development for the purposes of sewerage systems includes construction works. Section 2.3(3) of TISEPP defines construction works to include (amongst other works/activities): • temporary construction yards • temporary lay-down areas for materials or equipment • temporary structures • investigations (including geotechnical and other testing, surveying and the placement of survey marks, and sampling) • clearing of vegetation (including any necessary cutting, pruning, ringbarking or removal of trees) and associated rectification and landscaping.

Environmental Planning Instrument	Relevance to proposal
State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BCSEPP)	**Vegetation in non-rural areas (Chapter 2)** Construction activities for the proposal will require the removal of one coastal banksia tree, two tuckeroo trees and a small number of lomandra individuals immediately adjacent to the south of the CSH. Chapter 2 of the BCSEPP would normally require a permit to be obtained from Northern Beaches Council for any vegetation clearing. However, subsection 2.4(1) of the BCSEPP states: '***This Policy does not affect the provisions of any other SEPP….***'. Similarly, Section 2.7(1) of the TISEPP identifies that in the event of any inconsistency between the provisions of Chapter 2 of the TISEPP and any other environmental planning instrument, the TISEPP prevails to the extent of the inconsistency. Accordingly, the proposal is permissible without development consent under the TISEPP, a permit from Northern Beaches Council is not required. This is similarly confirmed by Subsection 2.4(1) of the BCSEPP which states: ***"This Policy does not affect the provisions of any other SEPP"***. **Water catchments (Chapter 6)** Chapter 6 of this SEPP applies as the proposal is within mapped areas of 'Foreshores and Waterways'. Section 6.28 prescribes several factors that a consent authority must consider in deciding whether to grant consent to development within mapped Foreshores and Waterways areas. However, by virtue of Section 2.7 of the TISEPP, the TISEPP prevails over the BCSEPP to the extent of any consistency. As the proposal is permissible without development consent under the TISEPP and would consider the factors identified under Section 171 of the EP&A Regulation, consideration of the Section 6.28 of the BCSEPP is not required.
State Environmental Planning Policy (Resilience and Hazards) 2021 (RHSEPP)	The RHSEPP provides an integrated and co-ordinated approach to land use planning in the coastal zone. The RHSEPP identifies areas of littoral rainforest and coastal wetlands within the coastal zone. There are no mapped coastal wetlands in the vicinity of the works. A mapped littoral rainforest is located approximately 370 m to the southwest of the proposal site (on the opposite side of Middle Harbour), however as this is outside of the construction footprint, no further consideration of the RHSEPP is required.

Table 4 Consideration of key environmental legislation

Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act is the main piece of NSW legislation covering pollution and waste management. Duty to notify pollution incidents There is a requirement under Part 5.7 of the POEO Act to immediately report any pollution incidents to the relevant authority where material harm to the environment is caused or threatened. The definition of material harm and the relevant authorities are identified in Part 5.7 of the POEO Act. In the event of such an incident occurring during construction, this would be managed in accordance ***SWEMS0009 Responding to incidents with an environmental impact***. Environment Protection Licences (EPL) The NSOOS operates as part of the Northern Suburbs Sewage Treatment System which is licenced under EPL 372. Consultation has been undertaken with the EPA regarding the proposal, which has confirmed that the works are consistent with an emergency relief structure and do not constitute a new discharge point. Accordingly, a variation to EPL372 is not required.	NA	NA
Biodiversity Conservation Act 2016 (BC Act)	A search of the NSW Bionet Atlas data on 20 July 2024 did not identify the presence of threatened ecological communities or threatened flora species within the construction footprint of the proposal. There are several recorded sightings of threatened fauna in proximity to the proposal. Flora and fauna impacts are assessed in Section 5.	NA	NA
National Parks and Wildlife Act 1974 (NPW Act)	The proposal will not encroach on, or require access to any areas reserved under the ***National Parks and Wildlife Act 1974***, Aboriginal heritage is protected under the NPW Act. No disturbance to any known or	NA	NA

Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
	unknown Aboriginal heritage items is expected.		
Heritage Act 1977	The proposal will include works within the curtilage of the Middle Harbour Syphon NSOOS, which is a State-significant item listed on the State Heritage Register (SHR #01628). The CSH forms part of the Middle Harbour Syphon NSOOS SHR listing (referred to as an "accesshouse"). An exemption under Section 57(2) of the Heritage Act has been granted by the Sydney Water Senior Heritage Advisor for those works within the SHR curtilage of the Middle Harbour Syphon NSOOS (under Sydney Water's delegation of functions of the Heritage Act). Sections of the proposal would be within or adjacent to the curtilages of several heritage items listed in Schedule 5 of the Manly LEP (as detailed above) and the Sydney Water Section 170 Heritage and Conservation Register. Potential heritage impacts as a result of the proposal are expected to be negligible/ minor. Further discussion of heritage impacts is provided in Section 5.	Section 57(2) exemption	Pre-construction, Sydney Water
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	A search of the NSW Bionet atlas was undertaken on 18 August 2024, which identified a sighting of a Green Turtle (***Chelonia mydas***) approximately 240 m to the northwest of the CSH site. The Green Turtle is listed as a vulnerable species under the EPBC Act. Impacts to the Green Turtle from the proposal are expected to be negligible. The proposal is unlikely to affect any other matters of National Environmental Significance under the EPBC Act. Accordingly, referral of the proposal to the Australian Government Environment Minister is not required.	NA	NA
Fisheries Management Act 1994 (FM Act)	The site is immediately adjacent to areas of mapped key fish habitat (KFH) under the FM Act. An assessment of potential	NA	NA

Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
	impacts of the proposal on marine ecology has been prepared and is summarised in Section 5. The proposal is not expected to impact on any areas of seagrass/marine vegetation, or obstruct fish passage. Accordingly, approvals under Sections 205 or 219 of the FM Act are not required. A briefing was provided to the NSW Department of Primary Industries and Regional Development (DPIRD) on 12 July 2024. DPIRD subsequently advised that it has no specific objections to the proposal. Relevant recommendations received from DPIRD have been incorporated into the REF mitigation measures in Section 6.		
Water Management Act 2000 (WM Act)	Under the provisions of the WM Act, a water supply work and/or water use approval are generally required to take and/or use water from a river, lake, or groundwater source. A water access licence may also be required to account for the water taken. Based on the low landscape position of the proposal site (ie immediately above Mean High Water Mark), and the depth of excavation (approximately 2 m) for the installation of the temporary overflow relief pipeline, it is reasonable to presume that groundwater is likely to be encountered. Based on this assumption, an application for a Water Supply Works Approval (WSWA) was submitted to the NSW Department of Environment, Energy, Climate Change and Water for the works and subsequently approved on 19 December 2024 (Approval No. 10WA125165). All applicable works will be undertaken in accordance with the requirements of the approval.	Water Supply Work Approval (WSWA)	Prior to commencement of dewatering activities

5 Environmental assessment

The environmental impacts checklist (SWEMS0019.01) was completed for the works which considers all environmental aspects. Table 5 includes only the potentially impacted aspects.

Table 5 Key environmental aspects and potential impacts of construction and operation

Aspect	Potential impacts
Topography, geology and soils	Construction impacts relate to ground disturbance to install the temporary overflow relief structure (refer to Figure 2). Works at this location will be undertaken within the CSH, and the adjacent areas within Clontarf Reserve and Clontarf Beach. A temporary construction compound is proposed on the council managed reserve immediately north of the CSH, located off Monash Crescent. The land slopes from about 5m AHD in the easternmost extent of the site to near sea level (0 m AHD) at its western edge. The soil is mapped as having a high wind erosion hazard (Woy Woy Soil landscape). Historic imagery from the 1930s shows the presence of the NSOOS and CSH, with the surrounding area undeveloped. Subsequent images through the 1940s and 1950s show the surrounding areas being progressively developed for residential housing. There is no observable other development from the 1950s through to the present. A search of the NSW Contaminated Land Register (23 July 2024) did not identify any previous records indicating the potential presence of contamination within or near to the site. NSW Acid Sulfate Soil Risk Mapping identifies the site as a beach formation and therefore is not expected to comprise acid sulfate soil materials.
Water and drainage	The proposal site is: • immediately (<5 m) to the east of the nearest waterway (Middle Harbour) • within a medium flood risk hazard precinct (Northern Beaches Council Flood Hazard Map) • about 330 m south of a low-potential groundwater dependent ecosystem (GDE). The Northern Beaches Council Flood Hazard Map describes the Medium Flood Risk Precinct as follows: ***"The Medium Flood Risk Precinct is equivalent to the Flood Planning Area, and covers all flood prone land which is affected by the 1% Annual Exceedance Probability (AEP) flood (equivalent to the 1 in 100 year flood) with a freeboard added"*** Construction activities at this location are limited to a small area and will take about 3 months to complete. The works are expected to have a negligible impact on local flood patterns. The works are within the mapped 'Sydney Basin Central' groundwater source. No publicly available groundwater data within 1 km of the proposal site is available. However, based on the low landscape position of the proposal site (ie

Aspect	Potential impacts
	immediately above mean high water mark), and the depth of excavation (approximately 2 m), it is reasonable to assume that the groundwater is tidal in nature. Based on the assumption that the trench excavation will be open for around 6-8 weeks and assuming the groundwater is permanently at hightide, the volume of groundwater which may need to be dewatered has been estimated at a maximum of 1.83 ML in total. Given total volume would be below 3 megalitres (ML)/year, the existing Water Access Licence exemption applies and a Water Access Licence is not required. Any dewatering will however require a WSWA. An application for a WSWA was submitted for the proposal to NSW DCCEEW and subsequently approved on 19 December 2024. No dewatering works will be undertaken until the approval has been obtained. Fuel and chemical storage would be required during construction, which would be managed through implementing appropriate mitigation measures.
Terrestrial flora and fauna	**Existing environment** <u>Flora</u> A search of the NSW Bionet Atlas data on 20 July 2024 did not identify the presence of threatened ecological communities or threatened flora species at the proposal site. The area within Clontarf Reserve has not been identified as a specific Plant Community Type (PCT) on publicly available databases. The nearest mapped areas of mapped PCTs comprise two small stands of PCT 3594 (Sydney Coastal Sandstone Foreshores Forest) approximately 330 m to the east and southeast of the site. PCT 3594 has no associated Threatened Ecological Communities under the BC Act. <u>Fauna</u> The NSW Bionet Atlas has recorded sightings of three threatened fauna species in the vicinity of the proposal site. A summary of these sighting is detailed below.

Common Name	Scientific Name	Observation Date	Distance from site	No of individuals sighted	Conservation Status
Green Turtle	***Chelonia mydas***	July 2020	240 m	1	EPBC Act - Vulnerable BC Act – Vulnerable
Powerful Owl	***Ninox strenua***	April 2013	300 m	3	EPBC Act - Not Listed BC Act – Vulnerable
Grey-headed Flying-fox	***Pteropus poliocephalus***	October 2015	320 m	1	EPBC Act - Vulnerable BC Act – Vulnerable

Aspect	Potential impacts

The proposal site is also:

- not within or near to any land reserved under the NPW Act
- not within 200m of any recorded threatened flora or fauna sightings
- not mapped as bushfire prone land.

Construction impacts

Flora

An Aboricultural Impact Assessment was prepared to consider potential impacts on trees within the project construction footprint (Canopy Consulting, 2014) which is included as Appendix D. The assessment identified that minor vegetation impacts will occur from construction activities, including:

- removal of two tuckeroo trees (***Cupaniopsis anacardioides***) located immediately to the southern wall of the CSH stairs
- removal of a single coastal banksia tree (***Banksia integrifolia***) located approximately 2 m to the southwest of the CSH stairs
- partial removal of a stand of ***Lomandra longifolia*** plantings at the top of the Clontarf Beach foreshore
- potential trimming of some lower tree branches of the adjacent Norfolk Island Pine if required for equipment access. Note: this tree is not the heritage listed 'Norfolk Island Pine commemorative tree' referred to in the heritage assessment section below (which will not be impacted by the proposal).

Following the installation of the temporary overflow relief structure, disturbed areas will be stabilised and revegetated with suitable species in consultation with Northern Beaches Council. The three trees to be removed will be offset at a 1:1 replacement ratio in accordance in accordance with the Sydney Water Biodiversity Offset Guide.

Where possible, the offset trees will be replaced within Clontarf Reserve subject to the agreement of Northern Beaches Council. Where it is not possible to meet the offset requirement on site, an alternative site as close as practicable to the proposal site will be selected.

Fauna

Given the high mobility and transient presence of the identified threatened fauna species and small disturbance footprint of the works, impacts arising from the proposal at this site are expected to be minimal.

These impacts can be managed with the implementation of the specific mitigation measures in Table 8.

Aspect	Potential impacts
Aquatic ecology	**Existing environment** A Marine Ecology Assessment was prepared by Stantec to support the preparation of the REF. A copy of the assessment is provided in Appendix E and is summarised below. The subtidal seabed and intertidal habitats immediately offshore of the CSH comprise soft sediments with small, sparse patches of macroalgae and rocks (including some with encrusting oysters). One Common stingray and a few Fanbelly leatherjackets were observed, along with a range of common mollusc species in intertidal areas. No threatened or endangered species or populations as listed under the FM Act, BC Act or EPBC Act were observed during the field survey undertaken on 18 July 2024. **Construction impacts** The area of disturbance for construction is very small in comparison to the large area of similar habitat available within the surrounding area of Middle Harbour. Impacts to aquatic fauna and marine vegetation would be minimal and temporary during the construction phase. There is potential for fine sediments to be mobilised during construction, which can smother proximal aquatic vegetation and habitat. Mobilisation of finer debris can also result in the resuspension of sediments of an unknown quality, including those containing any legacy contaminants that may persist. Such disturbances would be temporary depending on the volume and the size of fine debris, and the extent of local wave, tide and current actions. Increased levels of turbidity are unlikely to exceed ambient turbidity levels currently experienced within the estuary after high rainfall or storm events. The condition of the existing subtidal overflow pipe will be checked to ensure that the outlet is not blocked/buried and will be able to function appropriately. If flushing of the existing pipe is required, this will be undertaken using a vacuum truck (or equivalent) operated from the existing Sydney Water maintenance hole on Clontarf Beach to minimise mobilisation of sediments within the water column. Where this is not practicable and the pipe is required to be flushed using a purging method (ie pushing material from the outlet into the water column), testing of the existing pipe for contaminants such as heavy metals will be undertaken prior to flushing to reduce risk of contaminants entering into Middle Harbour. It is likely that most highly mobile intertidal or subtidal fauna would temporarily seek alternative, unaffected habitat elsewhere in the vicinity. Less mobile fauna, or those with strong site fidelity and high likelihood of occurrence, such as Syngnathids (seahorses), could be temporarily affected by local changes in water quality that may affect breeding, feeding and/or foraging behaviour. Based on the likelihood of occurrence assessment, there is a low potential of occurrence of Syngnathids within areas immediately offshore due to the lack of preferred habitat.

Aspect	Potential impacts
	Any construction-related impacts would be temporary, relatively short term and localised. Silt curtains will be installed and maintained for the duration of all relevant works in close proximity to the shoreline of Middle Harbour. **Operational impacts** During operation, there would be controlled releases of wastewater diverted from the CSH through the newly installed overflow pipe into an existing pipe/subtidal outlet into Middle Harbour. The wastewater overflows released at the subtidal outlet would be expected to be equivalent in frequency, volume and composition to the overflow water currently being sporadically released from the CSH, onto the beach and into the harbour during high rainfall events. Recent uncontrolled wastewater overflows travel from the CSH through beach sands or via overland flow directly to Middle Harbour at the tide mark. Stratification would normally occur following high rainfall events due to influx of freshwater runoff, which would sit on the surface of marine waters until it mixes within the water column. The diversion of wastewater overflows to an existing 300 mm outlet would release these overflows at depth, with the released water forced to more readily mix with the deeper, faster-flowing channel water. Receiving waters would also be expected to be relatively poor in water quality during the time of overflow release due to other inputs from stormwater pipes and other overflows in Middle Harbour during heavy rainfall events. Accordingly, impacts associated with operational overflows are expected to be minor. These impacts would also be temporary, as the occurrence of overflows during operation of the diversion pipe are expected to decrease substantially following the completion of works for the NSOOS desilting program.
Heritage	**Aboriginal heritage** The proposal is located within a high-risk landscape for potential unidentified Aboriginals objects, being within 200 m of a waterway (Middle Harbour). There are 27 registered sites on the AHIMS database within 1 km of the proposal, however there are no recorded AHIMS sites within 200 m of the works area. In addition, this area has been subject to multiple past ground disturbances for construction of the CSH and twin syphon pipes below Middle Harbour, construction of the existing maintenance hole and discharge pipe on Clontarf beach, as well as construction of other utilities in the area such as gas. Due to the extent of past ground disturbance in this area, it is unlikely that previously unidentified Aboriginal sites would be encountered during excavation. No unregistered Aboriginal objects were observed during visual inspection on 16 June 2024 and 7 July 2024. Works can therefore proceed with caution. **Non-Aboriginal heritage** The proposal will include works within the curtilage of the Middle Harbour Syphon NSOOS, which is a State-significant item listed on the State Heritage Register (SHR#01628). An exemption under Section 57(2) of the Heritage Act has been granted by the Sydney Water Senior Heritage Advisor for those works within the SHR curtilage

Aspect	Potential impacts
	of the Middle Harbour Syphon NSOOS (under Sydney Water's delegation of functions of the Heritage Act). Standard Exemption 19 of the ***Heritage Act 1977*** allows for the temporary or emergency securing of a heritage item for the safety of users or the public. This exemption can be used where there has been damage caused by an unexpected event, rather than safety risks that arise from ongoing neglect or maintenance. This exemption is applicable as these works are temporary (5-7 years until the long-term solution has been implemented), in response to extreme wet weather events and required for the safety of users/ the public. The works will have a minimal impact on the heritage fabric of the CSH and will be undertaken consistent with the requirements of the Section 57(2) exemption. The temporary pipework attached to the CSH will be removed, and any fabric modified will be returned to its pre-construction condition once the long-term solution is complete. An existing stencilled image is located on the northern wall of the CSH. Although the origins of the artwork have not been confirmed, it is possible that it is potentially attributable to the artist known as 'Banksy'. Accordingly, the proposal will carried out in a manner which ensures that there is no impact to this artwork. The proposed works at CSH will be within or adjacent to the curtilages of several heritage items listed in Schedule 5 of the Manly LEP (refer to Figure 2): • Harbour foreshores – ID I1 • Clontarf Park – ID I42 • Norfolk Island Pine commemorative tree (***Araucaria heterophylla***) – ID I43 • Middle Harbour Submarine Syphon (NSOOS) – ID I44 • Middle Harbour Syphon (NSOOS) – ID I45. The works are largely underground except for temporary pipework coming out of the CSH. Any works are likely to have minimal or negligible impact on the heritage significance of the above LEP heritage items. The commemorative tree (ID 143) is located more than 50 m from the proposal and would not be affected by construction activities.
Noise and vibration	**Construction noise impacts** The Transport for NSW (TfNSW) Construction and Maintenance noise estimator tool (TfNSW, 2022) ("noise estimator tool") was used to perform a basic noise assessment to capture predicted noise impacts at different distances for different types of receivers. The proposal site is located within a public recreation area (Clontarf Reserve), which is a popular area for visitors, particularly during the warmer months. There is an existing restaurant/café within Clontarf Reserve (Bosk Kiosk & Restaurant) about 75 m to the northeast which is open 7 days a week. The nearest residential receivers (low-density housing) are approximately 60 m to the east of

the proposal site. In accordance with the noise estimator tool receiver type1 classifications, Bosk Kiosk and Restaurant is classified as an 'office/retail outlet'.

Based on the guidance contained in the noise estimator tool, the "R1" noise area category was selected as the closest corresponding noise area category.

Construction noise impacts

A total of four construction activity scenarios were modelled using the 'distance based noisiest plant scenario" in the noise estimator tool as follows:

- Activity 1: Site establishment and mobilisation
- Activity 2: Use of a temporary construction compound
- Activity 3: Installation of drainage infrastructure
- Activity 4: Cutting of syphon house stairway.

A summary of the resultant potential noise impacts for residential and non-residential receivers are detailed below in Table 6 and Table 7 (respectively).

The noise impact categories as detailed in the Interim Construction Noise Guideline (EPA, 2009) have been selected to assess the potential noise impacts of each activity, with and without line of sight. Where the noise estimator tool calculated that affected distances for noise level exceedances will be less than the actual distance to the corresponding sensitive receiver, these have been marked as not applicable (n/a).

Table 6 Construction noise impact summary – distance to residential receivers where potential impacts are predicted

Activity	$L_{Aeq(15minute)}$ noise level above background (L_{A90})		
	20 to 30 dB(A)	> 30 dB(A)	$L_{Aeq(15minute)}$ 75dB or greater
	Moderately intrusive	Highly intrusive	Highly affected
Activity 1 – line of sight	n/a	n/a	n/a
Activity 1 – no line of sight	n/a	n/a	n/a
Activity 2 – line of sight	n/a	n/a	n/a
Activity 2 – no line of sight	n/a	n/a	n/a
Activity 3 – line of sight	85 m	n/a	n/a
Activity 3 – no line of sight	n/a	n/a	n/a
Activity 4 – line of sight	155 m	60 m	n/a
Activity 4 – no line of sight	105 m	n/a	n/a

Table 7 Construction noise impact summary – Non-residential receivers

Land use	$L_{Aeq(15minute)}$ noise level above Noise Management Level *	
	10-20dB(A)	Highly affected – 75dB(A) or above
Activity 1		
Active recreation	n/a	10 m
Passive recreation	15 m	10 m
Activity 2		
Active recreation	n/a	15 m
Passive recreation	25 m	15 m
Activity 3		
Active recreation	n/a	20 m
Passive recreation	30 m	20 m
Activity 4		
Active recreation	n/a	35 m
Passive recreation	60 m	35 m

While the works will be audible to nearby residential receivers on Monash Crescent to the southeast, most construction activities are not predicted to be intrusive.

The cutting of the CSH stairs (Activity 4) will require the use of a concrete saw and is predicted to be moderately intrusive for those residences within 155 m of the site, and highly intrusive for two dwellings on Monash Crescent. However, as the concrete saw will only be used intermittently for short periods over 1-2 days during construction, the impacts would be limited in extent.

Depending on the activity being undertaken at the time, passive and active recreation users of Clontarf Reserve are predicted to be highly affected for areas located up to 35 m from the worksite (during Activity 4), however for most of the construction program, highly affected areas will extend only 20 m from the works (i.e. Activities 1, 2 and 3). Given their generally high mobility, it is expected that most recreational users will move further from the worksite to lessen the potential noise impact.

The noise estimator tool identifies recommended mitigation measures to be implemented based on the extent of potential noise exceedances above the applicable noise management levels for works both within and outside of standard construction working hours.

It is noted that the Bosk Café and Restaurant is also available for use as a wedding venue, with wedding ceremonies held immediately adjacent within Clontarf Reserve. Although the noise predictions identify that Bosk Café and Restaurant would not be highly affected, some construction activities will be

Aspect	Potential impacts
	clearly perceptible at the venue (including concrete cutting of the CSH stairs). Consultation will be undertaken with the operators of Bosk Café and Restaurant to identify any potential noise sensitive functions (ie weddings) scheduled to take place during the construction period. Where an overlap with construction activities may occur, appropriate time-specific mitigation measures will be implemented to ensure that noise from construction activities does not adversely affect the identified noise sensitive event(s). Overall, although some sensitive receivers may experience short-term noise impacts, the overall noise impact is not expected to be substantial and can be managed through standard mitigation measures. **Construction vibration impacts** The construction methodology for the proposal includes the use of a single piece of vibration generating plant, being a hand held soil compactor which will used to compact materials following the backfilling of open trenched areas. The soils at the proposal site comprise highly unconsolidated siliceous sands (ie beach and dune materials) which have poor vibration propagation properties. Combined with the small hand held compactor which will be used, vibration impacts will be negligible. Although the adjacent Clontarf Syphon House is listed on the State Heritage Register and the Manly Local Environmental Plan 2013, the structure is comprised of thick walled cast in-situ concrete which will not be sensitive to vibration from the nearby use of a hand held soil compactor. Therefore, no vibration related impacts to the Clontarf Syphon House are expected. **Operational noise and vibration impacts** The overflow diversion infrastructure at the proposal site would only discharge overflows during extreme weather events. No noise or vibration generating plant or equipment is required for the operation of the overflow infrastructure and therefore no operational noise or vibration impacts are expected.
Air and energy	Receivers in nearby residential premises could potentially be impacted by changes to air quality during construction. During construction, dust may be generated during vehicle movements on unsealed areas, stockpile creation and movement, and during ground disturbance. Dust generation would be more likely in dry and windy conditions, and in areas not covered by hardstand. However, given the high sand content of the soils, dust generation is likely to be minimal. Odour may be generated during overflow events, however with the installation of the temporary relief structure, it is expected that impacts would be substantially reduced in comparison to recent events where overflows have originated directly from the CSH to Middle Harbour. There would be minor emissions from plant, equipment, and vehicles during construction. If this machinery is poorly maintained, or left running unnecessarily, overall fuel emissions would increase. Implementing mitigation measures to

Aspect	Potential impacts
	manage stockpiles and vehicle movements will minimise the risk of adverse air quality impacts.
Waste and hazardous materials	During construction, the proposed work has the potential to generate the following types of waste: • green waste from vegetation clearing • excess excavated spoil • general construction waste • concrete washout waste from concrete pouring activities • domestic waste including food scraps, plastic and paper containers generated by site construction personnel. The proposal is not anticipated to generate large volumes of waste. Where possible, it is preferred to reuse suitable excavated materials from site to backfill excavations. The CEMP would identify all potential waste streams associated with the work and outline method of reuse, recycling or disposal of waste at appropriately licensed facilities. The CEMP would also include other onsite management practices such as keeping areas free of rubbish. No impacts associated with waste or hazardous materials are anticipated during operation.
Traffic and access	**Construction traffic impacts** It is estimated that construction activities will require an average of 5 light vehicle and two heavy vehicle movements per day. Construction vehicles will access the site via Peronne Ave or Amiens Rd into Sandy Bay Road and will use the existing (sealed) internal road within Clontarf Reserve to reach the construction area. These movements represent a negligible increase on existing vehicle traffic using Clontarf Reserve. Light vehicles will park in existing marked spaces close to the worksite. Heavy vehicle movements (primarily medium rigid trucks) will be intermittent and be present at the site temporarily (e.g. material deliveries, spoil loading etc). The construction compound will occupy an additional 4 public parking spaces, however this would be temporary over a period of about 3 months. Given the large number of public parking spaces within Clontarf Reserve, impacts on parking availability are expected to be minor. Regular consultation with council will continue throughout the project. **Operational traffic impacts** Regular but infrequent inspections of the temporary overflow relief structure will be required and is likely to be undertaken concurrently with inspections of the existing maintenance hole on Clontarf Beach. Operational traffic impacts are therefore expected to be negligible.

Aspect	Potential impacts
Social and visual	Potential amenity impacts related to noise, air quality, and traffic and access have been assessed above. The existing wastewater assets are visible from adjacent residential properties and Clontarf Reserve, with views partially blocked by nearby surrounding vegetation. Receivers surrounding the proposal would experience minor and localised visual impacts from construction activities and equipment, however these impacts would be limited to the construction and will therefore be temporary in nature. The area in front of the CSH has high recreational usage by the public, especially during the summer months. In addition, the Manly to Spit Bridge walk traverses along the beachfront through this area. During construction there will be impacts to public amenity and recreational access as the construction works area will be fenced off for public safety. The construction period is likely to overlap with summer, the peak period for public recreation and access. Where through access is restricted along the beachfront, pedestrian detours and signage will be provided to ensure there is an alternate route available for the public. Once complete, these works will ensure less impacts to public recreation and amenity in this area, compared to the current situation with intermittent uncontrolled overflows from the CSH.
Cumulative and future trends	A search of the DPHI's Major Projects website was conducted on 27 November 2024 and identified the following approved projects within 5 km of the proposal: • Warringah Freeway Upgrade, Cammeray, NSW – about 4.0 km to the southwest of the proposal • Western Harbour Tunnel, North Sydney – about 4.0 km to the southwest of the proposal The broader NSOOS desilting program is also being delivered by Sydney Water however it is unlikely that the construction program will overlap with the construction of the temporary overflow relief structure. Due to the minor and localised nature of these proposed works and the distance between the proposal and the above major projects, it is unlikely that cumulative amenity impacts such as noise, air quality, and traffic would occur at a local or regional scale.

6 Environmental mitigation measures

Table 8 Mitigation measures

Mitigation measures
General
Should the proposal change from the REF, and different /additional scope of works than described in this REF is required, no further environmental assessment is required provided the change: • remains within the assessment area for the REF and has no net additional environmental impact; or • is outside the assessment/study area for the REF but: - reduces impacts to biodiversity, heritage or human amenity; - avoids engineering (for example, geological, topographical) constraints; and - after consultation with any potentially affected landowners and relevant agencies. It must be demonstrated in writing how the changes meet these requirements, for approval by Sydney Water's Project Manager in consultation with the environmental and community representatives. Consultation will also be undertaken with Sydney Water's heritage advisors in case additional or amended heritage approvals are required.
Prepare a Construction Environmental Management Plan (CEMP) for the site establishment addressing the requirements of this environmental impact assessment. The CEMP should specify licence, approval and notification requirements. Prior to the start of work, all project staff and contractors will be inducted in the CEMP. The CEMP must be readily available on site and include a site plan which shows: • go/no go areas and boundaries of the work area, including locations of laydown and storage areas for materials and equipment • location of environmental controls (such as erosion and sediment controls, fences or other measures to protect vegetation, spill kits) • location and full extent of any vegetation disturbance. The CEMP will delineate approved disturbance boundary before construction.
Prepare an Incident Management Plan (IMP) outlining actions and responsibilities for: • predicted/onset of heavy rain during works • spills • unexpected finds (e.g. heritage and contamination) • other potential incidents relevant to the scope of works. All site personnel must be inducted into the IMP.
To ensure compliance with legislative requirements for incident management (e.g. ***Protection of the Environment Operations Act 1997)***, Sydney Water's employees and contractors will follow SWEMS0009. Attach SWEMS0009 to the CEMP.
Complaints to be managed in accordance with Sydney Water's Complaints Procedure and Community Engagement Plan.
A pre-condition site assessment to be performed before site occupation to identify any existing contamination.
Topography, geology, and soils
Prevent sediment moving offsite in accordance with Managing Urban Stormwater, Soils and Construction, Volume 1 and 2A (Landcom 2004 and DECC 2008), including, but not limited to: • divert surface runoff away from disturbed soil and stockpiles

Mitigation measures

- install sediment and erosion controls before construction starts
- reuse topsoil where possible and stockpile separately
- inspect controls at least weekly and immediately after rainfall
- rectify damaged controls immediately
- remove controls once surfaces have been stabilised, including removing trapped sediment in drainage lines.

Minimise ground disturbance and stabilise disturbed areas progressively.

Sydney Water to ensure imported material is Virgin Excavated Natural Materials (VENM) or meets a relevant NSW EPA Resource Recovery Order and Resource Recovery Exemption, or is a commercially supplied material that is not waste.

If using materials that are subject to a NSW EPA Resource Recovery Order/Exemption Sydney Water must ensure the conditions in that Order/Exemption are strictly adhered to.

Stop work in the immediate vicinity of suspected contamination. Indicators of contamination include discoloured soil, anthropogenic material within fill, asbestos, chemical or petrol odours and leachate. Contain disturbed material on an impermeable surface and cordon areas off. Notify the Sydney Water Project Manager and the Environmental Representative (who will contact Property Environmental Services) to agree on proposed management approach.

Stop work during heavy rainfall or in waterlogged conditions when there is a risk of sediment loss off site.

Sweep up any sediment/soil transferred off site at least daily, or before rainfall.

Eliminate ponding and erosion by restoring natural landforms to the pre-works condition.

The site will be designed to ensure that dirt/mud is not tracked offsite by vehicles (e.g. use of hardstand, rumble grids or equivalent at exit).

If acid sulfate soils are encountered during construction, works affecting acid sulfate soils must cease. Works affecting acid sulfate soils and can only recommence following preparation and implementation of an acid sulfate management plan.

Water and drainage

Keep functioning spill kit on site for clean-up of accidental chemical/fuel spills. Keep the spill kits stocked and located for easy access.

All dewatering activities are to be undertaken in accordance with the requirements of the Water Supply Works Approval (WSWA) No. 10WA125165. In the event of any inconsistency between the WSWA and these mitigation measures contained in this REF, the WSWA shall prevail to the extent of the inconsistency.

Locate portable site amenities, chemical storage and stockpiles of erodible materials away from watercourses, drainage lines and flood prone areas.

Store all chemicals and fuels in accordance with relevant Australian Standards and Safety Data Sheets. Record stored chemicals on site register. Bunded areas to have 110% capacity of stored liquid volume. Chemicals and fuels in vehicles must be tightly secured. All chemicals to be clearly labelled.

Conduct refuelling, fuel decanting and vehicle maintenance in compounds where possible. If field refuelling is necessary, designate an area away from waterways and drainage lines with functioning spill kits close by.

Conduct any equipment wash down within a designated washout area. Ensure the area is bunded and any wastewater is captured within the site.

Mitigation measures

Ensure equipment is leak free. Repair oil/fuel leaks immediately or remove from site and replace with a leak-free item.

Bund potential contaminants and store on robust waterproof membrane, away from drainage lines.

Flora and fauna

Provided it is essential for delivering the project, Sydney Water's Project Manager can approve the following vegetation removal and tree trimming, without additional environmental assessment (but only after consultation with the Environmental and Community Representatives and affected landowners). Sydney Water considers vegetation removal in these circumstances has minimal environmental impact.

- Any minor:
  - vegetation trimming or
  - removal of exotic vegetation or
  - removal of planted native vegetation.

  where the vegetation is not a threatened species (including a characteristic species of a threatened community or population), heritage listed, in declared critical habitat or in a declared area of outstanding biodiversity value.
- Any removal of remnant vegetation where there is no net change to environmental impact (e.g. a different area of vegetation is removed but the total area is the same or less than assessed in the EIA).

Written explanation of the application of this clause (including justification of the need for trimming or removal and any proposed revegetation) should be provided when seeking Project Manager approval. Any impacts to native vegetation and trees must be offset in accordance with the Biodiversity Offset Guideline (SWEMS0019.13).

The avoid, minimise, then offset hierarchy should be adopted when considering impacts to vegetation within the study area. Following the installation of the temporary overflow relief structure, disturbed areas will be stabilised and revegetated with suitable species in consultation with Northern Beaches Council. The three trees to be removed will be offset at a 1:1 replacement ratio in accordance with the Biodiversity Offset Guideline (SWEMS0019.13). Where possible, the offset trees will be replaced within Clontarf Reserve subject to the agreement of Northern Beaches Council. Where it is not possible to meet the offset requirement on site, an alternative site as close as practicable to Clontarf Reserve will be selected.

Physically delineate vegetation to be cleared and/or protected on site and install appropriate signage prior to works commencing. An arborist should be engaged to ensure the structural root zones of the retained trees are adequately protected.

Temporary protective fencing is to be installed to delineate and prevent access within the tree protection zone (TPZ) of the large Norfolk Island Pine immediately to the south of the syphon house steps for the duration of construction. Any excavation works within the TPZ are to be undertaken in consultation with an arborist.

If any threatened species (flora or fauna) is discovered during the works, stop work immediately and notify the Sydney Water Project Manager. Work will only recommence once the impact on the species has been assessed and appropriate control measures provided.

Manage biosecurity in accordance with:

- ***Biosecurity Act 2015*** (see NSW Weedwise), including reporting new weed infestations or invasive pests
- contemporary bush regeneration practices, including disposal of sealed bagged weeds to a licenced waste disposal facility.

Record Pesticides and Herbicides use in accordance with SWEMS0017.

In a TOBAN, activities involving general purpose hot works (that are not essential/emergency works) require an exemption. Exemption request are to be submitted to CDResiliencePrograms@sydneywater.com.au or CustomerHub.DutyManager@sydneywater.com.au

Mitigation measures

Impacts to hollow-bearing trees and their structural root zones should be avoided where practical.

Install a silt curtain(s) immediately offshore of Clontarf Beach prior to commencing excavation activities and prior to flushing the existing overflow pipe to contain any temporary increases in turbidity and reduce dispersal of any potentially contaminated sediments and debris suspended by the works.

Flushing of the existing subtidal overflow pipe should be undertaken using a vacuum truck (or equivalent) from the existing Sydney Water maintenance hole on Clontarf Beach. If the pipe is to be flushed via a purging method (ie pushing material from the outlet into the water column), testing of the existing pipe for contaminants such as heavy metals is to be undertaken prior to flushing to reduce risk of contaminants entering into Middle Harbour.

Site rehabilitation to be undertaken following construction works.

Heritage

If any Aboriginal objects, suspected Aboriginal objects or non-Aboriginal relic is found, cease all excavation or disturbance in the area and notify Sydney Water Project Manager in accordance with SWEMS0009.

All activities must be undertaken in accordance with the requirements of, and consistent with the proposed works described in the s57 exemption issued by the Sydney Water Senior Heritage Advisor under delegation of Heritage NSW (see Appendix G). In the event of any inconsistency between the s57 exemption and these Environmental Mitigation Measures, the s57 exemption shall prevail to the extent of the inconsistency.

Works must not impact the stencilled image on the northern wall of the Syphon House (as this may potentially be attributable to the artist known as ‘Banksy‘).

All removed heritage fabric / elements will be reinstated following the decommissioning of the temporary overflow relief structure. This will include, but not be limited to the following:

- section of the ‘kickboard’ removed from at the top of one side of the staircase to accommodate the temporary outlet pipe
- the right-hand side entrance sliding door panel (if removed).

Noise and vibration

Works must comply with the Interim Construction Noise Guideline (EPA, 2009), including scheduling work and deliveries within the following working hours:

- 7am to 6pm Monday to Friday
- 7am to 4pm Saturday
- No work on Sunday or public holidays.

Any proposed work outside of these hours must be justified.

The proposal will also be carried out in accordance with Sydney Water's Noise Management Procedure SWEMS0056.

All reasonable and feasible noise mitigation measures should be justified, documented, and implemented on-site to mitigate noise impacts.

Incorporate **standard daytime hours noise management mitigation measures** into the CEMP, including but not limited to:

- implement a noise complaints handling procedure
- appropriate plant will be selected for each task, to minimise the noise impact (eg all stationary and mobile plant will be fitted with residential type silencers)

Mitigation measures

- engine brakes will not be used when entering or leaving the work site(s) or within work areas.
- regularly inspect and maintain equipment in good working order
- arrange work sites where possible to minimise noise (eg generators away from sensitive receivers, site set up to minimise use of vehicle reversing alarms, site amenities and/ or entrances away from noise sensitive receivers).

If works **beyond standard daytime hours are needed greater than on an ad hoc basis**, Sydney Water would:

- justify the need for out of hours work (OOHW) and why it is not possible to carry out the works during standard daytime hours
- consider potential noise impacts and: implement the relevant standard daytime hours mitigation measures; Sydney Water's Noise Management Code of Behaviour (SWEMS0056.01) and document all reasonable and feasible management measures to be implemented
- identify additional community notification requirements and outcomes of targeted community consultation
- seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives.

Consultation will be undertaken with the operators of Bosk Café and Restaurant to identify any potential noise sensitive functions (ie weddings) scheduled to take place during the construction period. Where an overlap with construction activities may occur, appropriate time-specific mitigation measures will be implemented to ensure that noise from construction activities does not adversely affect the identified noise sensitive event(s). The proposed measures to be implemented are to be developed in consultation with the Sydney Water environment and communications representatives.

Air and energy

Use alternatives to fossil fuels where practical and cost-effective.

Track energy use as per SWEMS0015.28 Contractor NGER template.

Maintain equipment in good working order, comply with the clean air regulations of the ***Protection of the Environment Operations Act 1997***, have appropriate exhaust pollution controls, and meet Australian Standards for exhaust emissions.

Switch off vehicles/machinery when not in use.

Implement measures to prevent offsite dust impacts, for example:

- water exposed areas (using non-potable water source where possible such as water from excavation pits)
- cover exposed areas with tarpaulins or geotextile fabric
- modify or cease work in windy conditions.

Cover all transported waste.

Waste and hazardous materials

Manage waste in accordance with relevant legislation and maintain records to show compliance eg waste register, transport and disposal records. Record and submit SWEMS0015.27 Contractor Waste Report.

Minimise the generation of waste, sort waste streams to maximise reuse/recycling in accordance with the ***Waste Avoidance and Resource Recovery Act 2001***.

Mitigation measures

Manage waste and excess spoil in accordance with the NSW EPA Resource Recovery Orders and Exemptions (if applicable) and / or Waste Classification Guidelines. Where materials are not suitable or cannot be reused onsite or offsite, recycle soils at a licensed soil recycling facility or dispose at an appropriately licenced landfill facility.

Prevent pollutants from escaping including covering skip bins.

If fibro or other asbestos containing material is identified, restrict access and follow Sydney Water's Asbestos Management – Minor Works procedure, Document Number 746607 and SafeWork NSW requirements. Contact Sydney Water Project Manager (who will consult with Property Environmental Services propertyenvironmental@sydneywater.com.au).

Traffic and access

All vehicles to park within nominated construction vehicle parking areas/spaces (if applicable).

Where through access along Clontarf Beach is restricted between Clontarf Syphon House and the Middle Harbour foreshore, pedestrian detours and signage are be provided to ensure there is an alternate route available for the public.

Social and visual

Undertake works in accordance with Sydney Water Communications policies and requirements including:

- Notify impacted residents and businesses
- Erect signs to inform the public on the nature of work
- Personnel treat community enquiries appropriately.

The worksite will be restored to pre-existing condition or better.

Maintain the compound in a clean and tidy condition.

Cumulative and future trends

Continue to liaise with Sydney Water Property team and NSOOS desilting project delivery team at to minimise any cumulative impacts.

Appendix A – Section 171 checklist

Section 171 checklist	REF finding
Any environmental impact on a community	There may be short-term impacts on the community from soil and water impacts, noise, and traffic during construction. There may be longer term impacts during depot operation from noise and traffic impacts. However, given the distance to sensitive receivers, these impacts would be minor. Any impacts would be managed by implementing the mitigation measures in this document.
Any transformation of a locality	The proposal will not result in the permanent transformation of a locality. Following completion of construction, the site would be rehabilitated.
Any environmental impact on the ecosystems of the locality	The proposal will require the removal of one coastal banksia tree, two tuckeroo trees and a small number of lomandra individuals, but will not result in environmental impacts to ecosystems of the locality. Following completion of construction activities, the site would be rehabilitated.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	The proposal will not result in a reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality. Following completion of construction activities, the site would be rehabilitated.
Any effect upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or any other special value for present or future generations	The proposal will occur on land that is state heritage listed, however it will not have any effect upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or any other special value for present or future generations. The heritage values within and adjacent to the Clontarf site would not be significantly impacted.
Any impact on the habitat of any protected animals (within the meaning of the ***Biodiversity Conservation Act 2016***)	The proposal will require the removal of one coastal banksia tree, two tuckeroo trees and a small number of lomandra individuals. As such, the proposal will not have any impact on the habitat of any protected animals.
Any endangering of any species of animal or plant or other form of life, whether living on land, in water or in the air	The proposal will not be endangering any species.
Any long-term effects on the environment	The proposal will not have any long-term impacts on the environment and will provide an immediate benefit by reducing he occurrence of uncontrolled overflows from the Clontarf Syphon House ahead of the broader desilting and rehabilitation program for the NSOOS.

Section 171 checklist	REF finding
Any degradation of the quality of the environment	The proposal will not cause the degradation of the quality of the environment.
Any risk to the safety of the environment	The proposal will not increase risk to the safety of the environment.
Any reduction in the range of beneficial uses of the environment	The proposal will not have any reduction in the range of beneficial uses of the environment, and will reduce the occurrence of uncontrolled wastewater overflows on Clontarf Beach.
Any pollution of the environment	Environmental mitigation measures will mitigate the potential for the proposal to pollute the environment during construction, and will reduce the occurrence of uncontrolled wastewater overflows on Clontarf Beach.
Any environmental problems associated with the disposal of waste	The disposal of wastes will be conducted in accordance with the environmental mitigation measures, and no environmental problems associated with the disposal of waste are expected.
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	The proposal will not increase demand on resources, that are, or are likely to become, in short supply.
Any cumulative environmental effect with other existing or likely future activities	The proposal is unlikely to result in cumulative impacts at a local or regional scale.
Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	The proposal will temporarily disturb a small section of Clontarf Reserve and Clontarf Beach, however these impacts will be temporary in nature, with affected areas rehabilitated following the completion of construction activities.
Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the EP&A Act, Division 3.1	There are no applicable strategic planning statements or plans relevant to the proposal.
Any other relevant environmental factors.	The proposal has been assessed against the factors listed above, and there are no other relevant environmental factors to consider.

Appendix B – Consideration of principles of ecologically sustainable development (ESD)

Principle	Proposal alignment
Precautionary principle - ***if there are threats of serious or irreversible environmental damage, lack of scientific uncertainty should not be a reason for postponing measures to prevent environmental degradation. Public and private decisions should be guided by careful evaluation to avoid serious or irreversible damage to the environment where practicable, and an assessment of the risk-weighted consequences of various options.***	The proposal will not result in serious or irreversible environmental damage and there is no scientific uncertainty relating to the proposal.
Inter-generational equity - ***the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.***	The proposal will reduce the frequency of uncontrolled wastewater overflows discharging directly from the Clontarf Syphon House, providing improved environmental outcomes for nearby residents and users of Clontarf Reserve. This will benefit future generations through improved management of wastewater at this location.
Conservation of biological diversity and ecological integrity - ***conservation of the biological diversity and ecological integrity should be a fundamental consideration in environmental planning and decision-making processes.***	The proposal will not significantly impact biological diversity or ecological integrity. Construction activities will require the removal of one coastal banksia tree, two tuckeroo trees and a small number of lomandra individuals, but will not result in environmental impacts to ecosystems of the locality. The vegetation requiring removal would be offset.
Improved valuation, pricing and incentive mechanisms - ***environmental factors should be included in the valuation of assets and services, such as 'polluter pays', the users of goods and services should pay prices based on the full life cycle costs (including use of natural resources and ultimate disposal of waste) and environmental goals***	The proposal is necessary to ensure the improved management of wastewater at this location. It provides an optimum outcome in the short-term for the community and environment with respect to financial cost ahead of the longer term solution for the NSOOS desilting and rehabilitation program.

Appendix C – Consideration of TISEPP consultation

TISEPP section	Yes	No
Section 2.10, council related infrastructure or services – consultation with council		
Will the work:		
Potentially have a substantial impact on stormwater management services provided by council?		X
Be likely to generate traffic that will strain the capacity of the road system in the LGA?		X
Connect to, and have a substantial impact on, the capacity of a council owned sewerage system?		X
Connect to, and use a substantial volume of water from a council owned water supply system?		X
Require temporary structures on, or enclose, a public space under council's control that will disrupt pedestrian or vehicular traffic that is not minor or inconsequential?	X	
Excavate a road, or a footpath adjacent to a road, for which the council is the roads authority, that is not minor or inconsequential?		X
Section 2.11, local heritage – consultation with council		
Is the work likely to affect the heritage significance of a local heritage item, or of a heritage conservation area (not also a State heritage item) more than a minor or inconsequential amount?		X
Section 2.12, flood liable land – consultation with council		
Will the work be on flood liable land (land that is susceptible to flooding by the probable maximum flood event) and will works alter flood patterns other than to a minor extent?		X
Section 2.13, flood liable land – consultation with State Emergency Services		
Will the work be on flood liable land (land that is susceptible to flooding by the probable maximum flood event) and undertaken under a relevant provision*, but not the carrying out of minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance? * (e) Div.14 (Public admin buildings), (g) Div.16 (Research/ monitoring stations), (i) Div.20 (Stormwater systems)?		X
Section 2.14, development with impacts on certain land within the coastal zone– council consultation		
Is the work on land mapped as coastal vulnerability area and inconsistent with a certified coastal management program?		X
Section 2.15, consultation with public authorities other than councils		
Will the proposal be on land adjacent to land reserved under the ***National Parks and Wildlife Act 1974*** or land acquired under Part 11 of that Act***? If so, consult with DPE (NPWS).***		X
Will the proposal be on land in Zone C1 National Parks and Nature Reserves or on a land use zone that is equivalent to that zone? ***If so, consult with DPE (NPWS).***		X
Will the proposal include a fixed or floating structure in or over navigable waters? ***If so, consult TfNSW.***		X
Will the proposal be on land in a mine subsidence district within the meaning of the ***Coal Mine Subsidence Compensation Act 2017***? ***If so, consult with Subsidence Advisory NSW.***		X
Will the proposal be on land in a Western City operational area specified in ***the Western Parkland City Authority Act 2018,*** Schedule 2 and have a capital investment value of $30 million or more? ***If so, consult the Western Parkland City Authority***.		X
Will the proposal clear native vegetation on land that is not subject land (ie non-certified land)? ***If so, notify DPE at least 21 days prior to work commencing. (Requirement under s3.24 Chapter 3 Sydney Region Growth Centres - of the SEPP (Precincts – Central River City) 2021).***		X

Appendix D – Aboricultural Impact Assessment

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Ben Groth
Sydney Water
[redacted]

RE: Technical Memorandum – Arboricultural Impact Assessment for Clontarf Syphon Overflow, Monash Crescent, Clontarf NSW 2093

Dear Ben,

I trust you are well. Following our site inspection on 14 August 2024, I am pleased to submit the attached technical memorandum, which outlines the arboricultural impact assessment for the Clontarf Syphon Overflow project at Monash Crescent, Clontarf.

The report includes the findings of the site visit and provides detailed recommendations regarding the trees potentially impacted by the proposed water infrastructure works. We have carefully assessed the trees in relation to the planned construction activities and the potential for root zone encroachments, machinery movement, and other related factors.

If you have any questions, please do not hesitate to contact us.

Yours Sincerely,

[redacted]

Kane Hollstein
Senior Consulting Arborist | Director
Dip. Arb., AQF Level 5
ISA TRAQ | QTRA | VALID | IACA Accredited Member

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1. Introduction

1.1. Background

Sydney Water engaged Canopy Consulting to inspect trees on the site in relation to proposed water infrastructure works at Monash Cres, Clontarf NSW 2093. This arboricultural assessment will form part of the Review of Environmental Factors (REF).

Kane Hollstein, AQF Level 5 Arborist of Canopy Consulting, attended the site on 14 August 2024 inspect the tree(s) of concern.

2. Method

To record the above-ground health and condition of the trees, a Visual Tree Assessment (VTA), adapted from (Lonsdale, 2013), was undertaken from ground level on 14 August 2024.

This involved an inspection of the trees:

- Physical and biological traits
- Inherent genetic and/or structural defects
- Growth characteristics
- Local environmental and climatic conditions
- Immediate growing environment and surrounding built infrastructure

No foliage or soil samples were taken. No below ground investigation was performed.

Trees were assessed from within the site only unless otherwise stated.

Tree dimensions, including height and canopy spread were estimated. Trunk diameters were measured using forestry callipers or diameter tape.

2.1. Tree Protection Zone and Structural Root Zone

The Tree Protection Zone (TPZ) and Structural Root Zone (SRZ) methods have been derived from the Australian Standard 4970–2009: *Protection of Trees on Development Sites* (Standards Australia Limited, 2009). The radius of the TPZ is calculated for each tree by multiplying its Diameter at Breast Height (DBH) by 12.

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$$\text{TPZ radius} = \text{DBH} \times 12$$

In the event the crown spread of the tree extends beyond this offset; the TPZ may be adjusted to the outer extent of the crown spread.

The SRZ is the area around the base of a tree required for the tree's stability in the ground. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres.

$$\text{SRZ radius} = (D \times 50)^{0.42} \times 0.64$$

2.2. Tree Protection Zone (TPZ)

The Tree Protection Zone (TPZ) is a radial distance measured from the centre of the trunk. Application of the TPZ is intended to protect the root system and canopy from potential damage incurred from construction works and ensure the long-term health, stability and landscape viability of each tree to be retained.

Incursions into the TPZ may occur due to excavation, modification of existing ground levels, trenching or inverting the soil profile. Such works may damage part or all of the root system or affect soil structure and growing conditions required for long-term growth.

2.3. Structural Root Zone (SRZ)

The Structural Root Zone (SRZ) is the area required for mechanical support and anchorage of a tree. The woody root growth and soil cohesion in this area are required to hold a tree upright.

Incursions into the SRZ are not recommended as they are likely to result in loss or damage to woody roots which may significantly affect stability.

2.4. Acceptable Encroachments into the TPZ

An encroachment of less than 10% of the entire TPZ is considered minor provided it is outside the SRZ and the area lost is compensated for elsewhere and contiguous to the TPZ.

A major encroachment is considered to be greater than 10% of the entire TPZ area. Where unavoidable, exploratory excavation using non-destructive methods such as pneumatic, hydraulic or hand digging may be required to evaluate the extent of potential damage to the root system and determine whether the tree(s) will remain viable. The area lost to encroachment should be compensated for elsewhere and contiguous to the TPZ.

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Additional encroachments within the TPZ are acceptable, provided the arborist can demonstrate the tree(s) will remain viable.

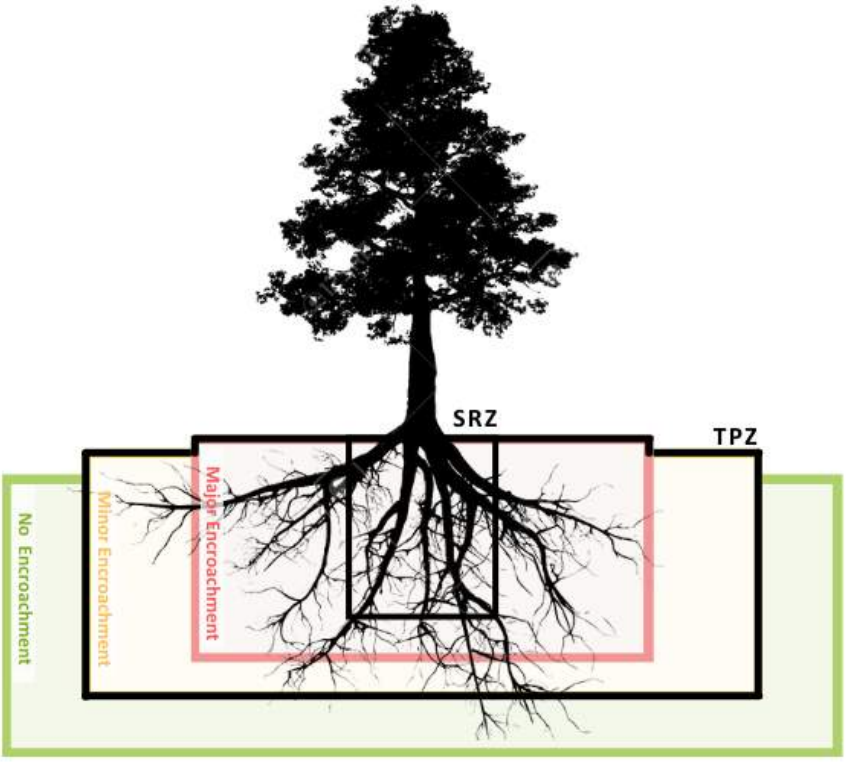

Figure 1: Indicative zones of TPZ and SRZ encroachment.

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3. Findings

A review of the following plans and documents indicates Sydney Water proposes the construction of an above-ground DN600 sewer main in addition to a DN375 underground service with associated chambers, joins and bends. The work is required to reduce sewer overflow during heavy rainfall events.

- Sastii JV DWG6404|P1, Rev 4; dated 24/09/2024
- Sastii JV DWG6404|P2, Rev 4; dated 24/09/2024
- Sastii JV DWG6404|P3, Rev 4; dated 24/09/2024
- Sastii JV DWG6404|P4, Rev 4; dated 24/09/2024

Seven trees were inspected and included as part of the assessment. This includes trees expected to be directly impacted and those potentially indirectly affected by material storage and construction activity. All trees were located in the parkland south of the Syphon House. As the trees were subject to a previous site assessment, numbering begins at tree 5.

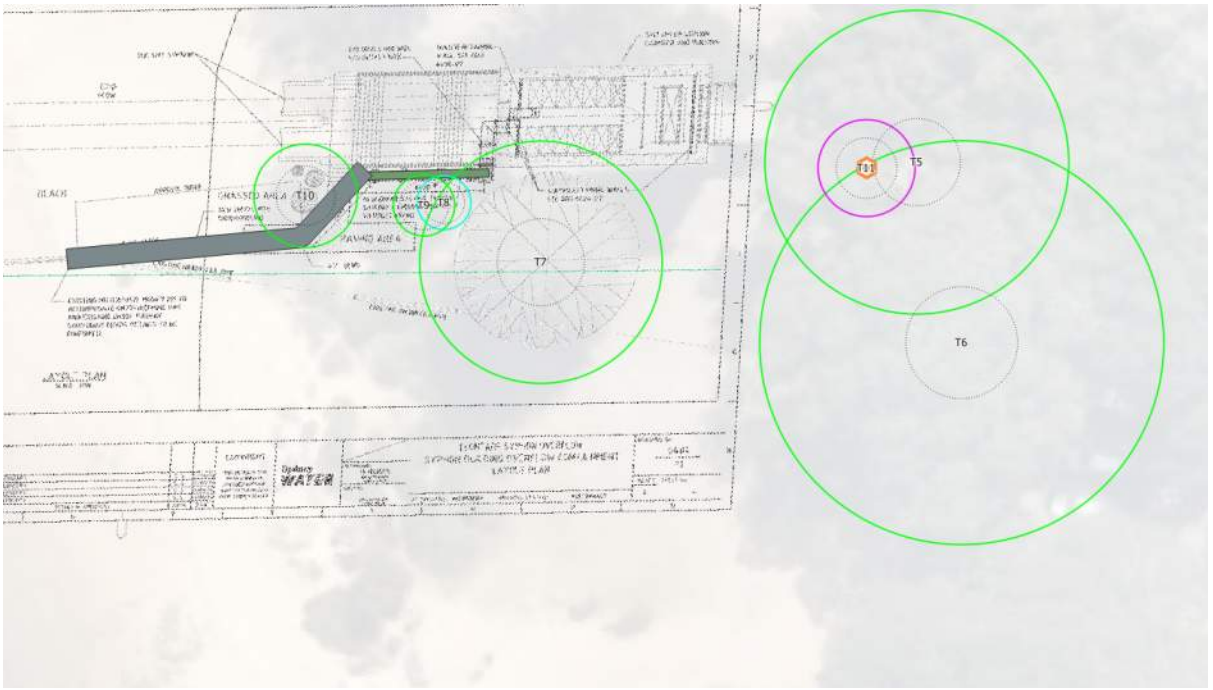

Figure 2: Map showing tree location. (Nearmap, 2024)

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Tree ID: 5 — Contarf Syphon Building

Latin Name	*Ficus microcarpa var hilli*
Common Name	Hills Fig
Tree QTY	1
Tree Height (Estimated) [m]	12
Canopy Spread (Estimated) [m]	12
DBH [cm] Total	94
Health	Good
Structure	Good
Tree Age	Mature
Useful Life Expectancy (Yrs.)	Long (>40)
STARS © Landscape Significance Rating	1 (High)
STARS © Retention Value	High - Priority for Retention
Observations	Co-dominant stems, Deadwood minor (<3cm diameter), Included bark, Root scalping, Suppressed
Observation Comments	
Tree Protection Zone (TPZ) Radius [m]	11.28
Structural Root Zone (SRZ) Radius [m]	3.24

LEGEND

TPZ

- High - Priority for Retention
- Low - Consider for Removal
- SRZ

Page: 1 of 7
Produced 15/10/2024

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Tree ID: 6 — Contarf Syphon Building

Latin Name	*Ficus macrophylla*
Common Name	Moreton Bay Fig
Tree QTY	1
Tree Height (Estimated) [m]	15
Canopy Spread (Estimated) [m]	16
DBH [cm] Total	141
Health	Good
Structure	Fair
Tree Age	Mature
Useful Life Expectancy (Yrs.)	Long (>40)
STARS © Landscape Significance Rating	1 (High)
STARS © Retention Value	High - Priority for Retention
Observations	Cavity, Deadwood moderate (3-10cm diameter), Decay, Root scalping, Wound(s)
Observation Comments	Large trunk cavity with good response growth.
Tree Protection Zone (TPZ) Radius [m]	15
Structural Root Zone (SRZ) Radius [m]	4.15

LEGEND

TPZ

- High - Priority for Retention
- Low - Consider for Removal
- SRZ

Page: 2 of 7
Produced 15/10/2024

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Tree ID: 7 — Contarf Syphon Building

Latin Name	*Araucaria heterophylla*
Common Name	Norfolk Island Pine
Tree QTY	1
Tree Height (Estimated) [m]	11
Canopy Spread (Estimated) [m]	9
DBH [cm] Total	75
Health	Good
Structure	Good
Tree Age	Mature
Useful Life Expectancy (Yrs.)	Long (>40)
STARS © Landscape Significance Rating	1 (High)
STARS © Retention Value	High - Priority for Retention
Observations	Root scalping
Observation Comments	
Tree Protection Zone (TPZ) Radius [m]	9
Structural Root Zone (SRZ) Radius [m]	3.24

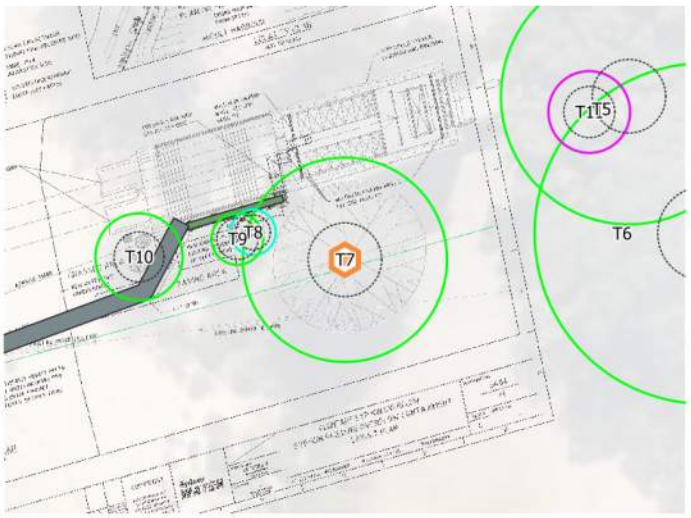
LEGEND

TPZ
- High - Priority for Retention
- Medium - Consider for Retention
- Low - Consider for Removal

SRZ

DN600 AG Pipe

DN375 BE Pipe Trench



Page: 3 of 7
Produced 15/10/2024

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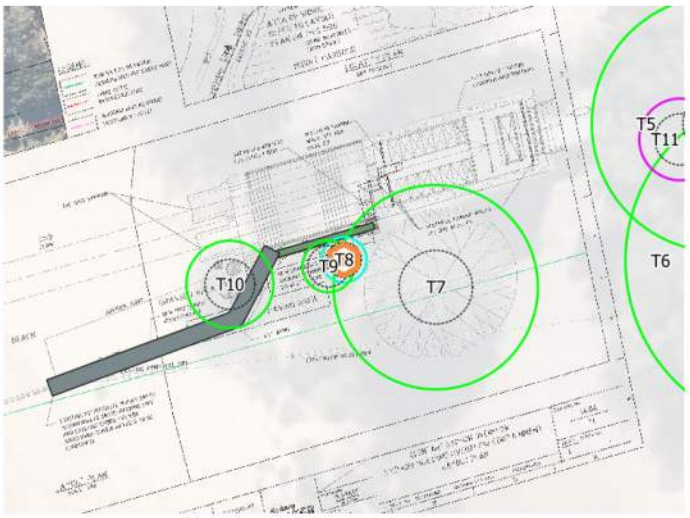
Tree ID: 8 — Contarf Syphon Building

Latin Name	*Cupaniopsis anacardioides*
Common Name	Tuckeroo
Tree QTY	1
Tree Height (Estimated) [m]	3
Canopy Spread (Estimated) [m]	2
DBH [cm] Total	15
Health	Fair
Structure	Good
Tree Age	Semi-mature
Useful Life Expectancy (Yrs.)	Medium (15-40)
STARS © Landscape Significance Rating	2 (Medium)
STARS © Retention Value	Medium - Consider for Retention
Observations	Dieback
Observation Comments	
Tree Protection Zone (TPZ) Radius [m]	2
Structural Root Zone (SRZ) Radius [m]	1.53

LEGEND

TPZ

- High - Priority for Retention
- Medium - Consider for Retention
- Low - Consider for Removal
- SRZ
- DN600 AG Pipe
- DN375 BE Pipe Trench



Page: 4 of 7
Produced 15/10/2024

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Tree ID: 9 — Contarf Syphon Building

Latin Name	*Cupaniopsis anacardioides*
Common Name	Tuckeroo
Tree QTY	1
Tree Height (Estimated) [m]	4
Canopy Spread (Estimated) [m]	4
DBH [cm] Total	19
Health	Good
Structure	Good
Tree Age	Semi-mature
Useful Life Expectancy (Yrs.)	Long (>40)
STARS © Landscape Significance Rating	2 (Medium)
STARS © Retention Value	High - Priority for Retention
Observations	
Observation Comments	
Tree Protection Zone (TPZ) Radius [m]	2.28
Structural Root Zone (SRZ) Radius [m]	1.82

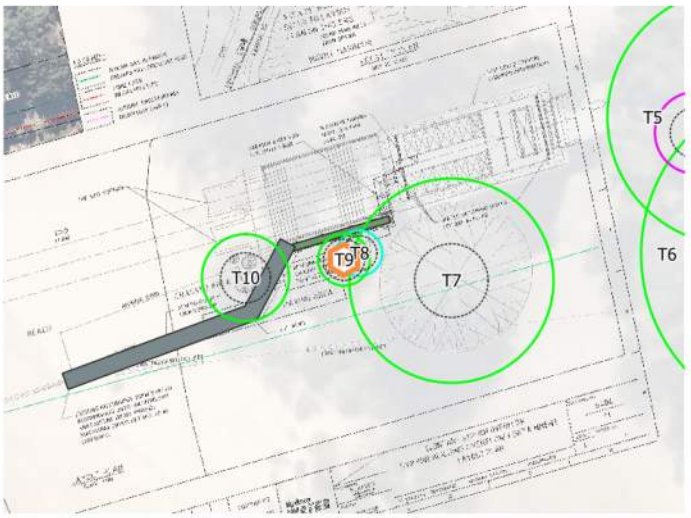
LEGEND

TPZ
- High - Priority for Retention
- Medium - Consider for Retention
- Low - Consider for Removal

SRZ

DN600 AG Pipe

DN375 BE Pipe Trench



Page: 5 of 7
Produced 15/10/2024

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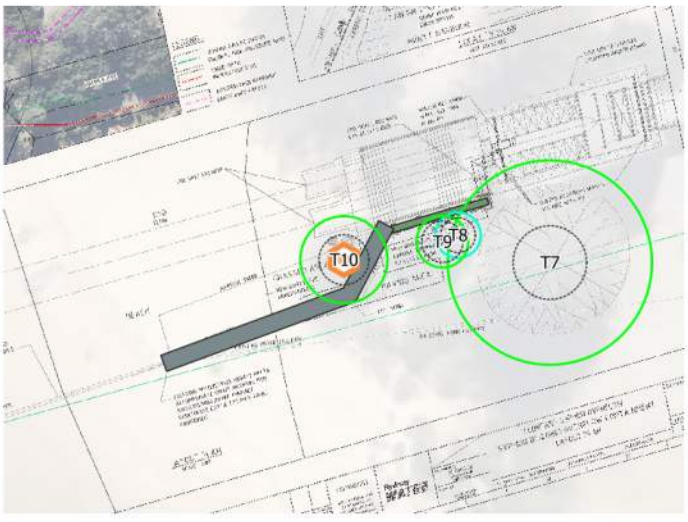
Tree ID: 10 — Contarf Syphon Building

Latin Name	*Banksia integrifolia*
Common Name	Coast Banksia
Tree QTY	1
Tree Height (Estimated) [m]	4
Canopy Spread (Estimated) [m]	5
DBH [cm] Total	32
Health	Good
Structure	Good
Tree Age	Semi-mature
Useful Life Expectancy (Yrs.)	Long (>40)
STARS © Landscape Significance Rating	2 (Medium)
STARS © Retention Value	High - Priority for Retention
Observations	
Observation Comments	
Tree Protection Zone (TPZ) Radius [m]	3.84
Structural Root Zone (SRZ) Radius [m]	2.2

LEGEND

TPZ

- High - Priority for Retention
- Medium - Consider for Retention
- SRZ
- DN600 AG Pipe
- DN375 BE Pipe Trench



Page: 6 of 7
Produced 15/10/2024

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Tree ID: 11 — Contarf Syphon Building

Latin Name	*Nerium Oleander*
Common Name	Oleander
Tree QTY	1
Tree Height (Estimated) [m]	4
Canopy Spread (Estimated) [m]	4
DBH [cm] Total	30
Health	Good
Structure	Fair
Tree Age	Mature
Useful Life Expectancy (Yrs.)	Medium (15-40)
STARS © Landscape Significance Rating	3 (Low)
STARS © Retention Value	Low - Consider for Removal
Observations	
Observation Comments	
Tree Protection Zone (TPZ) Radius [m]	3.6
Structural Root Zone (SRZ) Radius [m]	2.25

LEGEND

TPZ

- High - Priority for Retention
- Medium - Consider for Retention
- Low - Consider for Removal

SRZ

DN600 AG Pipe

Page: 7 of 7
Produced 15/10/2024

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4. Impact Assessment

Trees 7-10 are within the area where construction works are proposed. Specifically:

- **Tree 7** will be subject to construction works within the TPZ. However, the permanent impacts on this tree will be limited as the proposed DN600 pipe will be installed above grade and be suspended from the existing concrete structure. Construction impacts by way of soil compaction will not be realised as the soil is entirely sand. The movement of machinery and its potential impacts on the trunk and surface roots can be managed with trunk and ground protection. Crown uplifting and reduction pruning may be required, but this is expected to be a minor volume and of little impact to the tree.
- **Trees 8 & 9** are directly within the footprint of the proposed DN600 pipe, which will conflict with their crown, trunk and branches. These trees will require removal as there are no possible reasonable options to retain them.
- **Tree 10** will be subject to a major TPZ and SRZ encroachment for the excavation and shoring of the below-ground DN375 pipe. This species, *Banksia integrifolia*, is anecdotally poor at tolerating root disturbance, even in sandy soil. This tree will require removal to facilitate the project.
- **Trees 5, 6, 7 and 11** may be subject to indirect impacts via machinery movement during the construction process. Material and spoil storage will also be required. In the first instance, it is advisable to occupy the area of Clontarf Park that is outside the TPZ of these trees. This is to avoid potentially spills and damage to surface roots which are particularly prevalent for trees 5 and 6. Doing so would negate the need for ground and trunk protection of trees 5, 6 and 11, though this would still be required for tree 7. In any event, these trees can be retained with little or no impact, provided tree protection is installed and maintained during construction.

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5. Recommendations

Based on the results of the investigation of the tree, the following course of action is recommended.

Tree 7:

- Install appropriate **trunk and ground protection** to mitigate potential impacts from machinery movement, despite the sandy soil minimising compaction risks. This will be required to limit damage from machinery slewing on surface roots and potential trunk strikes.
    - Install a minimum 100mm cover of sand or mulch. If mulch is used, geotextile fabric will be required as an interface to prevent mulch from migrating into the soil. Track mats, road plates or rumble boards are to be installed over this to disperse loads.
    - Install trunk protection
- Perform **crown uplifting and reduction pruning** as required. The volume of pruning should be minor and not expected to significantly affect the overall health of the tree.

Tree 8 & Tree 9:

- These trees are directly in the path of the proposed DN600 pipe installation. Due to the **significant conflict with their crown, trunk, and branches** and the lack of feasible retention options, these trees will require **removal**.

Tree 10:

- Due to a major TPZ and SRZ encroachment from the excavation and shoring required for the DN375 pipe, and given that **Banksia integrifolia** is particularly poor at tolerating root disturbance, it is recommended that this tree be **removed** to facilitate the project.

Trees 5, 6, 7 and 11:

- These trees may experience **indirect impacts** from machinery movement and material storage. To minimise risk, it is advisable to:
    - **Store materials** and conduct operations outside the TPZ of these trees, particularly to avoid damage to surface roots. This includes access and egress routes. **TPZ fencing** must be installed to delineate no-go zones in these areas.

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- If this is not possible, ensure that **ground and trunk protection** measures are installed:.
  - Install a minimum 100mm cover of sand or mulch. If mulch is used, geotextile fabric will be required as an interface to prevent mulch from migrating into the soil. Track mats, road plates or rumble boards are to be installed over this to disperse loads.
  - Install trunk protection on trees 5, 6, and 7.

5.1. Project Arborist

An official "Project Arborist" must be commissioned to oversee the tree protection, and any works within the TPZs and complete regular monitoring compliance certification.

The project arborist must have a minimum of five (5) years of industry experience in arboriculture, horticulture with relevant demonstrated experience in tree management on construction sites, and Diploma level qualifications in arboriculture – AQF Level 5.

5.2. Tree Protection Zone Fencing

Protective fencing is to be installed along the edge of the TPZ if material storage is outside the TPZ. Fencing is to comply with Australian Standard AS 4687-2007 Temporary fencing and hoardings (Standards Australia, 2007).

Once erected, protective fencing must not be removed or altered without approval from the project arborist. The TPZ fencing should be secured to restrict access.

TPZ fencing is to be a minimum of 1.8m high and mesh or wire between posts must be highly visible. Fence posts and supports should have a diameter greater than 20mm and should ideally be freestanding, otherwise be located clear of the roots.

Tree protection fencing must remain intact throughout all proposed construction works and must only be dismantled after their conclusion. The temporary dismantling of tree protection fencing must only be done with the authorisation of the Project Arborist and/or the responsible authority.

An example of tree protection fencing is shown in Figure 3.

Any works to be undertaken within the Tree Protection Zone fencing are to be monitored and certified by the project arborist.

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Legend:

1. Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
2. Alternative plywood or wooden paling fence panels. The fencing material also prevents building materials or soil entering the TPZ.
3. Mulch installation across the surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.
4. Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.

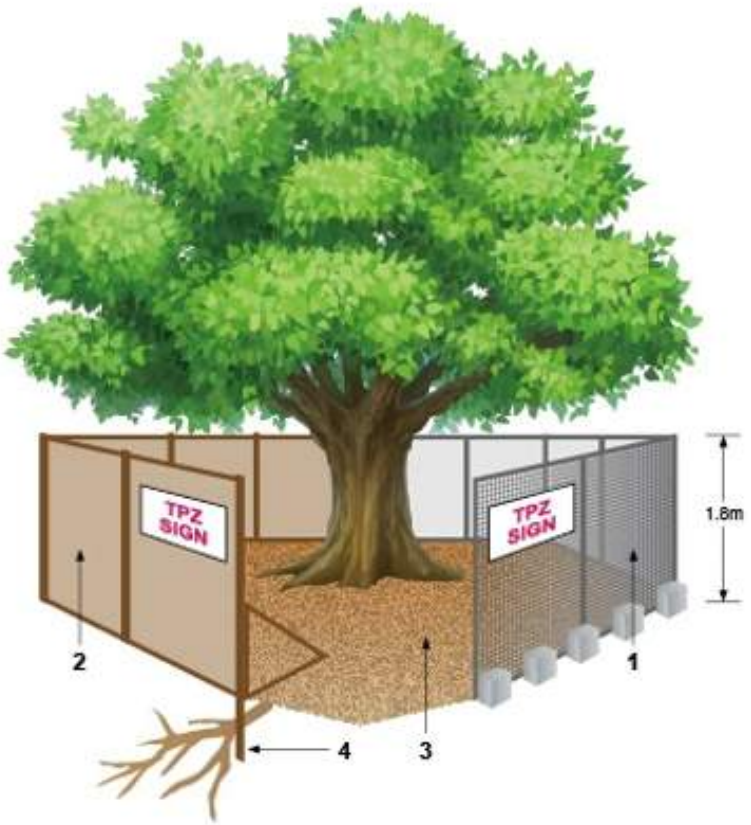

Figure 3: Recommended tree protection fencing measures. (Standards Australia, 2009)

5.3. Prohibited Activities within the TPZ

Activities generally excluded from the TPZ included but are not limited to-

a) Machine excavation including trenching;
b) Excavation for silt fencing;
c) cultivation;
d) storage;
e) preparation of chemicals, including preparation of cement products;
f) parking of vehicles and plant;
g) refuelling;
h) dumping of waste;

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i) wash down and cleaning of equipment;
j) placement of fill;
k) lighting of fires;
l) soil level changes;
m) temporary or permanent installation of utilities and signs, and
n) physical damage to the tree.

5.4. Tree Protection Signs

Signs identifying the TPZ are to be installed on the tree protection fencing in 10m intervals. An example is shown below in Figure 4.

Figure 4: Example of tree protection signage. (Standards Australia, 2009)

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5.5. Sediment Control

Sediment control within tree protection zones is to be installed to avoid below ground excavation as this may damage roots. Coir logs installed above grade that are pinned to avoid roots are an acceptable method.

5.6. Ground, Trunk and Branch Protection

If temporary access for machinery is required within the TPZ of trees to be retained, ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction. Measures may include a permeable membrane such as geotextile fabric beneath a 100mm thick layer of mulch or crushed rock below rumble boards, or steel plates or track mats as per Figure 5.

Tree trunk/s and/or major branches located within close proximity to works must be wrapped with protective hessian or similar acceptable material to prevent tree injury. Major branches would typically be considered to be of a diameter greater than 100mm diameter.

Timber battens (50 mm x 100 mm x 2000mm or similar) must be placed around tree trunks with battens spaced at 100 mm intervals and fixed against the trunk using metal or durable plastic strapping with connections appropriately finished or covered to protect pedestrians from snagging injury. The hessian and timber battens must not be fixed to the tree. Tree trunk and major branch protection are to remain in place for the duration of works and must be removed at the completion of the project.

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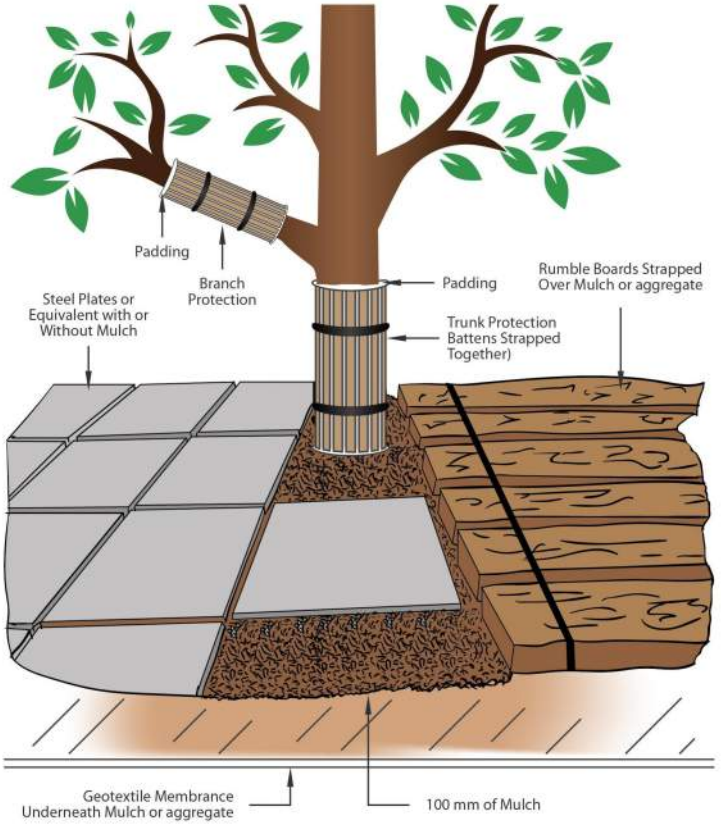

Figure 5: Details of trunk, branch and ground protection. (Standards Australia, 2009)

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6. References

Dunster, J. A. (2017). *Tree Risk Assessment Manual* (Second Edition ed.). International Society of Arboriculture.

Lonsdale, D. (2013). *Principles of Tree Hazard Assessment and Management* (The Stationery Office, Ed.). Arboricultural Association.

Nearmap. (2024). *Photo Maps by Nearmap*. Retrieved 2024, from http://maps.au.nearmap.com/

Standards Australia Limited. (2009). *Protection of Trees on Development Sites*. Standards Australia.

7. Report Assumptions and Limitations

1. Any description or information provided to the consultant by the client or third party is assumed to be correct.
2. All information has been sourced with care and verified to the best of the consultant's knowledge. Any opinions not duly researched is based upon the consultant's experience and observations.
3. The consultant shall not be required to give testimony or attend court by reason of this report unless under a contractual agreement, including payment of additional fees and charges for such services.
4. Modification or extraction of key contextual components invalidates the entire report.
5. There is no warranty, explicit or implicit that the problems and deficiencies associated with the site or vegetation may not arise in future.
6. Unless stated otherwise, the information contained within the report will address the items outlined in the project brief or that were examined during any site assessment and reflect the condition of those items at the time of inspection.
7. Unless otherwise specified, the inspection is limited to ground-based inspection of accessible areas without dissection, excavation or probing.
8. This report and its recommendations reflect an impartial assessment of the tree and its condition based on the available evidence and projected outcomes.

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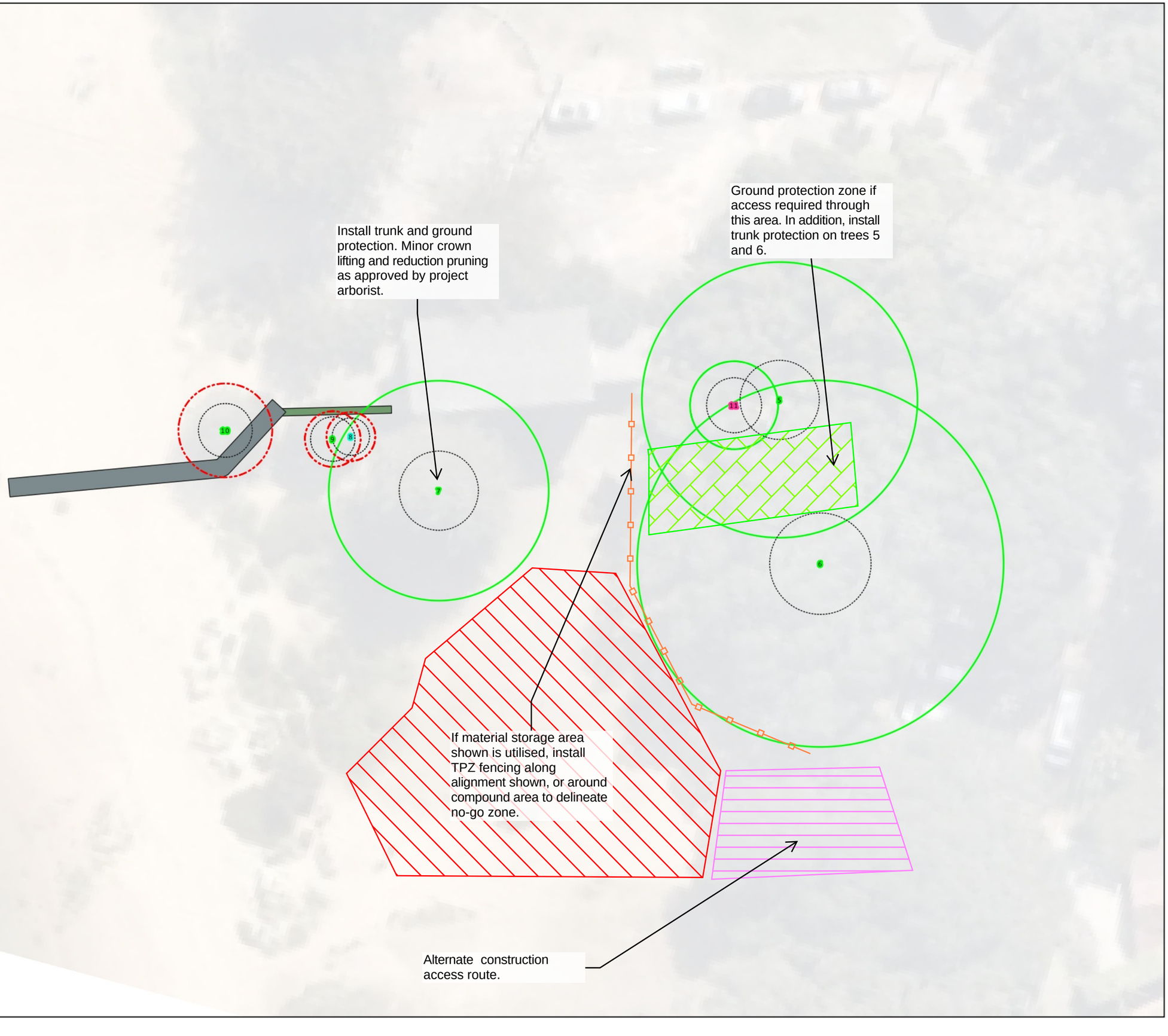
8. Appendix A - Tree Protection Management Plan



REV	DESCRIPTION	DATE
A	ISSUE	15/10/2024

NOTES:

LEGEND

TPZ - Recommendation

- Remove - project impacts
- Retain - generic
- SRZ
- DN600 AG Pipe
- DN375 BE Pipe Trench

DRAWN: KH
DWG NO: TPMP.01
SCALE: 1:300@A3

2.5 0 2.5 5 7.5 m

PROJECT:

CLONTARF SYPHON OVERFLOW

DWG:

TREE PROTECTION MANAGEMENT PLAN

CLIENT: SYDNEY WATER
SITE: MONASH CRES, CLONTARF NSW 2093

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Appendix E – Marine Ecology Assessment

Clontarf Overflow Diversion Project

Marine Ecological Assessment

Prepared for:
Sydney Water

3 February 2025

Prepared by:
Stantec Australia Pty Ltd

Project/File:
304501569

Stantec Australia Pty Ltd

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
Rev A	Draft MEA	Kate Sloss	14/08/2024	Will Macbeth	14/08/2024	Sean Smith	16/08/2024
Rev B	Final MEA	Kate Sloss	3/02/2024	Will Macbeth	3/02/2024		

The conclusions in the Report titled Clontarf Overflow Diversion Project are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from Sydney Water (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

Prepared by 

Signature

Kate Sloss

Printed Name

Reviewed by 

Signature

Will Macbeth

Printed Name

Approved by 

Signature

Sean Smith

Printed Name

Table of Contents

List of Tables

List of Figures

List of Appendices

Acronyms / Abbreviations

ASS	Acid Sulfate Soils
BC Act	***Biodiversity Conservation Act 2016***
CM Act	***Coastal Management Act 2016***
CSH	Clontarf Syphon House
DEECCW	NSW Department of Energy, Environment, Climate Change and Water
DPI	NSW Department of Primary Industries
EP&A Act	***Environmental Planning and Assessment Act 1979***
EPBC Act	Commonwealth ***Environmental Protection and Biodiversity Conservation Act 1999***
EPI	Environmental Planning Instrument
FM Act	***Fisheries Management Act 1994***
KFH	Key Fish Habitat
KTP	Key Threatening Processes
MEA	Marine Ecological Assessment
MNES	Matters of National Environmental Significance
NSW	New South Wales
NSOOS	Northern Suburbs Ocean Outfall Sewer
The Project	A pipe would be installed from CSH and would connect into the existing maintenance hole in the foreshore zone
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
RHSEPP	State Environmental Planning Policy (Resilience and Hazards) 2021
SEPP	State Environmental Planning Policy
Stantec	Stantec Australia Pty Ltd
TISEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021

1 Introduction

1.1 Background

The Syphon House at Clontarf in New South Wales (NSW) is part of the broader Northern Suburbs Ocean Outfall Sewer (NSOOS) that conveys sewage from a large section of northwestern Sydney. During high rainfall conditions Clontarf Syphon House (CSH) is subject to above-ground sewer overflows, which flow onto Clontarf Beach and into Middle Harbour. Current obstructions within the NSOOS between Clontarf and North Head Resource Recovery Facility are causing a higher frequency of occurrence of these overflows, which are a concern for the local community. A program called 'NSOOS desilting' is currently underway to remove the obstructions from the NSOOS; however, the timeframe for completion of these works is expected to be approximately 5–7 years.

Sydney Water is proposing a temporary solution to address the issue until the NSOOS desilting program is completed. The temporary solution includes the construction of a temporary overflow diversion pipe. The pipe would be installed to connect the CSH into the existing maintenance hole in the foreshore zone (the Project). Stantec was engaged by Sydney Water to undertake a Marine Ecology Assessment (MEA) to support a Review of Environmental Factors (REF) for the Project.

1.2 Description of Works

The key features of the Project would include:

- Site establishment
- Modifications to CSH
- Installation of the overflow diversion pipe
- Modification of the existing maintenance hole
- Clearing out the existing outfall pipe
- Controlled release of water through the overflow pipe during high rainfall conditions. It is anticipated that this would occur approximately five times per calendar year.

Site Establishment

Preparation of the site for construction activities would include erecting a temporary site shed, perimeter hoarding, establishing tree protection zones as needed, installing site amenities if needed, and setting up plant and material storage areas.

Modifications to CSH

Modifications to the existing CSH will be required for the Project. These include:

- Installing additional door fixtures at the western entrance to allow pipework for the exit of the overflow pipe.
- Cutting through the existing CSH stair kickboard to provide passage for the overflow diversion pipe.
- Installing pipework, including bracket/ fixtures, down the wall of the CSH.

Installation of overflow diversion pipe

- Excavating a trench approximately 2.5 m wide x 30 m long x 2 m deep to lay a 600 mm pipe between the CSH to the existing maintenance hole.
- Install shoring boxes and a spear-point dewatering system to dewater groundwater as needed.

Modification of existing maintenance hole

- Excavate a 4 m x 4 m area around the existing maintenance hole to either connect in the new 600 m pipework or remove/reconstruct the existing maintenance hole in same location.
- Install shoring boxes and a spear-point dewatering system to dewater groundwater as needed.

Clearing out the existing outfall pipe

- Remove silt/debris from the existing outfall pipe using a jetter truck accessing the existing maintenance hole.

1.3 Purpose

This MEA has been completed in general accordance with:

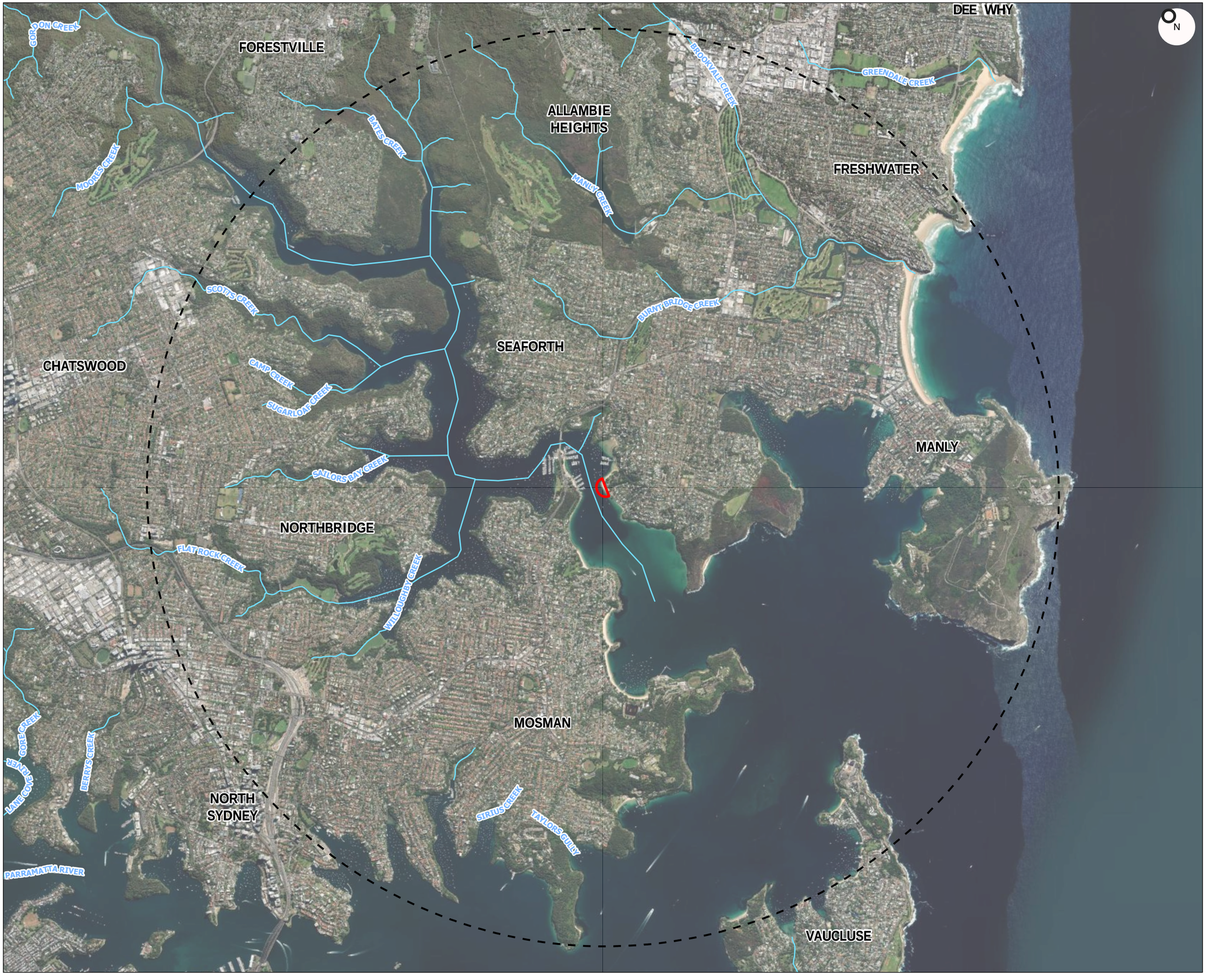
- ***Policy and Guidelines for Fish Habitat Conservation and Habitat (NSW DPI, 2013) (KFH Policy)***
- ***Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge, 2003)***
- ***Aquatic Ecology in Environmental Impact Assessment – EIA Guideline (Lincoln Smith, 2003)***

The purpose of this MEA is to:

- Provide a broad description of the habitats and species present within the Study Area with emphasis on any marine vegetation such as seagrasses and macroalgae beds.
- Identify any key threatening processes (KTPs) listed under the Fisheries Management Act 1994 (FM Act) or Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) that have the potential to be triggered by the Project.
- Assess potential impacts to marine ecology, including threatened and ecological communities, due to the construction and operation of the Project.
- Recommend potential mitigation measures to reduce the impact of the Project on marine ecology in alignment with the KFH Policy.

1.4 Study Area

Clontarf is located in the northern beaches region of Sydney, approximately 7 kilometres (kms) northeast from the Sydney central business district (Figure 1). The Study Area includes the CSH and a 100-metre (m) buffer extending from the CSH building into intertidal and subtidal areas of Middle Harbour (Figure 2). The Study Area is situated within the Northern Beaches Local Government Area.



Study Locality

Clontarf Overflow Diversion Project
Clontarf, NSW

Client: Sydney Water
Project Code: 304501569-GS-001
Drawn By: KS, Checked By: SM
Figure: 1 | Rev: 01
Date: 2024-08-15

Legend

- Study Area
- Study Locality

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial imagery supplied by ESRI and third party suppliers
2. Watercourse (NSW SS 2023)

Stantec

0 250 500 750 1,000 1,250
Metres

Scale at A3: 1:40,000

Study Area

Clontarf Overflow Diversion Project - Marine Habitat Assessment
Clontarf, NSW

Client: Sydney Water
Project Code: 304501569-GS-002
Drawn By: KS, Checked By: SM
Figure: 2 | Rev: 01
Date: 2024-08-15

Stantec

Legend

- Study Area
- Syphon House
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial imagery supplied by Metromap (March 2024)
2. Cadastre and Roads (NSW SS 2023)

0 20 40 60 80 Metres

Scale at A3: 1:1,500

1.5 Relevant Legislation and Guidelines

This section provides an overview of all Commonwealth, State and Local Government legislation, policies and guidelines that are relevant to the protection of aquatic ecology and habitats outlined in this report. It addresses all statutory instruments that outline matters for consideration and requirements to seek authorisation (licenses and approvals) to undertake various actions and activities associated with aquatic ecology.

1.5.1 Commonwealth Legislation

1.5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act protects nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES). MNES relevant to aquatic ecology are:

- Wetlands of international importance;
- Nationally listed threatened species and ecological communities;
- Migratory species; and
- Commonwealth marine areas.

The significance of impacts on MNES is determined in accordance with the ***Significant Impact Guidelines 1.1 — Matters of National Environmental Significance*** (Department of the Environment, 2013).

Where a self-assessment by a proponent identifies that an action (project)is likely to have a significant impact on a MNES, a referral must be submitted to the Minister for the Environment and Water (Australia), after which a decision is made whether or not the project is classified as a 'controlled action'. In the event that a project is classified as a controlled action, an approval under the EPBC Act is required.

1.5.2 State Legislation

1.5.2.1 Environmental Planning and Assessment Act 1979

The ***Environmental Planning & Assessment Act 1979*** (EP&A Act) is the primary legislation that permits or prohibits development in the state of New South Wales. The Act seeks to provide a framework for socially and economically responsible development that also seeks to protect the environment.

The EP&A Act also provides a mechanism for other Environmental Planning Instruments (EPIs) that are specific to development on state, regional and local scales. EPIs relevant to this report include several State Environmental Planning Policies (SEPPs), which are addressed further below.

1.5.2.2 State Environmental Planning Policy (Resilience and Hazards) 2021

The State Environmental Planning Policy (Resilience and Hazards) 2021 (RHSEPP) provides planning and environmental controls associated with development within coastal areas, potential/ actual hazardous or offensive development and land that requires remediation.

The location of the activities being undertaken at Clontarf are within the Coastal Use Area and the Coastal Environment Area mapped in the RHSEPP. Chapter 2, Division 3 (Coastal Use) and Division 4 (Coastal Environment) provide the following relevant considerations for this MEA:

2.10 Development on land within the coastal environment area

(1) Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following—

(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,

(b) coastal environmental values and natural coastal processes,

(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,

(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,

(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,

(f) Aboriginal cultural heritage, practices and places,

(g) the use of the surf zone.

(2) Development consent must not be granted to development on land to which this section applies unless the consent authority is satisfied that—

(a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subsection (1), or

(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or

(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

2.11 Development on land within the coastal use area

(1) Development consent must not be granted to development on land that is within the coastal use area unless the consent authority—

(a) has considered whether the proposed development is likely to cause an adverse impact on the following—

(i) existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,

(ii) overshadowing, wind funnelling and the loss of views from public places to foreshores,

(iii) the visual amenity and scenic qualities of the coast, including coastal headlands,

(iv) Aboriginal cultural heritage, practices and places,

(v) cultural and built environment heritage, and

(b) is satisfied that—

(i) the development is designed, sited and will be managed to avoid an adverse impact referred to in paragraph (a), or

(ii) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or

(iii) if that impact cannot be minimised—the development will be managed to mitigate that impact, and

(c) has taken into account the surrounding coastal and built environment, and the bulk, scale and size of the proposed development.

As the Project would include development within Coastal Use Area and the Coastal Environment Area mapped in the RHSEPP, the Project would normally require development consent from Northern Beaches Council. However, despite these provisions, section 2.7 of State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP) identifies that (with the exception of coastal wetlands and littoral rainforests) in the event of any inconsistency between the TISEPP and the RHSEPP, the TISEPP prevails to the extent of the inconsistency. As the Project does not encroach within areas of coastal wetlands or littoral rainforests mapped in the RHSEPP, the TISEPP is the prevailing planning instrument.

Division 18 of the TISEPP identifies that various development for the purposes of sewerage systems can either be carried out by or on behalf of a public authority without consent on any land, or land in a prescribed zone (and/or under the prescribed circumstances). As Sydney Water is a public authority, the works associated with the Project are permissible without consent. Notwithstanding, while development consent is not required, this assessment has considered the impacts of the Project with reference to sections 2.10(1), 2.10(2) and 2.11(1) of the RHSEPP in Section 5 of this MEA.

1.5.2.3 Fisheries Management Act 1994

The FM Act contains provisions for the conservation of fish stocks, key fish habitat (KFH), biodiversity, threatened species, populations and ecological communities. The FM Act regulates the conservation of fish, marine vegetation and some aquatic macroinvertebrates, and the development and sharing of NSW fishery resources for present and future generations. Part 7 of the FM Act identifies requirements for the protection of aquatic habitats. Part 7A lists threatened species, populations and ecological communities, as well as 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.

All types of marine vegetation (including seagrass, macroalgae, mangroves and saltmarsh), whether alive or dead, are protected under the FM Act.

This report has assessed the potential for impacts in terms of fisheries management, threatened species, threatened ecological communities and KFH in line with the FM Act and considered these impacts in Section 5.

1.5.2.4 Biodiversity Conservation Act 2016

The ***Biodiversity Conservation Act 2016*** (BC Act) contains provisions for the conservation of some NSW marine threatened species, populations and communities (including birds, mammals and reptiles) not covered under the FM Act. Section 7.3 of the BC Act requires proponents of activities

subject to Part 5 of the EP&A Act to determine whether the works will have a significant impact on threatened species. The test for significant impact is described in section 7.3 of the BC Act. A significant impact also occurs if the activity is carried out in an area of outstanding biodiversity value.

If a significant impact is likely to occur, the proponent of the activity must prepare a species impact statement in accordance with section 7.2 of the BC Act. Alternatively, the proponent can prepare a biodiversity development assessment report.

1.5.2.5 Coastal Management Act 2016

The ***Coastal Management Act 2016*** (CM Act) aims to manage the coastal environment in NSW in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic wellbeing of the state.

The site is located within the coastal environment area and coastal use area and must be considered as part of this MEA. This assessment has considered the objectives of Part 2 of the CM Act, which are equivalent to the matters considered as part of the Resilience and Hazards SEPP outlined above.

2 Methodology

2.1 Desktop Searches

A review of publicly available information was undertaken to identify existing biodiversity features such as threatened species, populations and communities, and important habitats that may occur within the Study Area and the broader Study Locality. The review focused on information from database searches and relevant ecological reports and guidelines.

2.1.1 Database Searches

The following databases were searched in July 2024:

- NSW BioNet: bionet.nsw.gov.au
- NSW Department of Planning, Industry and Environment — Environment, Energy and Science NSW Threatened Biodiversity Data Collection: environment.nsw.gov.au/threatenedspecies
- NSW DPI Fish Communities and Threatened Species Distribution of NSW (NSW DPI, 2016a)
- NSW DPI Threatened species lists: dpi.nsw.gov.au/fishing/species-protection/what-current
- NSW DPI Listed Protected Fish Species: dpi.nsw.gov.au/fishing/closures/identifying
- NSW DPI Fisheries Spatial Data Portal — Estuarine Macrophytes (NSW DPI, 2019)
- NSW DPI Fisheries key fish habitat (KFH) maps (NSW DPI, 2022a): dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST): environment.gov.au/epbc/protected-matters-search-tool
- Atlas of Living Australia: ala.org.au/
- Commonwealth Map of Marine Pests: marinepests.gov.au/pests/map.

2.1.2 Literature Review

Reports, relevant guidelines and other relevant literature were reviewed to provide an understanding of ecological values occurring or potentially occurring in the Study Area and Study Locality. Reviewed information included the following:

- ***Policy and Guidelines for Fish Habitat Conservation and Management (NSW DPI, 2013)***
- ***Fish Passage Requirements for Waterway Crossings and Policy (Fairfull & Witheridge, 2003)***
- ***Aquatic Ecology in Environmental Impact Assessment (Lincoln Smith, 2003)***
- Relevant State and Commonwealth Legislation outlined in Section 1.5.

2.1.3 Habitat Mapping

To facilitate the field survey a presumptive vegetation and habitat map was developed using ArcGIS Pro 3.0.2 to digitise areas of potential marine vegetation and habitat within the Study Area. Existing habitat mapping of estuarine macrophytes (DCCEEW, 2010) and aerial imagery provided by Metromap (June 2024) were used to support the presumptive mapping.

2.2 Likelihood of Occurrence

For each threatened species or ecological community, or migratory species identified within the PMST report, a likelihood of occurrence (LoO) assessment was undertaken. This assessment determines

how likely it is that each species or community is present in the Study Area using the criteria detailed in Table 1.

Species are considered 'likely to occur' (i.e., a moderate to high likelihood of occurrence) where:

- The species is 'known' or 'predicted' to occur in the Interim Biogeographic Regionalisation for Australia (IBRA) subregion in which the Project is located; and
- The Study Area contains habitat features or components associated with the species, or there are records of the species occurring in the Study Area.

A test of significance (under the FM Act – NSW DPI, 2008a) and/or an Assessment of Significance (AoS) (under the EPBC Act – DoE, 2013) have been completed for species considered 'likely to occur' by the habitat assessment, unless otherwise discussed in Section3.

Table 1 Likelihood of occurrence criteria

Likelihood of occurrence	Criteria
None/absent	The habitat within the Study Locality is unsuitable for the species.
Low	It is unlikely that the species inhabits the Study Locality; if it did, it would likely be a transient visitor. Criteria for this category may include: • The Study Locality does not support the specific habitat types or resources required by the species. • The Study Locality is beyond the current distribution of the species or is isolated from known populations. • Non-cryptic species not observed during targeted surveys.
Moderate	Potential habitat for the species occurs within the Study Locality. Criteria for this category may include: • Species previously recorded in contiguous habitat albeit not recently. • Habitat present, but poor quality, depauperate or modified types and/or resources. • Species has potential to utilise habitat during migration or seasonal availability of resources. • Cryptic species with potential habitat within the Study Locality that have not been targeted by surveys (for example, surveys were not undertaken within the appropriate season).
High	It is likely that the species would inhabit or utilise habitat within the Study Locality. Criteria for this category may include: • Species has been recently and/or regularly recorded in the Study Locality or surrounds. • Species uses habitat types or resources present in the Study Locality of influence that are abundant and/or in good condition. • Species is known or likely to maintain resident populations surrounding the area of influence. • Species is known or likely to visit the Study Area during regular seasonal movements or migration.
Known	The species was recorded within the Study Locality during study-specific targeted field surveys.

2.3 Field Methodology

A field survey of the subtidal and intertidal habitat within the Study Area was carried out on 18 July 2024. The aim of the field survey was to ground-truth presumptive habitat mapping and results from the desktop assessment, particularly with consideration to any threatened species likely to occur within the Study Area.

The survey of subtidal habitats was carried out from the shoreline using a combination of a visual survey and an underwater remotely operated vehicle (ROV) to define habitat types within the Study Area. All areas below the highest astronomical tide (HAT) were surveyed.

Data were recorded on a GPS-enabled, hand-held device using ArcGIS Field Maps to create points and polygons of identified habitats. Underwater photographs were captured via ROV and GoPro, with a list of observed aquatic flora and fauna species compiled.

Following field investigations, maps of the Study Area were interpolated to provide a georeferenced, high-resolution map of habitat extent, indicating general habitat composition (i.e., major habitat-forming groups such as seagrass/macroalgae/rock rubble and bare soft sediment). The extent of each habitat type was subsequently calculated using ArcGIS.

2.4 Limitations

Desktop searches are based on available information from online resources, which may be limited in accuracy or completeness of information as data may be crowd-sourced and availability of information is dependent on what information is collected, particularly relating to available species records.

Survey efficacy is influenced by a range of factors. For this type of survey, limitations are generally due to the survey being a single event of short duration that does not account for seasonal or other temporal variation.

These potential limitations have been addressed by applying the precautionary principle in cases where the survey methodology may have given a false negative result (i.e., a species that could reasonably be expected to occur based on previous records and available habitat may not be observed). All species (including threatened species) have been assessed based on the presence of their habitat and the likely significance of that habitat to a viable local population.

3 Existing Environment

3.1 Overview

Clontarf is a suburb located along the north-eastern foreshore of lower Middle Harbour, just south of the Spit Bridge. Middle Harbour is a drowned valley estuary that flows into Port Jackson (Sydney Harbour). The estuary and its surrounds are a popular recreational area for swimming, boating, fishing and kayaking. The Clontarf foreshore is a popular area for water recreation and includes a netted tidal pool, beaches, a marina with private and commercial berths, and protected swing moorings.

3.2 Marine Habitats

Middle Harbour supports a diverse range of marine and estuarine habitats including rocky shores, seagrasses, macroalgae, mangroves, unvegetated areas (i.e., beaches and mudflats) and deep open water areas. There are also artificial structures within Middle Harbour including wharves, jetties and netting for tidal enclosures that provide additional habitat for fish and invertebrates.

3.2.1 Seagrass, Mangroves and Saltmarsh

Seagrass beds are important fish habitat and food source for marine fauna and are one of the most productive ecosystems in the world (Westlake 1963). Seagrass and other marine vegetation including mangroves and saltmarsh also help to reduce erosion and improve water quality.

Under current NSW legislation (FM Act), seagrass, mangroves and saltmarsh are classified as marine vegetation, which is protected under the act. A permit must be obtained if harm to marine vegetation is required.

A review of the NSW estuarine macrophytes layer on the NSW Fisheries Spatial Data Portal (NSW DPI 2019) revealed five marine vegetation communities known to occur within the Study Locality (Figure 3):

- Halophila
- Mangrove
- Posidonia
- Posidonia/Zostera
- Zostera

The most extensive communities of marine vegetation mapped within the Study Locality are ***Zostera***, mangroves and ***Posidonia***, with 25.9 ha, 25.6 ha and 25 ha of coverage, respectively (see Table 2).

While there are no seagrass beds mapped within the Study Area, there are substantial areas of seagrass mapped within the Study Locality. This includes ***Zostera*** meadows opposite the Study Area to the west and to the south (Figure 3). There is also a patch of ***Posidonia*** to the north of the Study Area. Posidonia is listed as an endangered population under the FM Act and a nationally significant ecological community under the EPBC Act.

No mangroves were mapped within the Study Area or nearby. The closest mapped area of mangroves is 3 kms northwest of the Study Area.

Table 2 Marine vegetation and habitat in the Study Locality based off the NSW estuarine macrophytes mapped layer (NSW DPI 2019)

Type of marine vegetation	Marine vegetation community	Area within the Study Locality (ha)
Seagrass	Halophila	12.4806
Mangrove	Mangrove	25.5949
Seagrass	Posidonia	24.9958
Seagrass	Posidonia/Zostera	20.0021
Seagrass	Zostera	25.8876

3.2.2 Macroalgae

Macroalgae are an important resource as food and/or shelter for a large range of fish, shellfish and other invertebrate species, and they often act as nurseries for juvenile fish. Dead macroalgae and seagrass on beaches, known as 'wrack', is also an important source of food for beach invertebrates. Rotting beach wrack also provides a pathway of nutrient cycling in beaches (NSW DPI 2011). All macroalgae (alive or dead) is protected under the FM Act and a Section 205 permit is required to damage, remove, or shade it.

3.2.3 Un-vegetated Soft Sediment

While bare sandy or unconsolidated sediment habitats are considered to be relatively unproductive compared to vegetated or reef habitats, they do support microalgae (on the surface) and often a large biomass of meiofauna (microscopic organisms <0.5 mm) and macroinvertebrates (organisms >0.5 mm) including polychaete worms, crustaceans, molluscs, echinoderms and other 'worm-like' animals as 'infauna' within the sediment. These provide an important food source for larger animals such as fish, shorebirds and crustaceans, and are integral in the structure, health and functioning of aquatic habitats as they play a role in carbon and nutrient cycling, transferring energy to higher trophic levels (Camilleri, 1992), sediment aeration and habitat productivity (Ridd, 1996).

3.2.4 Hard Substrata

Hard substrata in the form of human-made structures form part of the marine habitat within the Middle Harbour area. These structures include concrete pipes, rock walls, jetties and wharves. This hard substrate provides habitat for macroalgae and a wide variety of sessile marine molluscs (e.g., oysters) and crustaceans (e.g., barnacles), as well as associated, more mobile marine fauna such as fish and crabs.

Presumptive Habitat Map

Clontarf Overflow Diversion Project - Marine Habitat Assessment
Clontarf, NSW

Client: Sydney Water
Project Code: 304501569-GS-003
Drawn By: KS, Checked By: SM
Figure: 3 | Rev: 01
Date: 2024-08-15

Legend

- Study Area
- Study Locality

Macrophyte

- Halophila
- Mangrove
- Posidonia Posidonia/
- Zostera Zostera

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery supplied by ESRI and third party suppliers
2. NSW Estuarine Macrophytes (NSW DPI 2019)

Stantec

0 500 1,000 1,500 2,000
Metres

Scale at A3: 1:50,000

3.3 Sediment Quality

Contaminated sediments buried under the upper layers of sediment within estuarine environments associated with urbanised areas may include heavy metals, pesticides, microplastics and polychlorinated biphenyls (Clarke, 2001). These contaminants are particularly prevalent in association with areas of commercial, industrial, agricultural and/or maritime development and activity and high levels can be toxic to marine flora and fauna. While this toxicity may be latent while the sediment is undisturbed, mobilisation of contaminated sediments can result from construction activities such as excavation of sediments, increasing the potential for detrimental ecological outcomes.

3.3.1 Acid Sulfate Soils

Acid sulfate soils/sediments (ASS) is the common name given to naturally occurring soils and sediments that contain iron sulfate (pyrite). ASS are defined as either:

- Actual ASS – highly acidic soils or sediments with pH <4, or
- Potential ASS – soils or sediments containing sulphuric material that have not been oxidised but have potential for oxidation to generate high acidity

Left undisturbed, ASS do not pose risks; however, when they are disturbed and exposed to oxygen the iron sulfate reacts to form sulfuric acid that is detrimental to waterways and aquatic life.

A review of the ASS risk layer on the NSW SEED mapping portal identified that there is a high probability of ASS in the bottom sediments within Middle Harbour (mostly from sediments that have been eroded from the land and deposited in the deeply cut bays). Conversely, the terrestrial areas of Clontarf Beach are mapped as ***'NB: No known occurrence, Beach'***. and therefore, does not comprise acid sulfate soil materials. ASS mapping was also reviewed from the Manly Local Environment Plan 2013 showing that the intertidal zone within the Study Area was mapped as Class 5 ASS, which is described as an area where ASS are typically not found.

3.4 Water Quality

The DCCEEW (formerly NSW DPE), in collaboration with local councils, regularly monitors the water quality and ecosystem health of estuaries across NSW as part of the NSW Marine Estate Management Strategy 2018–2028. A sample subset of NSW estuaries located between Taree and Wollongong are monitored every three years. The results from the latest monitoring event completed in Middle Harbour Creek over the 2019–20 summer showed that algae levels were fair and water clarity was good. Middle Harbour Creek received an overall 'B' grade from the latest monitoring event (NSW DPE 2023).

As part of the Beachwatch program, seven locations in Middle Harbour Creek are also assessed for swimming suitability based on microbial indicators (***Escherichia coli*** and coliforms). Clontarf Pool, just north of the Study Area, is one of the sites that is assessed and the latest grade it was given was 'Good', meaning the indicators measured meet all of the benchmark values for some of the time over the period of sampling (NSW DPE 2023).

3.5 Marine and Estuarine Fauna

A wide variety of marine and estuarine fauna including fishes, sharks and rays, large macroinvertebrates, marine mammals, reptiles and shorebirds are known to occur or presumed to likely occur in the Estuary. These include species that associate with: soft- and/or hard-bottom seabed; seagrass beds and/or macroalgae assemblages; artificial habitat such as seawalls, piles and pylons; and those that may be present transiently during longer movements and migrations along the NSW coast. Some of the marine and estuarine fauna may be species that area threatened and/or protected under Commonwealth and/or State legislation as discussed in Section 3.6.

Recreational fishing is allowed to take place at a number of locations within the Estuary including Clontarf Park, which is a hotspot for bream and whiting. Commonly caught estuarine fish likely to be found in and around the Study Area include those occurring in a range of benthic, demersal and pelagic habitats. The most abundant species caught by recreational fishers are Yellowfin bream (***Acanthopagrus australis),*** Yellowtail kingfish (***Seriola lalandi***), Fanbelly leatherjacket (***Monacanthus chinensis***), Dusky flathead (***Platycephalus fuscus)***, Australian salmon (***Arripis trutta***), Tailor (***Pomatomus saltatrix***), flounders, mullets, garfishes, Silver trevally (***Caranx georgianus)*** and Sand whiting (***Sillago ciliata)*** (NSW DPI 2022)***.*** Some of these species are likely to be resident populations (e.g., leatherjackets) while others are transient (e.g., Yellowtail kingfish).

3.6 Threatened and Protected Species, Populations and Ecological Communities

Reviews of the DCCEEW PMST, NSW BioNet database and the NSW DPI Listed Threatened Species, Populations and Ecological Communities were completed in July 2024 to assess the potential for any species, populations or ecological communities listed under the EPBC Act, FM Act or BC Act.to occur within the Study Locality.

3.6.1 Threatened Ecological Communities

The review results revealed that one threatened ecological community (TEC) occurred within the Study Locality. This is the ***Posidonia australis*** seagrass meadows of the Manning-Hawkesbury ecoregion, which are listed as endangered under the EPBC Act. No ***Posidonia australis*** was observed during the field survey and the closest mapped area of ***Posidonia*** is approximately 400 m north of the Study Area and not anticipated to be impacted upon by the Project. The full PMST report is attached in Appendix A.

3.6.2 Threatened Species and Populations

The review results revealed 84 threatened species and/or populations of marine or nearshore species that potentially may occur in the Study Locality. Of these species there were 67 birds (including on endangered bird population and including marine, wetland and terrestrial bird species), five reptiles, four marine mammals, four fish/Syngnathidae, three sharks (including one endangered shark population) and one soft coral. All terrestrial flora, reptiles, mammals (including bats) and invertebrates were excluded from the assessment.

All threatened species, populations and ecological communities potentially occurring within the Study Locality were subject to an assessment of their likelihood of occurrence within the Study Area based on the criteria listed in Table 1. The likelihood was based on the desktop assessment and the habitat observed within the Study Area during the field survey. Fish species occurring in freshwater were included, as some freshwater species may spend part of their lifecycle in brackish or saltwater, or may have a tolerance for both habitats.

The likelihood of occurrence assessment found the majority of the 84 threatened species and populations to have a low likelihood of occurrence in the Study Area. There is one record of occurrence of the Green turtle (***Chelonia mydas***) approximately 140 metres north of the Study Area; however, this species is transient and there is ample alternative habitat available for the species in the surrounding Estuary. Shorebird species with specific preference for intertidal sandy shores were also considered to have a low likelihood of occurrence given the existing disturbance and availability of alternative suitable habitat within the Study Locality.

The results of the full assessment for threatened species and populations can be found in Appendix A.

3.6.3 Protected Species

Under the EPBC Act and FM Act some species of marine fauna (including all cetaceans and fish/Syngnathids) have been formally protected because they are naturally scarce or their numbers have been substantially reduced over recent decades. These species are referred to as ‘Marine’ listed species and are protected to help prevent them becoming threatened in the future.

Under the FM Act the taking or collecting of protected species without a permit will incur a penalty in accordance with Section 19 of the FM Act. Under the EPBC Act a listing highlights the need for conservation and management as well as for protecting individuals from being killed, injured, taken, traded, kept or moved.

A number of species of protected marine fauna have the potential to occur within the Study Locality. An assessment of the likelihood of occurrence within the Study Area for each of these protected species Study Area was completed based on the criteria in Table 1. The full results of the assessments can be found in Appendix A.

Based on the results of the likelihood of occurrence assessments, Syngnathids and other marine-listed species with the potential to occur were considered to have a low likelihood of occurrence in the Study Area. This was predominantly due to the lack of suitable habitat, in particular for Syngnathid species, which have an affinity to marine vegetation and other complex habitats.

All marine vegetation including seagrass, saltmarsh, mangroves and macroalgae is protected under the FM Act. No seagrass, saltmarsh or mangroves were found within the Study Area; however, a few scattered patches of macroalgae were identified. Macroalgae are protected from ‘harm’ in the form of gathering, cutting, pulling up, destroying, poisoning, digging up, removing, injuring or shading under Division 4 of the FM Act.

3.7 Marine Pests and Diseases

Caulerpa taxifolia (Caulerpa) is an invasive marine plant that is listed in NSW as noxious marine vegetation under the FM Act. The species is perceived as a threat because it grows rapidly and may out-compete other native species. It also produces toxic substances that deter many herbivores from grazing upon it, reducing the potential for grazing to limit its spread (NSW DPI, 2016b). Caulerpa has been mapped within the Study Area and surrounds, as well as along Clontarf Beach, Sandy Bay and near The Spit (Figure 4). Patches of individual plants were also found growing on the sand (or amongst sparse ***Zostera capricornii*** and ***Halophila ovalis***) at 1–3 m depth at Clontarf Marina and Clontarf Beach and along the beach south from Parriwi Head (Creese et al. 2004). However, the distribution of Caulerpa can change over time, either expanding or contracting (for example, it often dies off during winter and grows rapidly in summer), so it is likely that Caulerpa is present in other areas within the estuary.

3.8 Areas of Conservation Significance

A search of the NSW DPI Fisheries Spatial Data Portal showed that there are two aquatic reserves within the Study Locality: North Harbour Aquatic Reserve and Cabbage Tree Aquatic Reserve (Sanctuary). North Harbour Aquatic Reserve is located approximately 1.4 km southeast from the Study Area and covers an area of 290 ha. Other than non-protected finfishes, no marine animals or plants can be harmed in the reserve. Cabbage Tree Aquatic Reserve is located south of Manly Beach approximately 4 km east from the Study Area and covers an area of approximately 20 ha. This reserve is ‘no take’ aquatic reserve that is home to a diverse range of marine life and marine habitats.

3.9 Matters of National Environmental Significance

There are nine types of MNES listed under the EPBC Act. For actions where there is potential for significant impacts to one of these MNES approval from the Minister for the Environment and Water (Commonwealth) would be required. Of the nine types of MNES, three are potentially relevant to the Project within the scope of this report:

- Listed TECs
- Listed Threatened Species
- Listed Migratory Species

Threatened species and TECs listed under the EPBC Act are considered as MNES and are discussed in Section 3.6.

The location and/or relevance of migratory species, national heritage places and commonwealth marine areas are discussed in the following sections.

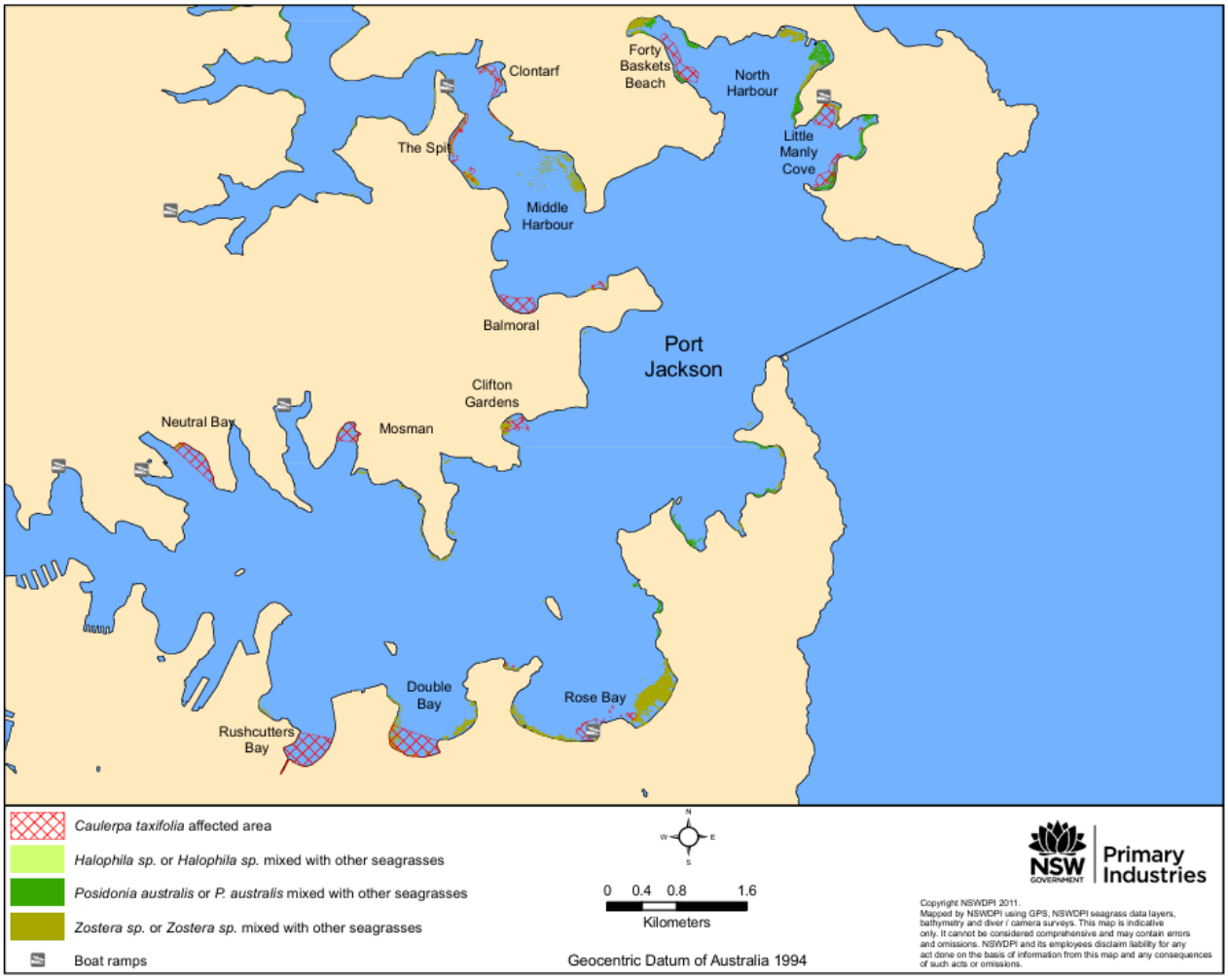


Figure 4: Mapping of Caulerpa taxifolia in Port Jackson (NSW DPI 2011)

3.9.1 Migratory Species

Migratory species include those animals that migrate to 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.

The PMST identified 25 migratory bird species, five migratory mammals and four migratory sharks that are predicted to occur within the Study Locality. An assessment of the likelihood of occurrence of migratory species was completed and the results are shown in Appendix A. All migratory species were found to have either a low or no likelihood of occurrence in the Study Area, predominantly based on their wide habitat range and transient nature. As such, impacts to these species from the Project are unlikely and no Assessments of Significance for migratory species have been undertaken.

4 Field Survey Results

The field survey was carried out on 18 July 2024 by two Stantec aquatic ecologists. Weather and sea conditions during the field survey are summarised in Table 3.

Table 3 Weather and sea conditions recorded during the field survey

Date	Temperature range (°C)	Rainfall (mm)	Wind direction	Max wind speed (km/h)	High tide (m)	Low tide (m)
18/07/2024	11.1-17.1	0	WNW	19	1.22 (05:37 h)	0.64 (11:09 h)

4.1 Marine Habitats in the Study Area

Habitat types observed in the subtidal and intertidal zones within the Study Area during the field survey Study Area are shown in Figure 5.

4.1.1 Subtidal Seabed

The subtidal seabed was predominantly soft sediment with small patches of macroalgae (***Sargussum*** sp. and ***Padina*** sp.) and rocks sparsely dispersed over the soft sediment substrate (Plate 1). Evidence of bioturbation of burrowing invertebrates (likely to be polychaete worms) was observed in the soft sandy sediments along the seabed (Plate 2).

Plate 1: Rocks and macroalgae dispersed in soft sediment

Plate 2: Soft sediment with polychaete holes in the Study Area

Habitat Assessment

Clontarf Overflow Diversion Project - Marine Habitat Assessment
Clontarf, NSW

Client: Sydney Water
Project Code: 304501569-GS-004
Drawn By: KS, Checked By: SM
Figure: 5 | Rev: 01
Date: 2024-08-15

Stantec

Legend

- Study Area
- Syphon House
- Cadastre

Habitat Type

- Concrete drain with encrusting oysters
- Rocks with encrusting oysters and algae
- Soft sediment
- Soft sediment with sparse rocks and macroalgae

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial imagery supplied by Metromap (March 2024)
2. Cadastre and Roads (NSW SS 2023)

0 10 20 30 40 50 Metres
Scale at A3: 1:1,000

4.1.2 Intertidal

The intertidal habitat was dominated by soft sediment. A small patch of rocks covered in algae and encrusting Sydney rock oysters (***Saccostrea glomerata***) was observed towards the southern end of the Study Area next to an existing concrete stormwater drainage pipe (Plate 3). Sydney rock oysters were also observed encrusting the stormwater pipe. Just south of the Syphon house, approximately 5 m east of the HAT, is a concrete manhole (Plate 4).

Plate 3: Small patch of rocks next to stormwater drainage pipe encrusted with oysters

Plate 4: Concrete maintenance hole on foreshore

4.2 Aquatic Flora and Fauna

No threatened or endangered species or populations as listed under the FM Act, BC Act or EPBC Act were observed in the Study Area during the field survey.

One Common stingray (***Trygonoptera Testacea)*** and a few Fanbelly leatherjackets were observed in the southern end of the Study Area via the ROV video feeds. A range of common mollusc species were observed on the rocks in the intertidal area, while a Comb sea star (***Astropecten polyacanthus***) was also found in the water at the northern end of the Study Area.

All incidental records of aquatic species identified during the survey are shown in Table 4.

Table 4 Aquatic species recorded within the Study Area during the field survey on 18 July 2024

Major Group	Species	Common Name
Brown algae	***Sargassum*** sp.	Gulfweed
	Padinia sp.	
Molluscs	***Saccostrea glomerata***	Sydney rock oyster
	Morula marginalba	Mulberry whelk
	Bembicium nanum	Striped-mouth conniwink
	Bembicium auratum	Gold-mouthed conniwink
Fishes	***Monacanthus chinensis***	Fanbelly leatherjacket
Rays	***Trygonoptera testacea***	Common stingaree
Echinoderms	***Astropecten polyacanthus***	Comb sea star
Birds	***Larus novaehollandiae***	Silver gull

5 Assessment of Impacts

This section assesses the potential impacts on marine ecology in the Study Area as a result of disturbances associated with the construction and operation of the Project. The two main components of the Project with potential to impact on aquatic ecology and the types of disturbances and impacts possible are detailed below.

Construction:

- Direct removal of intertidal habitat
- Water quality
- Contamination
- Commercial and recreational fishing

Operation:

- Water quality

5.1 Construction Impacts

5.1.1 Disturbance of foreshore areas

The Project requires the excavation of the upper foreshore area of Clontarf Beach as part of the installation of the diversion overflow pipe into the existing maintenance manhole. This area of disturbance is very small in comparison to the large area of similar habitat available within the surrounding area of Middle Harbour. It is expected that adjacent intertidal fauna in the Study Area would be broadly characteristic of most of the fauna throughout the wider estuary. Impacts to aquatic fauna and marine vegetation would be minimal and temporary during the construction phase, with site rehabilitation recommended following the construction works to re-instate lost habitat.

5.1.2 Water quality

There is potential for fine sediments to be mobilised during construction, primarily during excavation works for pipeline installation. Mobilised sediments can smother proximal aquatic vegetation and habitat depending on the size of debris particles. Mobilisation of finer debris can also result in the resuspension of sediments of an unknown quality, including those containing any legacy contaminants (see below), that may persist. This may only be a temporary disturbance to aquatic vegetation and habitat depending on the volume and the size of fine debris, and the extent of local wave, tide and current actions. Increased levels of turbidity are also unlikely to exceed ambient turbidity levels currently experienced within the Estuary after high rainfall or storm events.

It is likely that most highly mobile intertidal (e.g., crabs, shorebirds) or subtidal (e.g., fishes, mobile invertebrates) fauna would temporarily seek alternative, unaffected habitat elsewhere in the vicinity. Less mobile fauna, or those with strong site fidelity and high likelihood of occurrence, such as Syngnathids, could be temporarily affected by local changes in water quality that may affect breeding, feeding and/or foraging behaviour, although the disturbance and associated impacts would be expected to be short term and minor, and only until the animal relocates away from the area. An existing population of White's seahorse (***Hippocampus whitei***) exists in Clontarf Tidal Pool,

approximately 130 metres north of the Study Area. Construction impacts would involve minimal disturbance, with works below HAT limited to flushing of the existing pipe using a vacuum suction method from the manhole. Given the low potential occurrence of Syngnathids in the Study Area due to the lack of suitable habitat and considering the minimal disturbance of construction, impacts to the population of White's seahorse at Clontarf Tidal Pool is expected to be low.

Any construction-related impacts, however unlikely, would be temporary, relatively short term and localised; however, the installation of silt curtains is still recommended as best-practice for any intertidal and/or subtidal construction works.

5.1.3 Contaminated Sediments/ Acid Sulfate Soils

The location where trenching would be required for the installation of the diversion pipe is contained within areas mapped as having no known occurrence of ASS (***'NB: Beach'***) on the NSW SEED mapping portal. The project would therefore not expose, disturb or mobilise potential ASS or actual ASS materials. Although potential ASS (PASS) or actual ASS are not expected to be encountered, in the event of PASS/ASS materials being discovered on site, construction methods and site management procedures that do not leave ASS exposed to air without treatment. and/or dispose of ASS appropriately will be required. As long as these procedures are adhered to and mitigation measures are implemented (see Section 6), the risk of mobilisation and exposure of contaminated sediments would be reduced.

5.1.4 Commercial and recreational fishing

Fishing is a very popular recreational activity in Middle Harbour. While construction is taking place there may be restricted access to areas along the beachfront near CSH, restricting fishing activities in these areas. However, there are many alternative access points for shore-based recreational fishers to utilise should recreational-fishing access and quality be temporarily reduced during construction activities.

Given the high mobility of targeted species and their associated ability to avoid disturbances, the proposal is highly unlikely to impact local populations of aquatic species important to recreational fishing.

5.1.5 Key Threatening Process

A KTP is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. KTPs are listed under the FM Act and EPBC Act. Broadly, the KTPs include threats to threatened species, populations and ecological communities, as well as cause species, population or ecological communities to become threatened. Of these KTPs, one KTP under the FM Act has the potential to be triggered by the construction phase:

- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.

Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris is considered a Key Threatening Process under both the FM and EPBC Acts. The planned or

unplanned disposal of any wastes, petroleum-based products and other debris has potential to have direct and indirect impacts on marine fauna in the Estuary. For example, petroleum products destroy the insulating ability of fur-bearing mammals such as fur-seals and the water repellence of bird feathers, while they can also have an effect on the health, fitness, condition, growth rates, and larval survival of fish and invertebrates (Clarke, 2001). During construction works, uncontained debris and contaminants from unplanned spills can enter the waterways. The implementation of management measures to manage wastes and minimise risk of unplanned spills will be required to minimise this risk.

5.2 Operational Impacts

5.2.1 Water Quality

During operation of the diversion overflow pipe there would be controlled releases of water, diverted from the CSH through the newly installed overflow pipe into an existing pipe/subtidal outlet into Middle Harbour. The overflow water released at the subtidal outlet would be expected to be equivalent in frequency, volume and composition to the overflow water currently being sporadically released from the CSH, onto the beach and into the harbour during high rainfall events.

Recent uncontrolled wastewater overflows travel from the CSH through beach sands or or via overland flow directly to Middle Harbour at the tide mark. Stratification would normally occur following high rainfall events due to influx of freshwater runoff, which would sit on the surface of marine waters until it mixes within the water column.

The diversion of wastewater overflows to an existing 300 mm outlet during operation would release these overflows at depth, with the released water forced to more readily mix with the deeper, faster-flowing channel water. Receiving waters would also be expected to be relatively poor in water quality during the time of overflow release due to other inputs from stormwater pipes and other overflows in Middle Harbour during heavy rainfall events. Accordingly, impacts associated with operational overflows are expected to be minor. These impacts would also be temporary, as the occurrence of overflows during operation of the diversion pipe are expected to decrease substantially following the completion of works for the NSOOS desilting program.

6 Mitigation and Management

Mitigation measures have been proposed and summarised in Table 5 to prevent, manage or offset the likely impacts of the Project on aquatic ecology.

Table 5 Summary of mitigation measures

Potential Impact	Mitigation measure
Direct removal of intertidal sediment	• Site rehabilitation to be undertaken following construction works to re-instate any lost habitat
Direct impacts on water quality (consequent indirect impacts on biota)	• The potential for excavation work during heavy rainfall events should be avoided where possible. • Install a silt curtain(s) prior to commencing excavation activities and prior to flushing the existing pipe. This will localise any temporary increases in turbidity and reduce the dispersal of any contaminated sediments and debris that are suspended by the proposed works.
Mobilisation and exposure of contaminated sediments	• Silt curtains to be installed to contain mobilisation of potentially contaminated sediments • If ASS sediments are encountered during construction, works affecting ASS should cease and the client notified to re-assess the area before continuation with the works. • Flushing of the existing pipe should be undertaken using a vacuum truck (or equivalent) from the existing Sydney Water manhole on Clontarf Beach. If the pipe is to be flushed via a purging method (ie pushing material from the outlet into the water column), testing of the existing pipe for contaminants such as heavy metals should be undertaken prior to flushing to reduce risk of contaminants entering into Middle Harbour
Incorrectly disposed of construction waste and debris	• Construction-related waste products and debris should be immediately secured (or as soon as practicable) in covered waste containers for removal from the construction site.

7 Conclusion

The Clontarf Diversion Overflow Project aims to provide a temporary solution to the current issues within the NSOOS to reduce the amount of uncontrolled wastewater overflows over/through the beach sand at Clontarf. The proposed works would require the removal of sands high up in the foreshore area so that a temporary pipe can be laid and connected into the current maintenance hole. This Marine Ecological Assessment describes the existing environment within the Study Area and assesses the potential impacts that the Project may pose on aquatic biodiversity as a result of construction and operation of the Project. The assessment was informed by a review of existing information and data relating to the Study Area and Study Locality, as well as a targeted field survey.

The seabed within the Study Area was comprised predominantly of unvegetated soft sediment, with some small patches of rocks with macroalgae present. Potential impacts associated with the Project have been identified as the direct removal of intertidal sand, changes to water quality from mobilised sediments during construction works and during the operation of the temporary pipe, potential mobilisation of contaminated intertidal sediments, temporary changes to beach access for recreational beach users including recreational fishers, and indirect impacts from construction activities including construction waste and debris entering the water. Most of those potential impacts would be temporary in nature, only occurring during the construction phase of the Project. Appropriate mitigation and management measures have been recommended in this report to reduce the potential for disturbance on aquatic biodiversity within the Study Area.

Overall, the Project is not expected to facilitate or exacerbate any KTPs and is unlikely to significantly impact on any threatened species. Potential disturbances to habitat would impact on a very small proportion of the available habitat within the broader Middle Harbour estuary. The Project would not permanently fragment or isolate threatened species or populations, or substantially impact any species' lifecycle. Considering the above, and assuming recommended mitigation and management measures are implemented, the Project is highly unlikely to significantly impact on the aquatic ecology of the area.

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Appendices

Appendix A Likelihood of Occurrence Assessment

A.1 Threatened Species and Populations Assessment

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Birds						
Anthochaera phrygia	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-L)	None. No suitable habitat within the Study Area.
Ardenna grisea	Sooty Shearwater	-	V, M, Ma	The Sooty Shearwater forages in pelagic zone, 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. Birds nest in burrows or rock crevices on coastal slopes, ridges and cliff tops, in herbfields, tussock grassland or forest. Areas with waterlogged or shallow soils and/or dense vegetation are avoided	(PMST-L)	None. No suitable habitat within the Study Area.
Arenaria interpres	Ruddy Turnstone	-	V, M, Ma	Mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It can, however, be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral. The Ruddy Turnstone mainly forages between lower supralittoral and lower littoral zones of foreshores, from strand-line to wave-zone. They often forage among banks of stranded seaweed or other tide-wrack.	(PMST-K)	Low. Prefers specific habitat outside the Study Area.
Botaurus poiciloptilus	Australasian Bittern	E	E	Occurs from south-east QLD to south-east SA, TAS and the south-west of WA. Occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats.	1 (BioNet)	None. No suitable habitat within the Study Area.
Burhinus grallarius	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)	None. No suitable habitat within the Study Area

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Calidris acuminata	Sharp-tailed Sandpiper	-	V, M	Commonly located in muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland.	(PMST-K)	Low. Prefers specific habitat not in the Study Area.
Calidris canutus	Red Knot	-	V, M, 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-K)	Low. Prefers specific habitat not in the Study Area.
Calidris ferruginea	Curlew Sandpiper	E	CE, M, 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 Peninisula, 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-L)	Low. Prefers specific habitat not in the Study Area.
Calidris tenuirostris	Great Knot	V	V, M, 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-K)	Low. Prefers specific habitat not in the Study Area.
Callocephalon fimbriatum	Gang-gang Cockatoo	E	E	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.	(PMST-K)	None. No suitable habitat within the Study Area.
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of she-oak occur. Feeds exclusively on seeds found within cones pf she-oak trees.	(PMST-K) 8 (BioNet)	None. No suitable habitat within the Study Area.
Charadrius leschenaultii	Greater Sand Plover	V	V, M, 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. 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	(PMST-K)	Low. Prefers specific habitat not in the Study Area.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
				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.		
Charadrius mongolus	Lesser Sand Plover	V	E, M, Ma	The Lesser Sand-plover breeds in central and north eastern Asia, migrating further south for winter. 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 QLD 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-K)	Low. Prefers specific habitat not in the Study Area.
Climacteris picumnus victoriae	Brown Treecreeper (south-eastern)	V	V	Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands with an open understorey of Acacias, saltbush, lignum, Cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	(PMST-L)	None. No suitable habitat within the Study Area.
Dasyornis brachypterus	Eastern Bristlebird	E	E	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern QLD/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/ VICn 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-M)	None. No suitable habitat within the Study Area.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Diomedea antipodensis	Antipodean Albatross	V	V, M, Ma	The Antipodean Albatross is endemic to New Zealand, however forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW. It breeds on the New Zealand islands of Antipodes Island, Campbell Island, Pitt Island and the Auckland Islands. This subspecies nests in open patchy vegetation, such as among tussock grassland or shrubs on ridges, slopes and plateaus. On Antipodes Island, they nest in relatively uniform densities, but avoid areas of tall vegetation on steep coastal slopes, or amongst the tall ferns on poorly drained parts of the peaks near the island's centre.	(PMST-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Diomedea antipodensis gibsoni	Gibson's Albatross	V	V, M, Ma	In Australian territory, Gibson's Albatross has been recorded foraging between Coffs Harbour, NSW, and Wilson's Promontory, VIC. Gibson's Albatrosses are rarely observed in the Pacific Ocean or Indian Ocean. The only Australian record of this species is from a recapture off Wollongong, NSW, in September 1997. Gibson's Albatross breeds on Adams Island and Auckland Island, New Zealand. There are no breeding colonies of Gibson's Albatross in Australian territory. This albatross visits Australian waters while foraging and during the non-breeding season.	(PMST-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Diomedea epomophora	Southern Royal Albatross	-	V, M, Ma	During the non-breeding season, the Southern Royal Albatross has a wide and possibly circumpolar distribution, ranging north to about 35°S. The Southern Royal Albatross is moderately common throughout the year in offshore waters of southern Australia, mostly off southeastern NSW, VIC and TAS. Off SA, they are mostly seen May to September. It breeds on Campbell, Adams, Enderby and Auckland Islands, south of New Zealand. nests on flat or gently sloping ground on slopes, ridges, gullies and plateaux of large islands, and on the summits of islets. Depressions, gullies, lee slopes and vegetation provide shelter for its nests, but exposed sites are also needed nearby so that the Southern Royal Albatross can take off and land. Its nests are placed among vegetation that is sparse enough for easy access.	(PMST-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Diomedea exulans	Wandering Albatross	E	V, M, Ma	The Wandering Albatross breeds on Macquarie Island. Macquarie Island lies in the southwest Pacific Ocean, about half-way between New Zealand and Antarctica. A single breeding pair has also been recorded on Heard Island. The Territory of Heard Island and McDonald Islands are an Australian external territory and volcanic group of barren Antarctic islands, about two-thirds of the way from Madagascar to Antarctica. It feeds in Australian portions of the Southern Ocean. On breeding islands, the Wandering Albatross nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground. Nests of the Wandering Albatross are sited on moss	(PMST-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
				terraces, in dense tussocks, and often in loose aggregations on the west (windward) side of islands. It prefers open or patchy vegetation (tussocks, ferns or shrubs), and it requires nesting areas that are near exposed ridges or hillocks so that it can take off.		ranging habitat and is highly mobile.
Diomedea sanfordi	Northern Royal Albatross	-	E, Ma	The Northern Royal Albatross ranges widely over the Southern Ocean, with individuals seen in Australian waters off south-eastern Australia. It breeds on Chatham Island and Taiaroa Head on the South Island of New Zealand. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters. The Northern Royal Albatross nests on flat or gently sloping ground, on slopes, ridges, gullies and plateaux of large islands, and on the summits of islets.	(PMST-M)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Esacus magnirostris	Beach Stone-curlew	CE	Ma	The Beach Stone-Curlew occurs on open, undisturbed beaches, islands, reefs, and estuarine intertidal sand and mudflats, preferring beaches with estuaries or mangroves nearby. However this species also frequents river mouths, offshore sandbars associated with coral atolls, reefs and rock platforms and coastal lagoons. It has been observed around the north coast of Australia and associated islands from near Onslow in Western Australia to the Manning River in New South Wales. The species has largely disappeared from the south-eastern part of its former range, and is now rarely recorded on ocean beaches in New South Wales.	1 (BioNet)	Low. Prefers specific habitat not in the Study Area.
Erythrotriorchis radiatus	Red Goshawk		E	This unique Australian endemic raptor is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond andTweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	(PMST-M)	Low. Prefers specific habitat not in the Study Area.
Eudyptula minor	Little Penguin in the Manly Point Area (being the area on and near the shoreline	EP	-	Occurs in Australia and NZ. They generally breed from south of Port Stephens in NSW along the coast through Victoria, South Australia, Tasmania and as far as Fremantle in Western Australia. This endangered	75 (BioNet)	Low. Current records exist of this species occurring within the

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
	from Cannae Point generally northward to the point near the intersection of Stuart Street and Oyama Cove Avenue, and extending 100 metres offshore from that shoreline)			population occurs from just north of Smedley's Point to Cannae Point, North Sydney Harbour, Manly.		broader locality however the population occurs outside of the Study Area.
Falco hypoleucos	Grey Falcon	V	V	Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	(PMST-M)	None. No suitable habitat within the Study Area.
Fregetta grallaria grallaria	White-bellied Storm-Petrel (Australasian)	V	V	A wide oceanic distribution in the south Pacific and Atlantic Oceans, ranging into tropical waters from various breeding grounds. The White-bellied Storm-Petrel (Tasman Sea) breeds on small offshore islets and rocks in the Lord Howe Island group, including Roach Island and Balls Pyramid. It nests in crevices between large volcanic rocks, and in burrows excavated in banks. Breeding colonies are often situated along dykes. In the non-breeding season, it reaches and forages over near-shore waters along the continental shelf of mainland Australia.	(PMST-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Gallinago hardwickii	Latham's Snipe		V	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity	(PMST-L)	None. No suitable habitat within the Study Area.
Glossopsitta pusilla	Little Lorikeet	V	-	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in apples (***Angophora*** spp.), paperbarks (***Melaleuca*** 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	7 (BioNet)	None. No suitable habitat within the Study Area.
Grantiella picta	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, VIC and	(PMST-L)	None.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
				southern QLD. 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 Amyema.		No suitable habitat within the Study Area.
Haematopus fuliginosus	Sooty Oystercatcher	V	-	Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast. The availability of suitable nesting sites may limit populations. They favour rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Breeding occurs in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks.	1 (BioNet)	None. No suitable habitat within the Study Area.
Haematopus longirostris	Pied Oystercatcher	E	-	The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones.	1 (BioNet)	Low. Prefers specific habitat not in the Study Area.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	Ma	Distributed along the coastline (including offshore islands) of mainland Australia and TAS. 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).	26 (BioNet)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Hirundapus caudacutus	White-throated Needletail	V, P	V, M, 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-K) 5 (BioNet)	None. Almost exclusively aerial, so unlikely to

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
						land in the Study Area.
Ixobrychus flavicollis	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.	5 (BioNet)	Low. Prefers specific habitat not in the Study Area.
Lathamus discolor	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 (***Eucalyptus robusta***), Spotted Gum (***Corymbia maculata***), Red Bloodwood (***C. gummifera***), Red Ironbark (***E. sideroxylon***), and White Box (***E. albens***).	5 (BioNet)	None. No suitable habitat within the Study Area.
Limosa lapponica baueri	Nunivak Bar-tailed Godwit	-	E	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 kilometres. Birds arrive in NSW 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. 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.	(PMST-K)	Low. Prefers specific habitat not in the Study Area.
Limosa limosa	Black-tailed Godwit	V	E, Ma	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.	(PMST-K)	Low. Prefers specific habitat not in the Study Area.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Macronectes giganteus	Southern Giant-Petrel	E	E, M, Ma	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.	(PMST-M)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Macronectes halli	Northern Giant Petrel	V	V, M, Ma	The Northern Giant-Petrel has a circumpolar pelagic distribution, usually between 40-64ºS in open oceans. Their range extends into subtropical waters (to 28ºS) 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-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Melanodryas cucullata cucullata	South-eastern Hooded Robin	E	E	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. Prefers lightly wooded country, usually open Eucalypt woodland, Acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature Eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	(PMST-M)	None. No suitable habitat within the Study Area.
Neophema chrysostoma	Blue-winged Parrot	V	V, Ma	The Blue-winged Parrot inhabits a range of habitats from coastal, sub-coastal and inland areas, right through to semi-arid zones. Throughout their range they favour grasslands and grassy woodlands. They are often found near wetlands both near the coast and in semi-arid zones.	(PMST-L)	None. No suitable habitat within the Study Area.
Ninox connivens	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.	5 (BioNet)	Low. Prefers specific habitat not in the Study Area.
Ninox strenua	Powerful Owl	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains	364 (BioNet)	Low.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
				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 (Syncarpia ***glomulifera***), Black Sheoak (***Allocasuarina littoralis***), Blackwood (***Acacia melanoxylon***), Rough-barked Apple ***(Angophora floribunda***), Cherry Ballart (***Exocarpus cupressiformis***) and a number of Eucalypt species.		Found within Study Locality however prefers specific habitat not found in the Study Area.
Numenius madagascariensis	Eastern Curlew	-	CE, M, 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 TAS. 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-K)	Low. Prefers specific habitat not in the Study Area.
Onychoprion fuscata	Sooty Tern	V	-	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.
Pachyptila turtur subantarctica	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 m deep). Data from the south-eastern Australian Seabird Atlas confirm this pattern, with 83% (of 24 505 individuals) seen over	(PMST-K)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
				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.		
Pandion cristatus	Eastern Osprey	V	-	Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. They favour coastal areas, especially the mouths of large rivers, lagoons and lakes, feeding on fish over clear, open water.	8 (BioNet)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Phoebetria fusca	Sooty Albatross		V, M	In Australian waters the Sooty Albatross occurs off the south coast from Tasmania to Western Australia. Occasionally, the species is recorded off the NSW coast, north to Grafton. The Sooty Albatross is a pelagic or ocean going species that inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. It rarely occurs in continental shelf waters. Often small, isolated, subantarctic islands provide breeding habitat	(PMST-M)	None. Found predominately in open marine waters so no suitable habitat within the Study Area.
Pterodroma leucoptera leucoptera	Gould's Petrel	V	E, Ma	Breeds on both Cabbage Tree Island, 1.4 km 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.	1 (BioNet)	None. No suitable habitat within the Study Area
Pterodroma neglecta neglecta	Kermadec Petrel (western)	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.	(PMST-M)	None. No suitable habitat within the Study Area
Ptilinopus regina	Rose-crowned Fruit-Dove	V		Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.	2 (BioNet)	None. No suitable habitat within the Study Area

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Ptilinopus superbus	Superb Fruit-Dove	V		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.	2 (BioNet)	None. No suitable habitat within the Study Area
Pycnoptilus floccosus	Pilotbird	-	V	The pilotbird is found from the Wollemi National Park and Blue Mountains National Park in NSW through to the Dandenong Ranges, near Melbourne in VIC. Its natural habitat is temperate wet sclerophyll forests and occasionally temperate rainforest, where there is dense undergrowth with abundant debris.	(PMST-M)	None. No suitable habitat within the Study Area
Rostratula australis	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 WA. 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-L)	None. No suitable habitat within the Study Area
Stagonopleura guttata	Diamond Firetail	-	V	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (***Eucalyptus pauciflora***) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	(PMST-L)	None. No suitable habitat within the Study Area
Sternula nereis nereis	Australian Fairy Tern	-	V	Within Australia, the Fairy Tern occurs along the coasts of VIC, TAS, SA and WA; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from NSW (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.	(PMST-K)	Low. Prefers specific habitat not in the Study Area.
Thalassarche bulleri	Buller's Albatross	-	V, M, Ma	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 TAS 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-M)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Thalassarche bulleri platei	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 m depth although it is not so strongly associated with fishing grounds as are other albatrosses.	(PMST-M)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Thalassarche carteri	Indian Yellow-nosed Albatross	-	V, M, Ma	The Indian Yellow-nosed Albatross forages mostly in the southern Indian Ocean where it is particularly abundant off WA. In the Australasian region, the species occupies inshore and offshore waters, particularly where there are calm seas and light winds.	(PMST-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Thalassarche cauta	Shy Albatross	E	E, M, Ma	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 QLD along the entire south coast of the continent to Carnarvon in WA. 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 TAS, 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-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Thalassarche eremita	Chatham Albatross	-	E, M, Ma	"Breeding for the Chatham Albatross is restricted to Pyramid Rock, Chatham Islands, off the coast of New Zealand. The principal foraging range for this species is in coastal waters off eastern and southern New Zealand, and TAS. The Chatham Albatross is a marine species. It occurs in subantarctic and	(PMST-M)	Low. Has potential to fly through the Study Area and forage

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
				subtropical waters reaching the tropics in the cool Humboldt Current off South America. It has been noted in shelf-waters around breeding islands, over continental shelves during the non-breeding season, and occurs inshore and offshore. It enters harbours and bays and is scarce in pelagic waters. The Chatham Albatross preference for sea-surface temperatures is poorly known. In Chilean waters it has been observed over waters of 11.5 to 15°C. The species nests on level or gently sloping ledges, summits, slopes and caves of rocky islets and stacks. It is usually in broken terrain with little soil and vegetation."		(although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Thalassarche impavida	Campbell Albatross	-	V, M, Ma	The Campbell Albatross is a non-breeding visitor to Australian waters. Non-breeding birds are most commonly seen foraging over the oceanic continental slopes off TAS, VIC and NSW. They breed only on sub-Antarctic Campbell Island (New Zealand), south of New Zealand. After breeding, birds move north and may enter Australia's temperate shelf waters.	(PMST-M)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Thalassarche melanophris	Black-browed Albatross	V	V, M, Ma	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 ºC and 24 ºC. Spends most of its time at sea, breeding on small isolated islands.	(PMST-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Thalassarche salvini	Salvin's Albatross	-	V, M, Ma	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.	(PMST-L)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Thalassarche steadi	White-capped Albatross	-	V, M, Ma	Breeding colonies occur on islands south of New Zealand. The White-capped Albatross is a marine species and occurs in subantarctic and subtropical waters. The White-capped Albatross is probably common off the coast of south-east Australia throughout the year.	(PMST-K)	Low. Has potential to fly through the Study Area and forage (although generally forages in open water) however, this species has a wide-ranging habitat and is highly mobile.
Tringa nebularia	Common Greenshank	-	E, M, Ma	The species is known to forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water often among pneumatophores of mangroves or other sparse, emergent or fringing vegetation, such as sedges or saltmarsh. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats.	(PMST-K)	Low. Prefers specific habitat not in the Study Area
Tyto novaehollandiae	Masked Owl	V	-	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Dry Eucalypt forests and woodland, typically prefers open forest with low shrub density. Requires old trees for roosting and nesting.	1 (BioNet)	None. No suitable habitat within the Study Area.
Tyto tenebricosa	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.
Mammals						
Arctocephalus forsteri	Long-nosed fur-seal, New Zealand fur-seal	V, P	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.	(PMST-M) 10 (BioNet)	Low. Current records exist of this species occurring within the broader locality. Its wide distribution suggests its unlikely

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
						to be consistently found in the Study Area.
Arctocephalus pusillus	Australian fur-seal, Australo-African fur-seal	V, P	Ma	There are 10 established breeding colonies of the Australian fur-seal, which are restricted to islands in the Bass Strait; six occurring off the coast of Victoria and four off the coast of Tasmania. Pups have been born occasionally at Montague Island, on the southern NSW coast, and many non-breeding animals are known to congregate there. The greater range of the Australian fur-seal also includes South Australia, southern Tasmania and Jervis Bay Territory, with several haul-out sites known in each state. The extent of occurrence of the Australian fur-seal is estimated to be 132 000 km².For foraging, the Australian fur-seal prefers to utilise oceanic waters of the continental shelf and generally does not dive deeper than 150 m.	(PMST-M) 5 (BioNet)	Low. Current records exist of this species occurring within the broader locality. Its wide distribution suggests its unlikely to be consistently found in the Study Area.
Balaenoptera musculus	Blue whale	E	E, M, Ma	Much of the Australian continental shelf and coastal waters have no particular significance to the whales and are used only for migration and opportunistic feeding. The only known areas of significance to the blue whale are feeding areas around the southern continental shelf, notably the Perth Canyon, in Western Australia, and the Bonney Upwelling and adjacent upwelling areas of South Australia and Victoria.	(PMST-M)	Low. Usually associated with open water highly unlikely to enter estuaries.
Eubalaena australis	Southern right whale	E	E, M, Ma	The Southern right whale is seasonally present along the Australian coast between late April and early November. It has been recorded in the coastal waters of all Australian states with the exception of the Northern Territory. Principally found around the southern coastline off southern Western Australia and far west South Australia, The feeding habitat of the Southern right whale is very poorly known and there have been no dedicated studies in feeding areas. Based on sightings information, most feeding areas are thought to be in deeper offshore waters ranging from sub-Antarctic areas to locations south of 60 ° S. The Southern right whale prefers near-shore, shallow water depths and being in close proximity to other individuals whilst on calving grounds in Australian waters.	(PMST-L) 3 (BioNet)	Low. Usually associated with open water, but may swim into the Estuary, albeit boat traffic renders the estuary suboptimal.
Fish and Syngnathids						
Epinephelus daemelii	Black rockcod, Black cod, Saddled rockcod	V (FM Act)	V	The Black rockcod is a territorial species that inhabits caves, gutters and crevices. Usually found in depths up to 50m. They are found in subtropical and temperate waters of the south-western Pacific. Their distribution stretches along the whole NSW coast and includes Lord Howe Island.	(PMST-L)	Low. Sub-optimal habitat within Study Area.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Hippocampus whitei	White's seahorse, Crowned seahorse, Sydney seahorse	E (FM Act)	E, Ma	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	(PMST-K)	Low May occur in the Study Area however habitat within the Study Area is sub-optimal
Macquaria australasica	Macquarie perch	E (FM Act)	E	The Murray-Darling form of the Macquarie perch is still known to exist in waterways of VIC, NSW and the ACT. The eastern form is confined to the Hawkesbury-Nepean and Shoalhaven river systems including a number of Sydney's water supply reservoirs. The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks.	(PMST-M)	None. No suitable habitat in the Study Area.
Prototroctes maraena	Australian grayling	E (FM Act)	V	The Australian grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones such as the Tambo River, which is also known to have granite outcrops. The species has been found over 100 km upstream from the sea.	(PMST-L)	Low. May occur in the study during the marine phase of life-cycle. Study Area occurs at the end of the species' range and habitat is widespread.
Sharks						
Carcharias taurus	Grey nurse shark (east coast population)	CE (FM Act)	CE, M	Grey nurse sharks are found primarily in warm temperate (from subtropical to cool temperate) inshore waters around rocky reefs and islands, in or near deep sandy-bottomed gutters or rocky caves, and occasionally in the surf zone and shallow bays. They are often observed hovering motionless just above the seabed. They have been recorded at varying depths down to 230 m on the continental shelf, but are most commonly found between 15–40 m. They generally occur either alone or in small to medium sized groups, usually of fewer than 20 sharks.	(PMST-K)	Low. The species may occur within the Study Area, however suitable habitat is widespread. No aggregate sites are known in the Study Area.
Carcharodon carcharias	White shark, Great white shark	V (FM Act)	V, M, Ma	Great white sharks can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas. They also make open ocean excursions and can cross ocean basins (for instance from South Africa to the western coast of Australia and from the eastern coast of Australia to New Zealand). Great White Sharks are often	(PMST-K)	Low. May swim through the Study Area albeit widespread.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
				found in regions with high prey density, such as pinniped colonies (DEWHA 2009).		
Rhincodon typus	Whale shark	-	V, M, Ma	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. Whale Sharks are 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 (ppt).	(PMST-M)	Low. The Study Area is not considered as this species core range
Reptiles						
Caretta caretta	Loggerhead turtle	E	E, M, Ma	Loggerhead turtles are found in tropical and temperate waters off the Australian coast. In NSW they are seen as far south as Jervis Bay and have been recorded nesting on the NSW north coast and feeding around Sydney. Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months.	(PMST-K) 4 (BioNet)	Low. May swim through the Study Area albeit widespread.
Chelonia mydas	Green turtle	V	V, M, 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 QLD. 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-K) 6 (BioNet)	Low. BioNet record nearby Study Area so likely to swim through the Study Area albeit the species is widespread and transient.
Dermochelys coriacea	Leatherback turtle, Leathery turtle, Lute turtle	E	E, M, Ma	The Leatherback turtle has the widest distribution of any marine turtle, occurring in tropical, temperate and sub-polar waters from the North Sea and Gulf of Alaska in the Northern Hemisphere, to Chile and New Zealand in the Southern Hemisphere. Leatherback turtles occur in tropical and temperate waters of Australia. Large numbers of leatherback turtles feed off the southern QLD and NSW coasts and off WA's coast, south of Geraldton, but	(PMST-K)	Low. May swim through the Study Area albeit widespread.

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
				they are less abundant in the tropical waters of northern Australia. Most sightings are along the more heavily populated eastern seaboard of Australia where large adults are found year round in larger bays, estuaries and rivers. The frequency of sightings suggests that the species actively seeks out temperate feeding grounds, rather than simply straying to the south.		
Eretmochelys imbricata	Hawksbill turtle	-	V, M, Ma	Major nesting of Hawksbill turtles in Australia occurs at Varanus Island and Rosemary Island in WA, and in the northern Great Barrier Reef and Torres Strait, QLD. 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 Sargassum 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-K) 3 (BioNet)	Low. May swim through the Study Area albeit widespread.
Natator depressus	Flatback turtle	V	V, M, 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-K) 5 (BioNet)	Low. May swim through the Study Area albeit widespread.
Other						
Dendronephthya australis	Cauliflower soft coral	E (FM Act)	E	They occur within protected estuarine environments in NSW, however it is occasionally found in deeper offshore waters. Generally found in areas of sandy seabed where there is high current flow. Most commonly found in the Port Stephens estuary and the Brisbane Water area of Hawksbury River. They have been found sporadically in other locations in NSW waters including, Sydney Harbour, Terrigal, Botany Bay and Jervis Bay.	(PMST-K)	Low No preferred habitat within Study Area.
Threatened Ecological Communities (TECs)						

Scientific Name	Common Name	BC Act / FM Act*	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
***Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion**		-	E	This ecological community is characterised by the dominance of ***Posidonia australis*** seagrass within the Manning-Hawkesbury ecoregion.	(PMST-L)	None. This TEC is mapped within the Study Locality. However, it is not present within the Study Area.

*** Distribution and habitat requirement information adapted from:**
Australian Government DCCEEW https://www.environment.gov.au/biodiversity/threatened/species.
NSW DPE-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 DPE-EES Wildlife Atlas record data (Accessed December 2022, data retrieved for the years 2002-2022) http://www.bionet.nsw.gov.au/. and
Australian Government DCCEEW PMST http://www.environment.gov.au/epbc/protected-matters-search-tool.
Key:
EP = endangered population
CE = critically endangered
CD= conservation dependant
E = endangered
V = vulnerable
M = migratory (EPBC Act only)
Ma = marine (EPBC Act only)
C = Cetacean
P = Protected (National Parks and Wildlife Act 1974)
***(Bionet) = Species unidentified. Assumed sighting.**
****PMST-K = known to occur; PMST-L = likely to occur; PMST-M = may occur**

A.2 Migratory Species Assessment

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Birds					
Actitis hypoleucos	Common Sandpiper	M	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	(PMST-K)	Low. Prefers specific habitat not in the Study Area however it may fly through.
Anous stolidus	Common Noddy	M, Ma	Mainly occurs in ocean off the QLD 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-L)	Low. Prefers specific habitat not in the Study Area.
Apus pacificus	Fork-tailed Swift	M, Ma	Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	(PMST-L)	Low. The species is exclusively aerial and unlikely to land in the Study Area however may fly through.
Ardenna carneipes	Flesh-footed Shearwater	M	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 WA. 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-L)	Low. Prefers specific habitat not in the Study Area.
Calidris melanotos	Pectoral Sandpiper	M, 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-K)	Low. Prefers specific habitat not in the Study Area.
Calidris pugnax	Ruff	M, 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 of saline wetlands with exposed mudflats at the edges.	(PMST-K)	Low. Prefers specific habitat not in the Study Area.
Calidris ruficollis	Red-necked Stint	M	It is distributed along most of the Australian coastline with large densities on the VICn and TASn coasts. The Red-necked Stint breeds in Siberia and sporadically in	(PMST-K)	Low.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
			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		Prefers specific habitat not in the Study Area.
Calonectris leucomelas	Streaked Shearwater	M, 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-K)	Low. Prefers specific habitat not in the Study Area.
Charadrius bicinctus	Double-banded Plover	M	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-K)	Low. Prefers specific habitat not in the Study Area.
Cuculus optatus	Oriental Cuckoo	M	Occurs from the coastal region of the NT to the south of NSW coast. This species is very secretive inhabiting forests, occurring in coniferous, deciduous and mixed forest.	(PMST-K)	None. No specific habitat in the Study Area.
Fregata ariel	Lesser Frigatebird	M, Ma	Lesser frigatebirds are found throughout the Indian Ocean, western and central Pacific Ocean, and off Brazil in the Altantic Ocean They nest in low vegetation, where they can land and take off directly from the nest site. Frigatebirds catch flying fish in mid-flight, and harass other sea birds to force them to disgorge their catch, which is then caught in mid-air by the frigatebirds.	(PMST-K)	Low. Has potential to fly the Study Area although not preferred habitat. The species has a wide ranging habitat and is highly mobile.
Fregata minor	Great Frigatebird	M, 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-M)	Low. Has potential to fly the Study Area although not preferred habitat. The species has a wide ranging habitat and is highly mobile.
Limosa lapponica	Bar-tailed Godwit	M	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 NSW 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	(PMST-K)	Low. Has the potential to fly through the Study Area however prefers other specific habitat.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
			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. 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.		
Monarcha melanopsis	Black-faced Monarch	M	Widespread in eastern Australia. Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	(PMST-K)	None. No specific habitat in the Study Area.
Motacilla flava	Yellow Wagtail	M	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-L)	None. No specific habitat in the Study Area.
Myiagra cyanoleuca	Satin Flycatcher	M	Widespread in eastern Australia and vagrant to New Zealand. Inhabit heavily vegetated gullies in Eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	(PMST-K)	None. No specific habitat in the Study Area.
Numenius phaeopus	Whimbrel	M	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-K)	Low. Prefers specific habitat not in the Study Area
Pandion haliaetus	Osprey	M	The Osprey occurs in Indonesia, Philippines, Palau Islands, New Guinea, Solomon Islands, New Caledonia and Australia. The breeding range of the Osprey extends around the northern coast of Australia (including many offshore islands) from Albany in WA to Lake Macquarie in NSW; with a second isolated breeding population on the coast of SA, extending from Head of Bight east to Cape Spencer and Kangaroo Island. The total range (breeding plus non-breeding) around the northern coast is more widespread, extending from Esperance in WA to NSW, where records become scarcer towards the south, and into VIC and TAS, where the species is a rare vagrant. Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia	(PMST-K)	Low. Has potential to fly the Study Area although not preferred habitat. The species has a wide ranging habitat and is highly mobile.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Phaethon lepturus	White-tailed Tropicbird	M, Ma	The White-tailed Tropicbird can be found over pelagic waters and the coast of tropical and subtropical seas. It feeds on small fish, especially flying-fish, squid and some crustaceans (especially crabs). Its diet varies locally, for example taking mostly fish in the Seychelles. Most prey is caught by plunge-diving but flying-fish can be taken on the wing. Breeding is seasonal in places but elsewhere can be more or less continuous. It is loosely colonial, nesting in rocky crevices or sheltered scrape on the ground on small-remote islands preferring inaccessible spots on cliffs where take-off is relatively easy.	(PMST-K)	Low. Has potential to fly the Study Area although not preferred habitat. The species has a wide ranging habitat and is highly mobile.
Pluvialis fulva	Pacific Golden Plover	M	Most Pacific Golden Plovers occur along the east coast, and are especially widespread along the QLD 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 Sarcocornia, or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks.	(PMST-K)	Low. Has potential to fly through the Study Area however the species has a wide ranging habitat and is highly mobile.
Rhipidura rufifrons	Rufous Fantail	M	Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by Eucalypts such as Tallow-wood (Eucalyptus microcorys), Mountain Grey Gum (E. cypellocarpa), Narrow-leaved Peppermint (E. radiata), Mountain Ash (E. regnans), Alpine Ash (E. delegatensis), Blackbutt (E. pilularis) or Red Mahogany (E. resinifera); usually with a dense shrubby understorey often including ferns.	(PMST-K)	None. No specific habitat in the Study Area.
Sternula albifrons	Little Tern	M, Ma	Migrating from eastern Asia, the Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. 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 east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	(PMST-M)	Low. Has potential to fly through the Study Area however the species has a wide ranging habitat and is highly mobile.
Symposiachrus trivirgatus	Spectacled Monarch	M	Occurs along the entire east coast of Australia. Breeds in dense scrub in gullies of coastal ranges.	(PMST-M)	Low. Prefers specific habitat not in the Study Area.
Tringa brevipes	Grey-tailed Tattler	M	Within Australia, the Grey-tailed Tattler has a primarily northern coastal distribution and is found in most coastal regions. The Grey-tailed Tattler is often found on	(PMST-K)	Low.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
			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.		Prefers specific habitat not in the Study Area.
Tringa stagnatilis	Marsh Sandpiper	M	Fresh or brackish (slightly salty) wetlands such as rivers, water meadows, sewage farms, drains, lagoons and swamps.	(PMST-K)	None. No specific habitat in the Study Area.
Mammals					
Balaenoptera edeni	Bryde's whale	M, Ma	Bryde's whales have a wide distribution and occur in tropical, subtropical and warm temperate waters around the world. They live in all oceans from 40° south to 40° north. They have frequently been recorded along the east coast of Australia, most commonly between Merimbula and Tweed Heads.	(PMST-M)	Low. Usually associated with open water highly unlikely to enter estuaries.
Caperea marginata	Pygmy right whale	M, Ma	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 VIC, and the northern part of the Great Australian Bight, while WA has fewer records than comparative eastern Australian states. Concentrations of stranded animals have occurred at the entrance of the gulfs in SA and around TAS, but live sightings have predominated in the former region. The numerous strandings in TAS 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-M)	Low. Species is unlikely to forage in the Study Area due to Its wide distribution and preference for other habitats.
Lagenorhynchus obscurus	Dusky dolphin	M	The Dusky dolphin is found in coastal waters in the Southern Hemisphere. The species prefers cool currents and inshore waters, occasionally found offshore. The typical range of this dolphin is patchy however populations have been recorded around South America, the southwestern Africa and New Zealand. Some records of the species occur in South Australia and New Zealand. There are no records of this species in NSW.	(PMST-M)	Low. Species is unlikely to forage in the Study Area due to Its wide distribution and preference for other habitats.
Megaptera novaeangliae	Humpback whale	M, Ma	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	(PMST-K) 28 (BioNet)	Low. Species is unlikely to forage in the Study Area due to Its wide

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
			October and November, on the southward migration. As with the WA 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 QLD 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 QLD. 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, QLD. Feeding may also occur in northern waters of the Great Barrier Reef, as well as VIC, as sightings of humpback whales have been reported in these areas in summer months.		distribution and preference for other habitats.
Orcinus orca	Killer Whale, Orca	M	The Killer Whale is found in all oceans and seas of the world usually in family groups. They occur in most habitat types from coastal areas to the deep ocean waters, from the tropics to polar regions.	(PMST-L)	Low Species has wide distribution and prefers deep ocean waters
Sharks					
Carcharhinus longimanus	Oceanic Whitetip Shark	M, Ma	The oceanic whitetip shark is found throughout the world in tropical and sub-tropical waters. Generally found offshore in the open ocean, on the outer continental shelf, or around oceanic islands in deep water areas. Although they can make deep dives and have been recorded up to 1,082 meters (3,549 feet) deep, they typically live in the upper part of the water column, from the surface to at least 200 meters (656 feet deep). Oceanic whitetip sharks have a strong preference for the surface mixed layer in warm waters above 20°C.	(PMST-M)	Low. Usually associated with open water highly unlikely to enter estuaries
Lamna nasus	Porbeagle, Mackerel Shark	M, Ma	Most commonly widespread in Southern Australia from the Sydney region (NSW) to north of Perth (WA). Porbeagle sharks undertake daily vertical migrations to feed on mesopelagic fishes and squid. They regularly dive to 600 m with a maximum recorded depth of 1024 m during the day. At night, they spend most of their time at depths of 200–600 m in the open ocean	(PMST-L)	Low. Usually associated with deep water and highly unlikely to enter estuaries
Mobula birostris	Giant Manta Ray	M, Ma	The giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and in productive coastal areas. The species has also been observed in estuarine waters, oceanic inlets, and within bays and intercoastal waterways. Widespread, although relatively uncommon in Australian waters As such, giant manta rays can be found in cool water, as low as 19°C, although temperature preference appears to vary by region.	(PMST-M)	Low. Species is unlikely to forage in the Study Area due to Its wide distribution and preference for other habitats.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Mobula alfredi	Reef Manta Ray	M, Ma	Known on Australian waters from tropical north to at least Sydney, New South Wales; Elsewhere the species is circumglobally in tropical waters. Although Manta Rays are often seen inshore around coral and rocky reefs in tropical and subtropical waters, they also occur around offshore reefs and seamounts.	(PMST-K)	Low. Species is unlikely to forage in the Study Area due to Its wide distribution and preference for other habitats.
Australian Government DCCEEW PMST http://www.environment.gov.au/epbc/protected-matters-search-tool. **Key:** **M = migratory** **Ma = marine** **PMST-K = known to occur, -L = likely to occur, -M = may occur**					

A.3 Marine Species Assessment

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Fish and Syngnathids					
Acentronura tentaculata	Shortpouch pygmy pipehorse	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. Specimens in Aust. fish collections have been associated with coral, sponge gardens, vertical rock walls, wrecks and sand in a depth range of 3-22 m. Current likely range extends from far-north QLD to Southern NSW.	(PMST-M)	Low. This species is highly distributed across Australia however sub-optimal habitat within Study Area.
Seriolella brama	Blue warehou	CD	Blue warehou are a bentho-pelagic species that inhabits continental shelf and slope waters. Adults can be found at depths from 50-300 metres. Blue warehou are a schooling fish and usually aggregate close to the sea bed. Juveniles can sometimes be found schooling close to the surface in estuaries, often in association with jellyfish.	(PMST-K)	Low. No preferred habitat within Study Area.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Festucalex cinctus	Girdled pipefish	Ma	The Girdled pipefish is considered to reside in deeper waters 8-31 m in depth with only a single record of the species in waters less than 2 m. Specimens in Australian fish collections were collected in association with seagrass (including Zostera and Posidonia), kelp (Ecklonia), boulders, rocky reefs, rocks, shell rubble, sand, silt and mud. Found in NSW, QLD and NT waters.	(PMST-M)	Low May occur in the Study Area however, this species prefers deeper water habitat
Filicampus tigris	Tiger pipefish	Ma	Coastal species that has a potential range throughout NSW, QLD, WA, SA and TAS waters. Little more is known.	(PMST-M)	Low May occur in the Study Area however, this species is highly distributed across Australia.
Heraldia nocturna	Upside-down pipefish, Eastern upside-down pipefish, Eastern upside-down pipefish	Ma	The likely range of the Upside down Pipefish is associated with areas of suitable habitat and with a preference for temperate to cooler water environments. It's likely range extends from Coffs Harbour NSW southwards and as far up the WA coast as Perth.	(PMST-M)	Low. This species is highly distributed across Australia however sub-optimal habitat within Study Area.
Hippichthys penicillus	Beady pipefish, Steep-nosed pipefish	Ma	The likely range of the Beady pipefish is associated with areas of suitable habitat and with preference for warmer water environments. It's likely range extends from Wollongong NSW northwards as far as Exmouth WA.	(PMST-M)	Low. This species is highly distributed across Australia

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
					however sub-optimal habitat within Study Area.
Hippocampus abdominalis	Big-belly seahorse, Eastern potbelly seahorse, New Zealand potbelly seahorse	Ma	The Big-belly seahorse typically occurs in waters of less than 50 m depth in harbours and protected coastal bays; however, they have also been found in deep waters up to 104 m. Individuals found in shallow waters are typically found amongst algae, seagrasses and rocky reefs, whilst those in deeper water have been found attached to sponges and colonial hydroids, they have also been found around jetty piles and other man-made objects. The Big-belly Seahorse occurs from Newcastle, New South Wales (NSW), southwards to at least Eden and possibly further south. Globally the Big-belly Seahorse is known from North and South Island (New Zealand), Three Knights Islands to Stewart Island, the Snares and the Chatham Islands.	(PMST-M)	Low This species is highly distributed across Australia however sub-optimal habitat within Study Area.
Histiogamphelus briggsii	Crested pipefish, Briggs' crested pipefish, Briggs' pipefish	Ma	Coastal species that has a potential range throughout NSW, SA and TAS waters. Little more is known.	(PMST-M)	Low May occur in the Study Area however, this species is highly distributed across Australia.
Lissocampus runa	Javelin pipefish	Ma	The likely range of the Javelin Pipefish is associated with areas of suitable habitat and is expected to range from Perth WA through SA, VIC, TAS, NSW and as far as Mackay in QLD.	(PMST-M)	Low This species is highly distributed across Australia however sub-optimal habitat within Study Area.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Maroubra perserrata	Sawtooth pipefish	Ma	Species has a proposed range from southern QLD through NSW, TAS, VIC, SA and as far north as Geraldton in WA. The Sawtooth Pipefish prefers coastal temperate waters.	(PMST-M)	Low May occur in the Study Area however, this species is highly distributed across Australia.
Notiocampus ruber	Red pipefish	Ma	Red Pipefish prefer the cooler temperate waters of Southern NSW, VIC, TAS, SA and Southern WA.	(PMST-M)	Low May occur in the Study Area however, this species is highly distributed across Australia.
Phyllopteryx taeniolatus	Common seadragon, Weedy seadragon	Ma	Species known to range from Geraldton in WA to Port Stephens in Australia including TAS waters. They prefer shallow coastal waters comprising of algal, seagrass and seaweed beds.	(PMST-M)	Low This species is highly distributed across Australia however sub-optimal habitat within Study Area.
Solegnathus spinosissimus	Spiny pipehorse, Australian spiny pipehorse	Ma	The likely range of the Spiny pipehorse is associated with areas of suitable habitat and is expected to encompass SA, VIC, TAS, NSW and QLD waters.	(PMST-M)	Low. No preferred habitat within Study Area.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Solenostomus cyanopterus	Robust ghostpipefish, Blue-finned ghost pipefish,	Ma	Species has potential habitat across NSW, QLD, VIC, WA and NT waters. Little more is known about this cryptic species.	(PMST-M)	Low May occur in the Study Area however, this species is highly distributed across Australia.
Solenostomus paradoxus	Ornate ghostpipefish, Harlequin ghost pipefish, Ornate ghost pipefish	Ma	This species lives a predominantly pelagic lifestyle until it settles on the substrate to breed. This species inhabits coastal reefs with rock faces or coral drop-offs and is often associated with gorgonian and alcyonarian corals and crinoids. It is usually found in a depth range of 3-30 m. Current predicted range is restricted to the east coast of Australia extending from Wollongong NSW to far-north QLD.	(PMST-M)	Low Its wide distribution and preference for other habitats suggests its unlikely to be found in the Study Area.
Stigmatopora argus	Spotted pipefish, Gulf pipefish, Peacock pipefish	Ma	The likely range of the Spotted Pipefish extends from Canarvon in WA through the southern ocean and as far north as Newcastle in NSW. The species prefers coastal waters.	(PMST-M)	Low May occur in the Study Area however, this species is highly distributed across Australia.
Stigmatopora nigra	Widebody pipefish, Wide-bodied pipefish, Black pipefish	Ma	Species has a proposed range from southern QLD through NSW, TAS, VIC, SA and as far north as Geraldton in WA. The Widebody Pipefish prefers coastal temperate waters.	(PMST-M)	Low May occur in the Study Area however, this species is

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
					highly distributed across Australia.
Syngnathoides biaculeatus	Double-end pipehorse, Double-ended pipehorse, Alligator pipefish	Ma	Species has potential habitat across NSW, QLD, VIC, WA and NT waters. It occurs in lagoons and on reef flats, in bays and estuaries, in seagrass meadows, and in floating masses of algae, usually at depths of less than 5m.	(PMST-M)	Low This species is highly distributed across Australia however sub-optimal habitat within Study Area.
Trachyrhamphus bicoarctatus	Bentstick pipefish, Bend stick pipefish, Short-tailed pipefish	Ma	The likely range of the Bentstick pipefish is associated with areas of suitable habitat and with preference for warmer water environments. It's likely range extends from Wollongong NSW northwards as far as Carnarvon WA.	(PMST-M)	Low This species is highly distributed across Australia however sub-optimal habitat within Study Area.
Urocampus carinirostris	Hairy pipefish	Ma	The likely range of the Hairy pipefish is associated with areas of suitable habitat and with a preference for temperate to cooler water environments. It's likely range extends from Bundaberg QLD southwards and as far up the WA coast as Geraldton.	(PMST-M)	Low This species is highly distributed across Australia however sub-optimal habitat within Study Area.

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Vanacampus margaritifer	Mother-of-pearl pipefish	Ma	The likely range of the Mother-of-pearl pipefish is associated with areas of suitable habitat and with a preference for temperate to cooler water environments. It's likely range extends from Bundaberg QLD southwards and as far up the WA coast as Geraldton.	(PMST-M)	Low This species is highly distributed across Australia however sub-optimal habitat within Study Area.
Sharks					
Galeorhinus galeus	School shark, Eastern school shark, Snapper shark, Tope, Soupfin shark	CD	The School shark is most abundant in cold to temperate continental seas, from the surfline and very shallow water to well offshore. It is primarily a deep water demersal (bottom-dwelling) species, although individuals have been recorded undertaking daily vertical migrations, remaining at depths of around 500 metres during the day and moving up to around 100 metres at night. Females and juveniles utilise inshore coastal areas around Victoria, Tasmania and parts of South Australia for nursery areas.	(PMST-M)	Low. May swim through the Study Area albeit widespread.
Sphyrna lewini	Scalloped hammerhead	CD	The Scalloped hammerhead shark is a coastal pelagic species with a circumglobal distribution in warm temperate and tropical coastal areas between 45°N and 34°S. They are known to form large migratory schools and in Australia tend to move south during the warmer months.	(PMST-L)	Low. May swim through the Study Area albeit widespread.
Reptiles					

Scientific Name	Common Name	EPBC Act	Habitat requirements	Number of record (source)	Likelihood of occurrence
Hydrophis platura	Yellow-bellied Sea Snake	Ma	The Yellow-bellied sea snake is the most widely distributed of all sea snake species. It is found in most Australian waters with the exception of the colder southern coastline. The population living near the central coast of New South Wales was thought to be permanent and breeding, though no new studies have confirmed this. In addition the Yellow-bellied sea snake has been observed more recently at Scott Reef in the northern waters of Western Australia as part of a three-dimensional marine seismic survey. The distribution of the Yellow-bellied sea snake has been found to include the Indian and Pacific oceans around eastern Africa, Madagascar, Arabia, India, the coastal line of south-eastern Asia, Indonesia, Japan, Australia, New Zealand and the Pacific Islands. The Yellow-bellied sea snake is usually found within a few kilometres of the coast and prefers shallow inshore waters found to be between 11.7–36°C.	(PMST-M)	Low. May possibly occur in the Study Area. However, this species is highly distributed across Australia and globally.
Australian Government DCCEEW PMST http://www.environment.gov.au/epbc/protected-matters-search-tool. **Key:** **Ma = marine** **PMST-K = known to occur, -L = likely to occur, -M = may occur**					

Stantec

Stantec is a global leader in sustainable architecture, engineering, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

Appendix F – Aboriginal Due Diligence Assessment

This information has been redacted to protect sensitive Aboriginal heritage information (externally published version).

Appendix G – s57(2) exemption under the NSW Heritage Act 1977

Standard Exemption Record Keeping Form

This form is to assist owners and managers when recording the use of standard exemptions under section 57(2) of the Heritage Act 1977. Use the form each time a standard exemption is used. Retain copies of completed forms and all relevant information for your records and to demonstrate compliance with the general conditions of use for the standard exemptions.

Use of the standard exemptions is self-assessed. In completing this form you acknowledge that this record is not for assessment purposes and does not represent an endorsement of the Heritage Council for the work or use of exemptions. This form may be requested as part of an audit or compliance investigation. This information cannot be relied on as a defence to prosecution.

Affected heritage item

Name of State Heritage Register item/IHO item:	Middle Harbour Syphon NSOOS
Street address of heritage item:	Monash Crescent (East Side), Clontarf NSW

Local government area: Northern Beaches Council

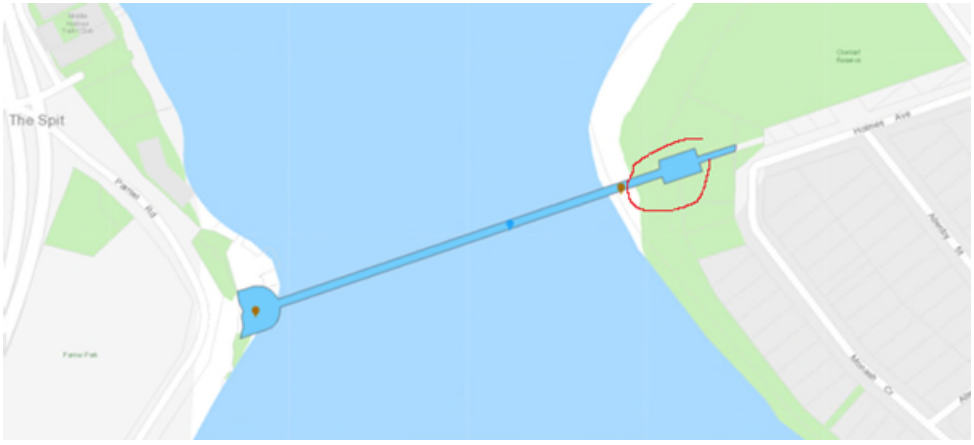
State Heritage Register/ interim heritage order reference number: SHR #01628

Activity/works

Description of works:

Include at a minimum what the activity/work is, how it will be carried out, what parts of the item it affects, what materials will be used.

In recent months there have been multiple uncontrolled wastewater overflow events from the CSH to Middle Harbour during wet weather events (8 occurrences from April-June 2024). The overflows have resulted in a range of complaints being lodged by nearby residents to Northern Beaches Council, NSW Government Ministers and Sydney Water. The ongoing overflow occurrences are causing erosion at the beach, restricting public access around the foreshore, inhibiting the use of Clontarf Beach.



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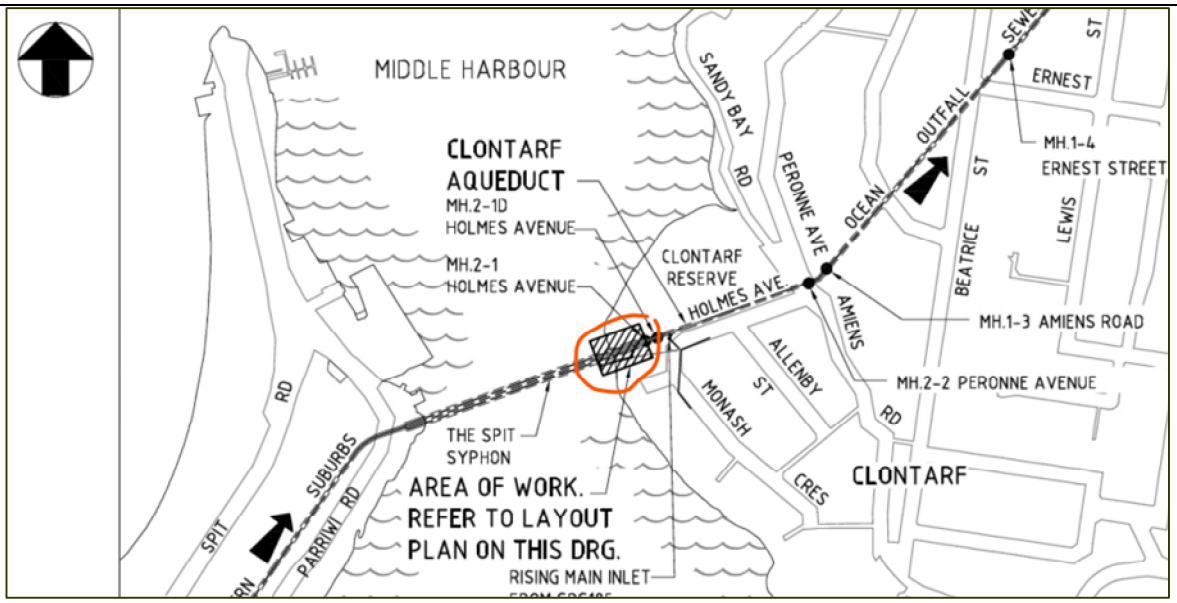


The overflows are a result of reduced hydraulic capacity within the NSOOS arising from partial collapses of the roof causing debris and siltation in the NSOOS between Clontarf and Sydney Water's North Head plant (known as Section 1).

Sand bags used to form temporary bunds 350mm in height, inside the syphon house, have been unable to contain wastewater overflows during significant wet weather events. The proposed works aim to reduce the likelihood of uncontrolled overflows to less than two times per year (on average).

Works are underway to remove obstructions in the NSOOS. In the future, flows may also be re-directed in the Northside Storage Tunnel (NST) as an additional measure. For this reason, the proposed works are temporary until the capacity of the NSOOS is restored. This is likely to take approximately 5-7 years. It is anticipated that restoration of the flow capacity of the NSOOS will reduce; if not eliminate the unsafe wet weather overflow issue at Clontarf.

Proposed Works Within SHR 01628's Curtilage:
The following activities are elements of the preferred temporary option to better control wet weather overflows at the Middle Harbour Syphon NSOOS, Clontarf:

1. Fix a temporary panel door to shroud the righthand side of the door to the syphon house (see marked-up Attachment 3)
2. Retaining structure, up to 350mm in height, on the floor of the Syphon House building (see Attachment 4)
3. New weir 350mm above the floor at the western side of the Syphon House building to direct overtopping flows into new temporary pipework
4. New weir 700mm above the floor at the eastern side of the Syphon House building (see Attachment 4)
5. New boxed pipe (600mm in height and 800mm in width) from the new 350mm weir to the top of the external steps on the western or waterfront side of the Syphon House building (see Attachment 4)
6. New above ground DN600 pipe fixed to the southern wall of the external staircase structure, from the boxed pipe to the ground (drop of 2.568m). Includes a necessary rodding hatch (see Attachment 4)

7. New above ground DN600 pipe on three to four concrete saddles running west towards the water and parallel to the southern wall of the external staircase structure (length of 8.66m) (see Attachment 4)
8. Excavate to extend this new DN600 pipe 1m underground
9. Install operational monitoring telemetry equipment.

Proposed Works Outside SHR 01628's Curtilage:

10. Connect the 600mm pipe to a new underground 20 m long DN375 pipe that will connect into the existing maintenance hole (MH1355052) (see Attachment 5)

The works are required to achieve safety at the site and adjacent public reserve and waterway. The proposed works are expected to commence in late 2024/early 2025 and take around 3 months to complete.

Standard Exemption: 19: Safety and security

Statement of Significance Referred to: State Heritage Register

> ***The Middle Harbour Syphon is a rare item of considerable cultural heritage significance. The syphon is a key component of the Northern Suburbs Ocean Outfall Sewer (NSOOS), the third major sewerage system to be built to service Sydney's growing wastewater needs. The syphon is one of three syphons associated with this sewerage system, the others being the Lane Cove Syphon and the Queenscliff Syphon located at Manly. The Lance Cove Syphon and The Middle Harbour Syphon are similar in size while the Manly Syphon is much smaller.***
>
> ***It was built between 1922 and 1925 and provides an excellent example of the skills of engineers of the time in constructing major public works. It is also possibly the best example in the state of an inverted syphon on such a scale. The syphon remains a vital part of Sydney's sewerage system, it is still in first rate condition and has been in constant use since its completion. The two access houses are well known foreshore landmarks and are of architectural interest because of their Art Deco style which displays influence of Egyptian architecture. The northern side of the syphon also consists of an aqueduct which runs along Clontarf Reserve.***
>
> Sourced from HMS - ViewItem (nsw.gov.au) on 02/07/2024

If not the State Heritage Register, record the document title, author and date:

Document Title	Author	Date
Not applicable	Not applicable	Not applicable

Was professional advice required to use the Standard Exemption? Yes: ☐ No: ☒

Was professional advice sought to use the Standard Exemption (even if it was not required by the relevant standards)? Yes: ☒ No: ☐

If yes to either of the above questions on professional advice, complete the table below (add additional rows if required):

Name of company/ person who advised	Date of advice	Title of any document containing the advice
Yvonne Kaiser-Glass	03/06/2024 to 23/10/2024	Meeting updates

Heritage NSW ("pre-lodgement meeting")	2/07/2024	Meeting

Cost of works:	$4.08M	Start date:	28/01/2025	Completion date:	28/04/2025

Were any inspections undertaken? Yes: ☒ No: ☐

If yes, complete below (add additional rows if required):

Date of inspection	Who inspected (name and organisation)	Purpose of inspection	Inspection findings
16/06/2024 & 7/07/2024	Yvonne Kaiser-Glass	Site inspections to take photos for this exemption and for the preparation of an AHDD	Proposed activities will have minor impact and excavation works are in an areas subject to numerous past disturbance (construction of the Syphon House, deep excavation for the large diameter pipes and excavation for the gas main).

Challenges encountered and/or change of plans

Describe here the challenge or change and how you managed it. Remember: any change of plans that would not comply with the Standard Exemption require approval under the ***Heritage Act 1977*** before activity/works can be undertaken.

Temporary equipment and/or material must be installed and operated for around 5-7 years to prevent environment impacts from severe weather events (C' in Specified activities/works for Standard Exemption 19: Safety and Security).

Use of this exemption and the likely timeframe was presented to and discussed with Heritage NSW on 02/07/2024 as part of a "pre-lodgement" meeting. No objections were raised.

The scope has remained largely consistent with that presented to and discussed with HeritageNSW on 02/07/2024 (PPT prepared to explained issue and proposed solution). One design change of note is that the DN600mm pipe will no longer be buried immediately once it drops down the side of the staircase wall. It will sit on concrete saddles and run west towards the water and parallel to the southern wall of the external staircase. This design change was out of concern for the health of the nearby mature Norfolk pine tree.

Heritage impact

Summarise how the activity/ work will change the heritage item. What elements of the item will be affected? Are those elements significant or non-significant? How will those elements change? Is the change permanent or temporary and will the change be reversible? Does the change to those elements affect their significance and/or the item's overall significance? Remember: there must be no impact to the item's overall significance to work under a Standard Exemption.

The installation and operation of the required temporary equipment has a minor impact on significant fabric (a small section of the 'kickboard' at the top of one side of the staircase will be removed to accommodate the temporary outlet pipe. It will be reinstated following the decommissioning of the temporary work). Likewise the righthand side of the sliding door panel will be reinstated following the decommissioning of the temporary work.

Also, as discussed above, the scope has been redesigned to avoid impacts to the roots of the Norfolk pine tree adjacent to the southern wall in the area of works.

The item's overall heritage significance will not be impacted by the urgent works necessary to protect environment and public health.

These meet the relevant standards for Standard Exemption 19: Safety and Security.

Heritage controls:

What measures were put in place to minimise or avoid impact from the activity/ work to significant elements, fabric, values and the item's overall heritage significance?

Works must not impact the stencilled image on the northern wall of the Syphon House in the event it is a Banksy artwork, based on word-of-mouth from past Sydney Water employees. Also removed fabric / elements will be reinstated, as explained above.

Contact details (person completing is form)

Name	Yvonne Kaiser-Glass
Organisation/role	Sydney Water (Senior Heritage Advisor)
Postal address:	1 Smith Street, Parramatta NSW 2150
Email:	[redacted]
Phone number:	

Name of heritage item owner (if not the contact who completed this form)	Sydney Water Corporation

Attachments

List of other documents that form part of the exemption record in addition to this form.

Attachment 1: Heritage Council's Plan 2044 for SHR Item 01628, Middle Harbour Syphon NSOOS

Attachment 2: Layout Plan - Clontarf Syphon Overflow Syphon Building Overflow Containment (Doc Ref # 6404/50/01)

Attachment 3: Section Sheet 2 - Clontarf Syphon Overflow Syphon Building Overflow Containment (Doc Ref # 6404/50/04)

Attachment 4: Clontarf Syphon Overflow Syphon Building Overflow Containment Sectional Plan (Doc Ref # 6404/50/03)

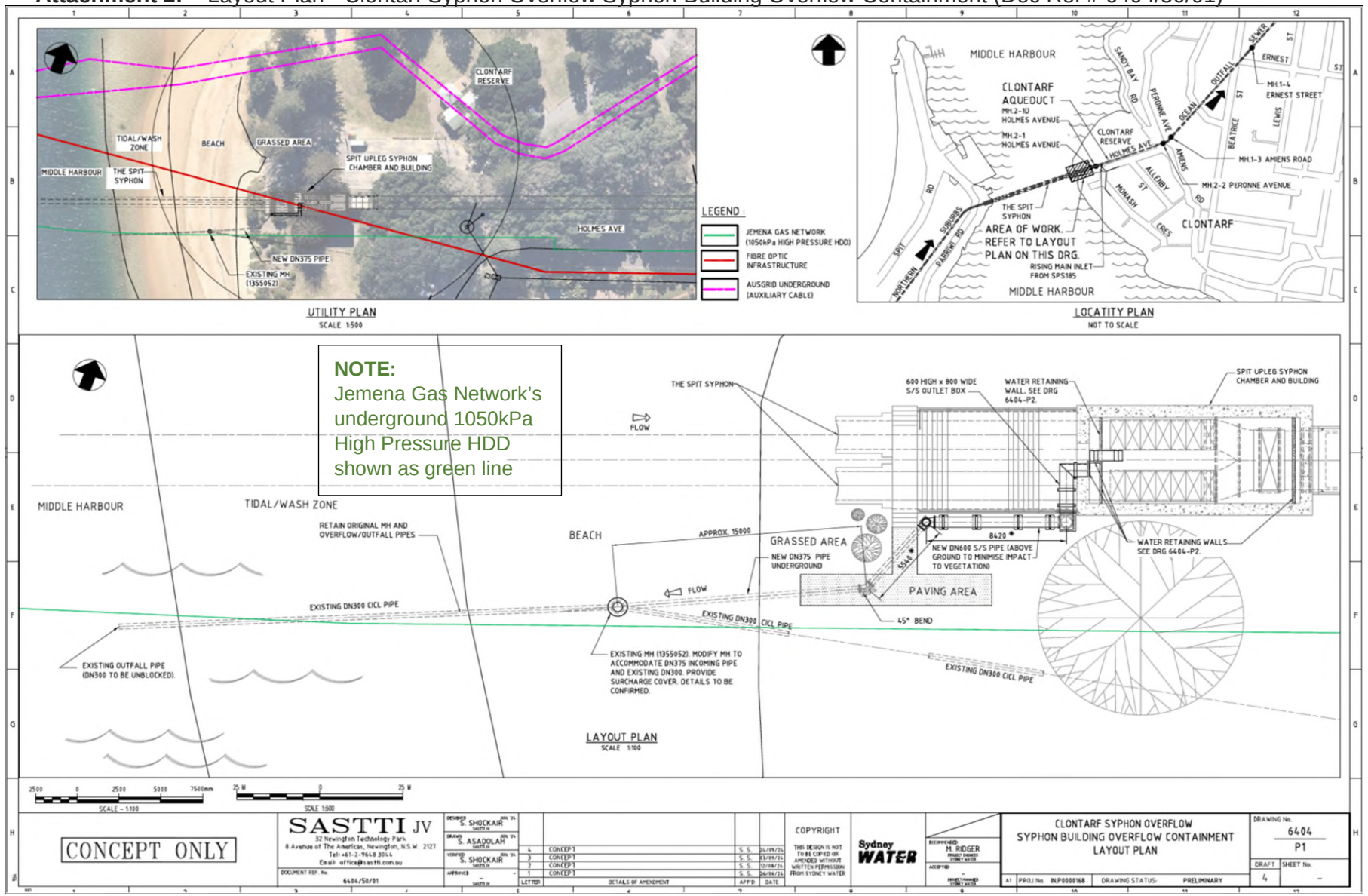
Attachment 5: Clontarf Syphon Overflow Syphon Building Overflow Containment Sectional Plan (Doc Ref # 6404/50/02)

Heritage NSW | Department of Planning and Environment | Locked Bag 5020 Parramatta NSW 2124 | Phone: 02 9873 8500
Email: heritagemailbox@environment.nsw.gov.au

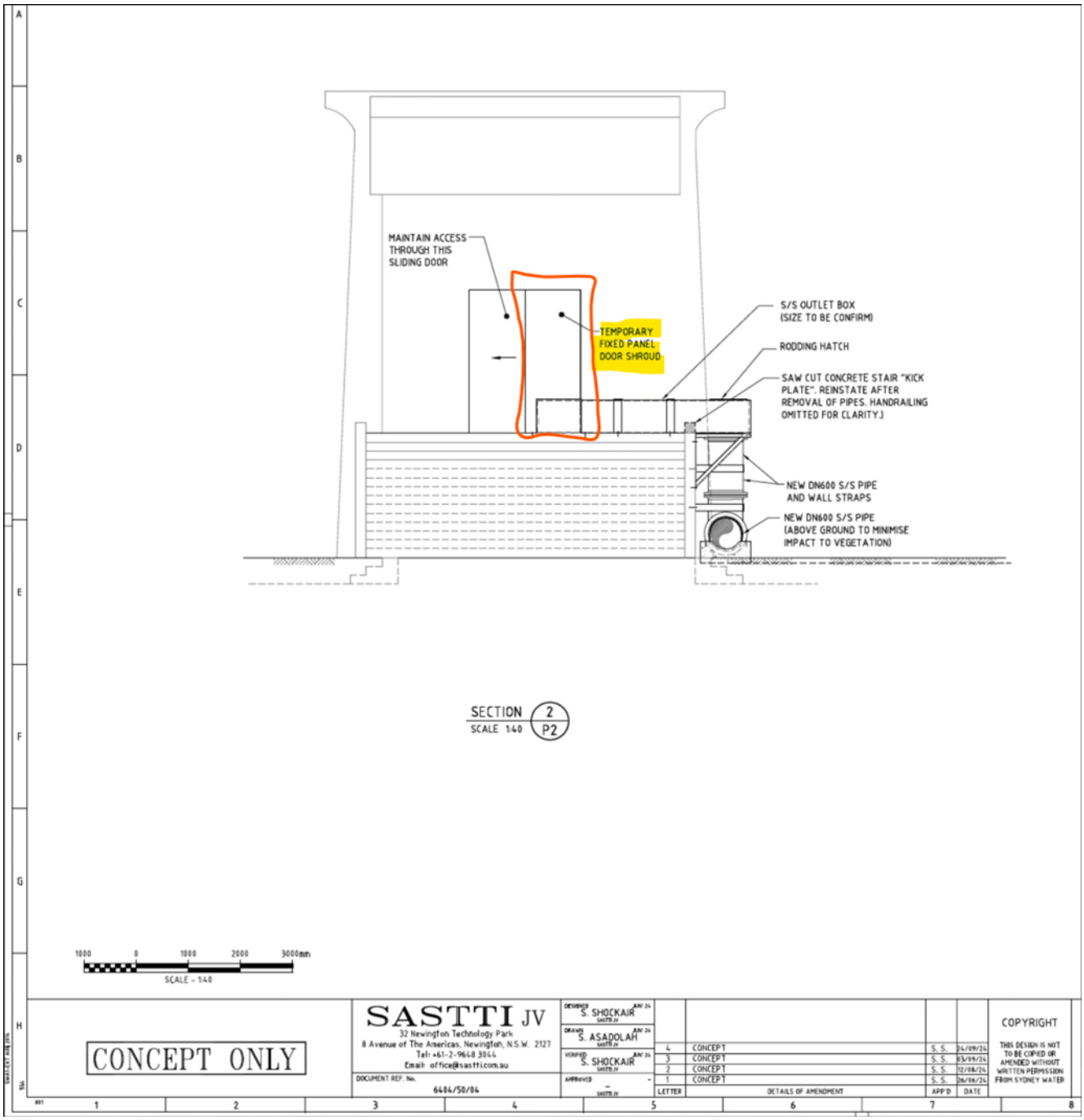
Attachment 1: Heritage Council's Plan 2044 for SHR Item 01628, Middle Harbour Syphon NSOOS

Sourced from HMS - ViewItem (nsw.gov.au) on 02/07/2024

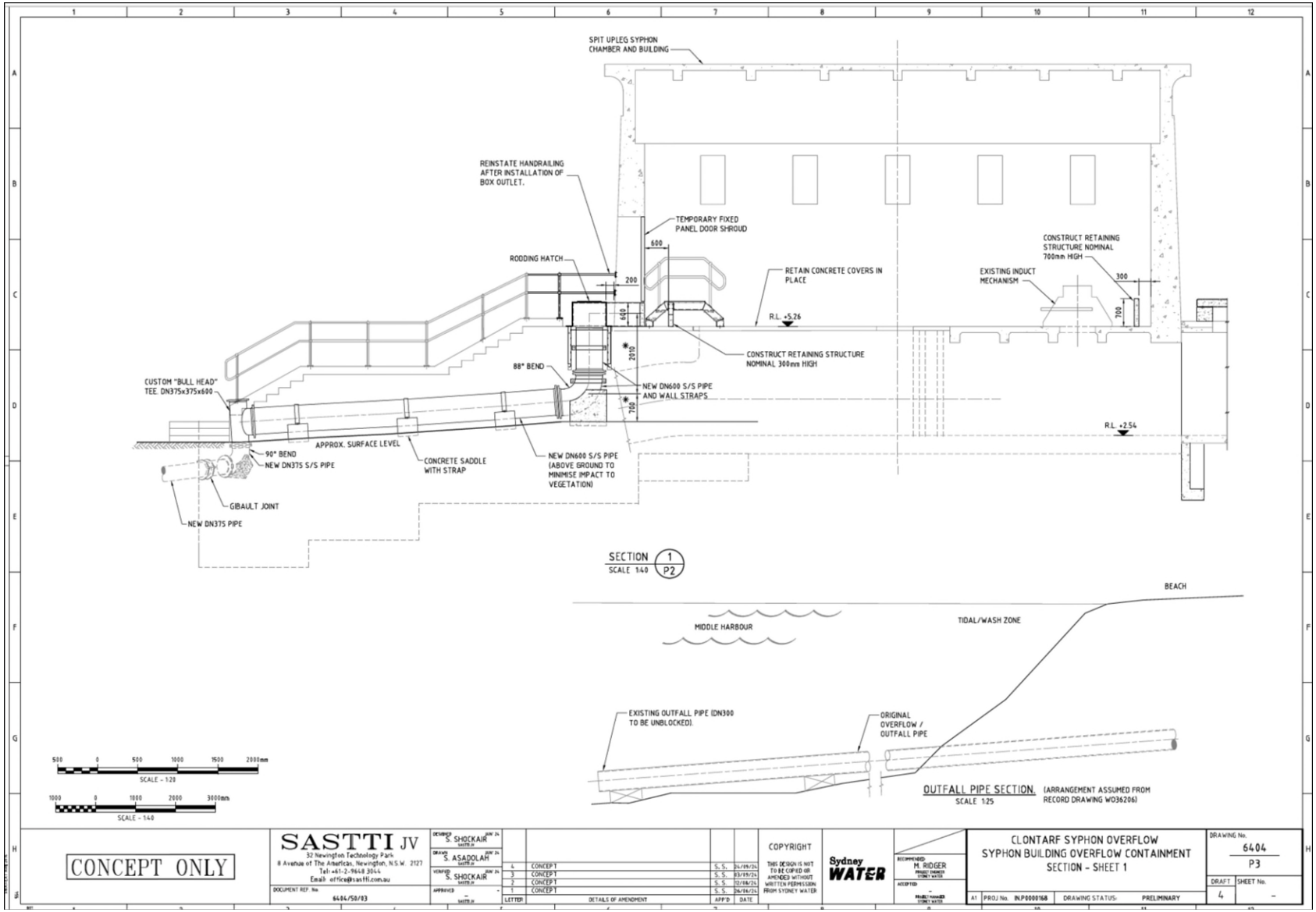
Attachment 2: Layout Plan - Clontarf Syphon Overflow Syphon Building Overflow Containment (Doc Ref # 6404/50/01)



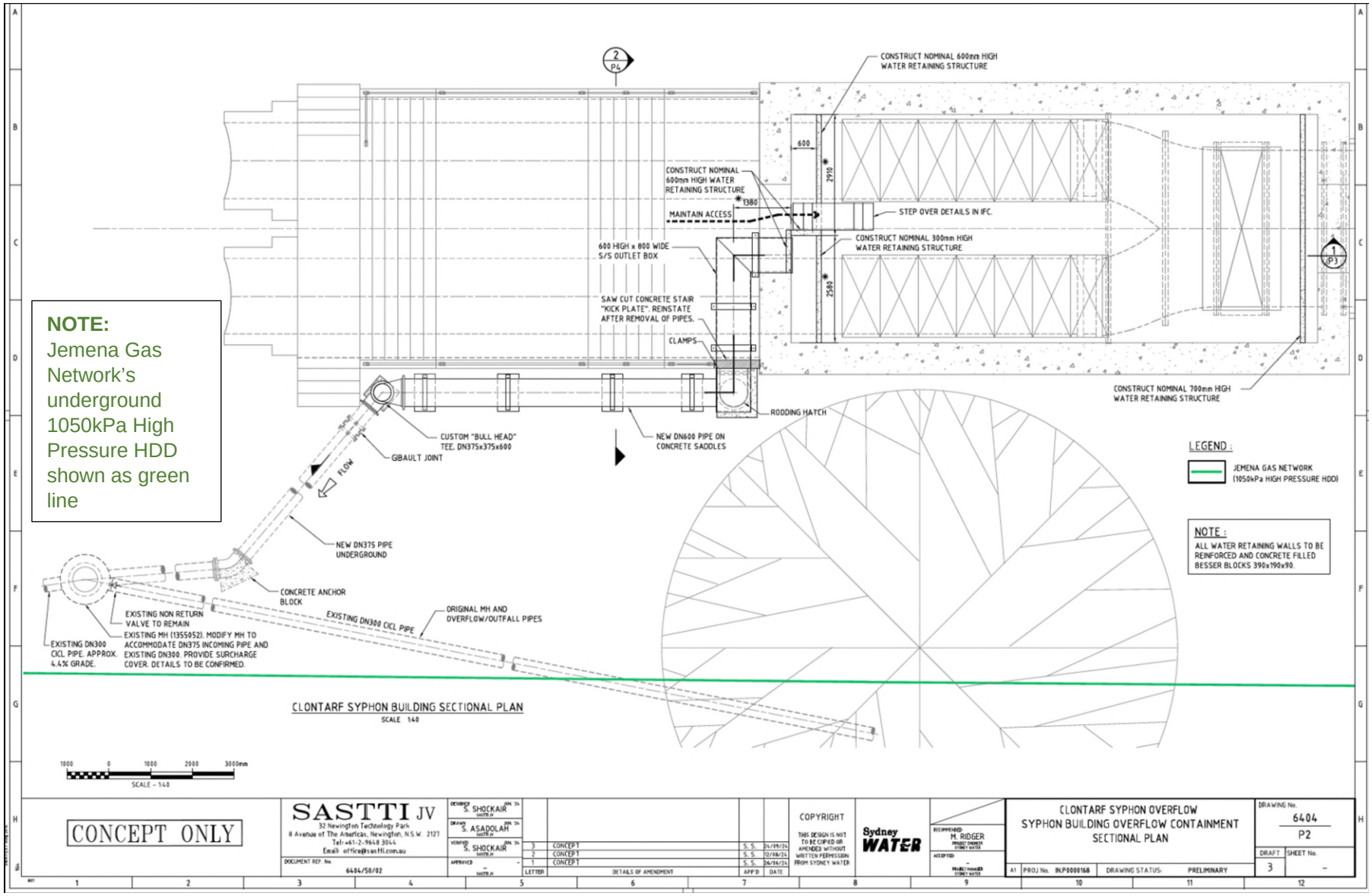
Attachment 3: Section - Sheet 2 - Clontarf Syphon Overflow Syphon Building Overflow Containment (Doc Ref # 6404/50/04)



Attachment 4: Section – Sheet 1 - Clontarf Syphon Overflow Syphon Building Overflow Containment (Doc Ref # 6404/50/03)



Attachment 5: Sectional Plan - Clontarf Syphon Overflow Syphon Building Overflow Containment (Doc Ref # 6404/50/02)



Appendix H – Construction Noise Impact Assessment Memo

1 Proposal details

1.1 Proposed scope of works

The scope of work is to construct a temporary overflow diversion structure at the Clontarf Syphon House (CSH). The worksite is located within Clontarf Reserve which will be accessed via Sandy Bay Road. The scope of work broadly includes:

- construction of water collection infrastructure within the CSH
- installation of an overflow diversion pipe (approximately 40m in length) from the CSH to Clontarf Beach
- connection of the overflow diversion pipe to the existing maintenance hole on Clontarf Beach

The proposal will not alter existing operational functions affecting noise emissions from the CSH. Assessment of operational noise impacts is therefore not required.

1.2 Duration and timing of works

Construction of the proposal is expected to start late 2024 and take about 3 months to complete.

The standard construction work hours are as follows:

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm
- Sunday and public holidays: no work.

Out of hours work are defined as:

- Out of hours day: Saturday 7am to 8am and 1pm to 6pm, Sunday and public holidays 8am to 6pm
- Out of hours evening: daily 6pm to 10pm
- Out of hours night: all other times.

Where possible, the proposal will occur during standard hours. However, in order to maximise the efficiency of the construction program to deliver the benefits sought by the community as soon as reasonably practicable, is proposed to also undertake extended hours of work on Saturdays from 7am to 4pm. No works are proposed to occur on Sundays or public holidays.

Accordingly, the proposed out of hours works for the proposal will be as follows:

- Daytime: Saturday 7am to 8am and 1pm to 4pm (hereafter referred to as ‘daytime out of hours’)

It is anticipated that daytime out of hours work will be conducted for approximately of 12-14 Saturday shifts during the project. Night-time works are not expected to be required.

1.3 Proposed activities/ equipment (noisiest plant details)

The proposed activities can be summarised by the following construction stages:

- Site establishment and mobilisation
- Establishment and use of a temporary construction compound
- Installation of drainage infrastructure
- Cutting of syphon house stairway

The equipment required during construction includes:

- Truck (medium rigid)
- Small excavator (6 tonne)
- Light vehicles (e.g. 4WD)
- Franna crane
- Power generator
- Concrete saw
- Power tools
- Truck mounted crane (Hiab)
- Welding equipment
- Concrete truck
- Truck compressor
- Compactor (hand held)
- Tipper truck
- Concrete pump
- Vacuum truck

Based on the above details, the noisiest activity will be use of a concrete saw during standard daytime construction hours.

1.4 Community consultation (if required)

Consultation has been occurring over several months with the surrounding community. This has included meetings and provision of project updates to the Clontarf Community Forum and Clontarf Locally Impacted Community.

As the majority of the works are located within Clontarf Reserve (managed by Northern Beaches Council), Sydney Water has been liaising with Northern Beaches Council regarding aspects of the proposal with potential affect the use and amenity of Clontarf Reserve. Council is supportive of the proposed works and has not raised any noise specific concerns to date.

2 Methodology

The Transport for NSW (TfNSW) Construction and Maintenance noise estimator tool (TfNSW, 2022) can be used to perform a basic noise assessment to capture predicted noise impacts at different distances for different types of receivers. Section 2 of this memo details the inputs required for the assessment. Section 3 of this memo details the output of the assessment.

2.1 Noise sensitive receivers and distance to receivers

The proposal is located within Clontarf Reserve, which is used for a mix of active and passive recreational activities. This mainly includes the use of the land as a public park, with a barbecue area and associated seating, as well as a dedicated children's playground, all of which are located within 50 m of the proposal worksite. There is also an existing restaurant/café within Clontarf Reserve (Bosk Kiosk & Restaurant) about 75 m to the northeast which is open 7 days a week. A small construction compound (~70m ^{2}) will be located immediately to the north of the Clontarf Syphon house opposite the existing public amenities building.

Outside of Clontarf Reserve the surrounding area comprises low density dwellings, with the nearest residential receiver located around 50 m to the southeast of the proposal site. There are a small number of commercial receivers, being Clontarf Marina (280 m to the north) and Middle Harbour Amateur Sailing Club and restaurants within the Spit East Reserve (250 m to the west on the opposite side of Middle Harbour).

2.2 Noise area category

The noise area category is chosen from the noise estimator tool to define an approximate background noise level for the environment surrounding the proposal. The noise area category is chosen based on a number of factors, including:

- surrounding land use and receiver types (refer Section 2.1 above)
- traffic volumes on nearby roads
- other transport infrastructure eg trains, airports/flight paths.

The applicable noise area category for the area surrounding the proposal is R1.

2.3 Background noise levels and noise management levels

Table 1 provides the assumed background noise levels and noise management levels. These noise management levels have been taken from the noise area category identified in Section 2.2 above.

Where the assessment identifies noise impacts above the noise management level (refer Section 3 of the memo), reasonable and feasible mitigation measures (refer Section 4 of the memo) should be applied.

Table 1 Background noise levels and noise management levels

Noise area category		R1
RBL or L_{A90}[1] Background level (dB(A))	**Day**	40
	Evening	35
	Night	30
$L_{Aeq(15minute)}$ Noise Management Level[2] (dB(A))	**Day**	50
	Day (OOHW)	45
	Evening	40
	Night	35

Notes: [1]L_{A90} = Background noise level

[2]Noise Management Level (NML) for works during standard hours = Background level plus 10dB(A)

NML for out of hours works = Background level plus 5dB(A).

2.4 Type of noise assessment

The next step requiring input to the noise estimator is to select either noisiest plant or scenario. This will calculate the predicted worst-case construction noise levels. These construction noise levels will be assessed against the noise management levels identified above. Based on the plant and equipment proposed to be used, there may be different worst-case construction noise levels at different times of the day or night.

The construction methodology generally comprises minor noise impact activities. None of the construction activities identified in Section 1.3 correspond with the pre-determined construction scenarios in the noise estimator tool. The “noisiest plant” option of the estimator tool has therefore been used as it will provide a more accurate assessment of noise impacts from the proposal. On this basis, the noisiest plant chosen for the three identified construction scenarios are identified in Table 2 as follows:

Table 2 Noise estimator inputs – construction stages and noisiest plant

Construction activity	Noisiest plant
Site establishment and mobilisation	Truck (medium rigid)
Use of a temporary construction compound	Truck (hiab with mounted crane)
Installation of drainage infrastructure	Concrete truck
Cutting of syphon house stairway	Concrete saw

2.5 Line of sight to receivers

A receiver may have line of sight, or no line of sight, to the proposal.

Line of sight is the straight line between the noise source and the receiver. Receivers with line of sight will typically include those in front of the work, who do not have their view blocked by barriers such as terrain (e.g. a large hill), permanent noise walls or other buildings.

Receivers with no line of sight (all other factors being equal, such as distance to the work and type of equipment) will experience less noise than receivers with line of sight. Typically, these include the receivers who have their view blocked from the works by barriers including those listed above.

The nearest line of sight receivers will be recreational users of Clontarf Reserve/Clontarf Beach which will be able access public areas immediately adjacent to the proposal site. The nearest residential receivers with line of sight are located approximately 50m to the southeast on Monash Crescent. Residential dwellings located behind this first row of line of sight receivers are considered to have no line of sight as they are behind a solid barrier.

Other residential receivers are located on Peronne Ave approximately 210 m to the east of the proposal site and are considered to have a line of sight to the construction compound. The houses beyond those with street frontage to Peronne Ave are located on a steep incline and are therefore also considered to have line of sight to the construction compound.

As a result, the noise estimator will run based on the following activities:

- Activity 1 (site establishment and mobilisation) - Truck (medium rigid) deliveries during standard daytime construction hours and daytime out of hours work periods – line of sight and no line of sight
- Activity 2 (Use of a temporary construction compound) – Truck (hiab with mounted crane) deliveries during standard daytime construction hours and daytime out of hours work periods – line of sight
- Activity 3 (Installation of drainage infrastructure) – Use of concrete pump truck during standard daytime construction hours and daytime out of hours work periods – line of sight and no line of sight
- Activity 4 (Cutting of syphon house stairway) – Use of concrete saw during standard daytime construction hours only – line of sight

3 Assessment of impacts

3.1 Activity 1: Site establishment and mobilisation

Activity 1 comprises deliveries to and from site using a medium rigid truck during standard construction hours and daytime out of hours work periods, with both line of sight and no line of sight to nearby receivers.

The results from the noise estimator tool for Activity 1 are shown in Table 3, Table 4 and Section 6. For nearby residential receivers to the southeast of the proposal site, work during standard working hours is not expected to be intrusive. Passive recreation users of Clontarf Reserve/Clontarf Beach within 15 m of the proposal site will experience exceedances (10-20 dB(A)) of the applicable noise management level (NML), while both passive and active recreation users within 10 m of the works will experience noise levels of 75dB (A) or greater (i.e. 'highly affected'). All other receivers are predicted to comply with the applicable NMLs.

It is noted that the noise estimator tool assumes that the noisiest piece of plant (in this case a medium rigid truck) will be operated constantly. However in reality these trucks will only be operated at intermittent intervals for deliveries. Similarly, the majority of recreational users of Clontarf Reserve are likely to be within 15 m of the works for short periods (eg people traversing past the site on the Spit to Manly Walk). Accordingly, it is considered that overall noise impacts from the proposal will be minor.

Details of mitigation measures are identified in Table 3 and Table 4, and are discussed further in Section 114 of this memo.

3.2 Activity 2: Use of a temporary construction compound

Activity 2 involves the use of a temporary construction compound during standard daytime construction hours and daytime out of hours work periods, with both line of sight and no line of sight to nearby receivers. Residential receivers to the southeast of the proposal site on Monash Crescent will not have a direct line of sight to the construction compound due to the presence of the Clontarf Aqueduct between the source and receiver.

The results from the noise estimator tool for Activity 2 are shown in Table 3, Table 4 and Section 6. Compound activities will be audible to residential receivers on Monash Crescent and Peronne Ave during standard daytime construction hours and daytime out of hours work periods, however are not expected to be intrusive. Passive recreation users of Clontarf Reserve/Clontarf Beach within 25 m of the proposal site will experience exceedances (10-20 dB(A)) of the applicable NML, while both passive and active recreation users within 15 m of the works will experience noise levels of 75dB(A) or greater (i.e. 'highly affected'). All other receivers are predicted to comply with the applicable NMLs.

It is noted that the noise estimator tool assumes that the noisiest piece of plant (in this case a hiab truck) will be operated constantly. However in these trucks will only be operated at intermittent intervals for deliveries. Similarly, the majority of recreational users of Clontarf Reserve are likely to be within 25 m of the works for short periods (eg people traversing past the site on the Spit to Manly Walk). Accordingly, it is considered that overall noise impacts from the proposal will be minor.

Details of mitigation measures are identified in Table 3 and Table 4, and are discussed further in Section 114 of this memo.

3.3 Activity 3: Installation of drainage infrastructure

Activity 3 involves the use of a concrete truck during standard daytime construction hours and daytime out of hours work periods, with both line of sight and no line of sight to nearby receivers.

The results from the noise estimator tool for Activity 3 are shown in Table 3, Table 4 and Section 6. The concrete truck will be moderately intrusive to a small number of residential receivers in Monash Crescent (approx. 7 households) within 85 m of the proposal that have a direct line of sight to the worksite during standard construction hours and out of hours (daytime) works. Passive recreation users of Clontarf Reserve/Clontarf Beach within 30 m of the proposal site will experience exceedances (10-20 dB(A)) of the applicable NML, while both passive and active recreation users within 20 m of the works will experience noise levels of 75dB(A) or greater (i.e. 'highly affected'). All other receivers are predicted to comply with the applicable NMLs.

It is noted that the noise estimator tool assumes that the noisiest piece of plant (in this case a concrete truck) will be operated constantly. However concrete trucks will only be operated at intermittent intervals during the concrete pours. Similarly, the majority of recreational users of Clontarf Reserve are likely to be within 25 m of the works for short periods (eg people traversing past the site on the Spit to Manly Walk). Accordingly, it is considered that overall noise impacts from the proposal will be minor.

Details of mitigation measures are identified in Table 3 and Table 4, and are discussed further in Section 114 of this memo.

3.4 Activity 4: Cutting of syphon house stairway

The installation of the overflow diversion structure between the syphon house doors and the base of the syphon house steps will require cutting through of a small section of the existing concrete stair kicker. It is likely that this will require the use of a concrete saw and is therefore a "noisy work" activity. However, it is anticipated that the concrete saw will only be required on one day during the entire construction period. This will occur during standard daytime construction hours only, with the concrete saw used intermittently for a total duration of approximately 20 minutes over period of 1-2 hours. As the use of the concrete saw will be very limited, the associated noise impacts have been considered as a separate activity (Activity 4).

The results from the noise estimator tool for Activity 4 are shown in Table 3, Table 4 and Section 6. Concrete cutting will be moderately intrusive to residential receivers within 155 m of the proposal, and highly intrusive to those within 60 m of the proposal with a direct line of sight (i.e. residents on the corner of Monash Crescent and Holmes Ave). Passive recreation users of Clontarf Reserve/Clontarf Beach within 60 m of the proposal site will experience exceedances (10-20 dB(A)) of the applicable NML, while both passive and active recreation users within 35 m of the works will experience noise levels of 75dB(A) or greater (i.e. 'highly affected'). All other receivers are predicted to comply with the applicable NMLs.

3.5 Consideration of noise sensitive events/functions

The noise estimator tool identifies recommended mitigation measures to be implemented based on the extent of potential noise exceedances above the applicable noise management levels for works both within and outside of standard construction working hours. However, for office/retail receivers (which includes Bosk Café and Restaurant), specific mitigation measures for daytime works are limited to circumstances where the receiver would be 'highly affected' for standard working hours, and for evening and night time periods for works outside of standard working hours. Therefore, although works undertaken on Saturday afternoons between 1.00pm – 4.00pm are outside of standard working hours, there are no applicable mitigation measures recommended by the noise estimator tool.

It is noted that the Bosk Café and Restaurant is also available for use as a wedding venue, with wedding ceremonies held immediately adjacent within Clontarf Reserve. Although the noise predictions identify that Bosk Café and Restaurant would not be highly affected, some construction activities will be clearly perceptible at the venue (including concrete cutting of the CSH stairs). Consultation will be undertaken with the operators of Bosk Café and Restaurant to identify any potential noise sensitive functions (ie weddings) scheduled to take place during the construction period. Where an overlap with construction activities may occur, appropriate time-specific mitigation measures will be implemented to ensure that noise from construction activities does not adversely affect the identified noise sensitive event(s).

Details of mitigation measures are identified in Table 3 and Table 4, and are discussed further in Section 114 of this memo.

Table 3 Affected distance (metres) for residential receivers during Activity 1, Activity 2, and Activity 3 – Standard Construction Hours; Out of hours works (daytime)*

Activity	$L_{Aeq(15minute)}$ noise level above background (L_{A90})		
	20 to 30 dB(A)	> 30 dB(A)	$L_{Aeq(15minute)}$ 75dB or greater
	Moderately intrusive	Highly intrusive	Highly affected
Activity 1 – line of sight	n/a	n/a	n/a
Activity 1 – no line of sight	n/a	n/a	n/a
Activity 2 – line of sight	n/a	n/a	n/a
Activity 2 – no line of sight	n/a	n/a	n/a
Activity 3 – line of sight	85 m	n/a	n/a
Activity 3 – no line of sight	n/a	n/a	n/a
Activity 4 – line of sight	155 m	60 m	n/a
Activity 4 – no line of sight	105 m	n/a	n/a
Recommended additional mitigation measures – TfNSW Construction and Maintenance noise estimator tool (2022). Refer Section 4.2 of this memo for further details			
Standard construction hours	Notification (N)	N	N Phone Call (PC) Respite Offer (RO)
Out of hours (daytime)	N Respite Period 1 (R1) Duration Respite (DR)	N, R1, DR	N, PC, RO

* The nearest residential receivers are located approximately 50 m to the southeast of the proposal site. Where the noise estimator tool calculated that affected distances for noise level exceedances will be less than 50 m, these have been marked as not applicable (n/a)

Table 4 Affected distance (metres) for non-residential receivers with line of sight during Activities 1, 2 & 3 – Standard construction hours; Out of hours works (daytime)

Land use	$L_{Aeq(15minute)}$ noise level above NML	
	10-20dB(A)	Highly affected – 75dB(A) or above
Activity 1		
Active recreation	n/a	10 m
Passive recreation	15 m	10 m
Activity 2		
Active recreation	n/a	15 m
Passive recreation	25 m	15 m
Activity 3		
Active recreation	n/a	20 m
Passive recreation	30 m	20 m
Activity 4		
Active recreation	n/a	35 m
Passive recreation	60 m	35 m
Recommended additional mitigation measures (refer Section 4.2 for further details)	N (Notification)	N PC (Phone Call) RO (Respite Offer)

3.6 Vibration

The construction methodology for the proposal includes the use of a single piece of vibration generating plant, being a hand held soil compactor which will used to compact materials following the backfilling of open trenched areas. The soils at the proposal site comprise highly unconsolidated siliceous sands (ie beach and dune materials) which have poor vibration propagation properties. Combined with the small hand held compactor which will be used, vibration impacts will be negligible.

Although the adjacent Clontarf Syphon House is listed on the State Heritage Register and the Manly Local Environmental Plan 2013, the structure is comprised of thick walled cast in-situ concrete which will not be sensitive to vibration from the nearby use of a hand held soil compactor. Therefore, no vibration related impacts to the Clontarf Syphon House are expected.

4 Mitigation measures

4.1 Standard mitigation measures

Standard techniques for controlling noise impacts during construction are presented in the ICNG. A construction environmental management plan (CEMP) should be prepared before work starts, incorporating the measures summarised below in Table 5, 6, and 7.

Table 5 Standard mitigation measures

Standard measures
Works must comply with the Interim Construction Noise Guideline (EPA, 2009), including scheduling work and deliveries during standard daytime working hours of 7am to 6pm Monday to Friday and 8am to 1pm Saturday. The following additional working hours are also permitted: • 7am to 8am, and 1pm to 4pm Saturdays No work to be scheduled on Sunday nights or public holidays. Any proposed work outside of these hours must be justified. The Proposal will also be carried out in accordance with: • Sydney Water's Noise Management Procedure SWEMS0056 All reasonable and feasible noise mitigation measures should be justified, documented and implemented on-site to mitigate noise impacts.
Incorporate standard daytime hours noise management safeguards into the CEMP, including but not limited to: • Implement a noise complaints handling procedure. • Do not warm-up plant or machinery near residential dwellings before the nominated working hours. • Select appropriate plant for each task, to minimise the noise impact (eg all stationary and mobile plant will be fitted with residential type silencers). • Do not use engine brakes when entering or leaving the work site(s) or within work areas. • Regularly inspect and maintain equipment in good working order. • Arrange work sites where possible to minimise noise (eg generators away from sensitive receivers, site set up to minimise use of vehicle reversing alarms, site amenities and/ or entrances away from noise sensitive receivers).
If works are needed **beyond the daytime hours are needed greater than on an ad hoc basis**, Sydney Water Network Operations would: • justify the need for out of hours work (OOHW) and why it is not possible to carry out the works during the working hours identified in the REF • consider potential noise impacts and implement the relevant standard daytime hours safeguards, follow Sydney Water's Noise Management Code of Behaviour (SWEMS0056.01) and document all reasonable and feasible management measures to be implemented • identify additional community notification requirements • seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives.
If night works are needed, Sydney Water Network Operations would: • justify the need for night works • consider potential noise impacts and implement the relevant standard daytime and out of hours safeguards and document consideration of all reasonable and feasible management measures • identify community notification requirements (ie for scheduled night work (not emergency works)) • notify all potentially impacted residents and sensitive noise receivers not less than one week prior to commencing night work • seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives.
If works on **Sundays or public holidays are required**, Sydney Water would: • justify why all other times are not feasible

Standard measures

- consider potential noise impacts and implement relevant standard daytime, out of hours and night-time safeguards and other reasonable and feasible management measures
- identify community notification requirements
- seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives.

Consultation will be undertaken with the operators of Bosk Café and Restaurant to identify any potential noise sensitive functions (ie weddings) scheduled to take place during the construction period. Where an overlap with construction activities may occur, appropriate time-specific mitigation measures will be implemented to ensure that noise from construction activities does not adversely affect the identified noise sensitive event(s). The proposed measures to be implemented are to be developed in consultation with the Sydney Water environment and communications representatives.

4.2 Additional mitigation measures

Table 6 provides a list of the recommended mitigation measures from TfNSW noise estimator tool in relation to the assessment outcome (refer section 3.2 of this document). Not all mitigation measures are recommended at all locations (refer commentary for further detail). Community consultation will determine the number of nights/week if works are to extend beyond two nights/week. Table 7 also includes further information on why some of these mitigation measures will or will not be implemented.

Table 6 Additional mitigation measures

Abbreviation	Additional mitigation measure and description	Commentary
N	Notification (letterbox drop or equivalent) Advance warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of using variable message sign, letterbox drop (or equivalent), web site / social media or a combination to distribute information detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of five 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.	Will be done (all locations) – refer Table 7 – letterbox drops at least one week out from starting
SN	Specific notifications Specific notifications are letterbox dropped (or equivalent) to identified stakeholders no later than five working 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. This form of communication is used to support periodic notifications, or to advertise unscheduled works.	Not recommended by the noise estimator tool
PC	Phone calls Phone calls detailing relevant information made to identified/affected stakeholders, who have provided their contact details, within seven calendar days of construction start. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposal and specific needs. Where the resident cannot be telephoned then an alternative form of engagement should be used.	The noise estimator tool identified this was only applicable for passive and active recreation users of Clontarf Reserve. As recreational users are transient, it is not practicable to contact these receivers via phone call. It is therefore not proposed to adopt this mitigation measure

Abbreviation	Additional mitigation measure and description	Commentary
IB	Individual briefings 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.	Not recommended by the noise estimator tool.
RO	Respite offer Respite Offers should be considered 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, or when duration respite has been agreed (see below)	Recommended by the noise estimator tool during Period 1 out of hours work (i.e. 7am-8am & 1pm-4pm Saturdays) for: • Residential receivers within 85 metres with direct line of sight (Activity 3) • Recreation users of Clontarf Reserve within 10 m (Activity 1) and 15 m (Activity 2 & 3) The duration of works within Period 1 would not exceed 3 hours as works during this period would only be undertaken between 1pm-4pm. In addition Saturday afternoon works in Period 1 are likely to be preceded by a lunch break during normal construction hours (12pm-1pm). Similarly, given the transient nature of the majority of park users, and the small affected distance, this measure is not considered appropriate to this project.
R1	Respite Period 1 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	The R1 mitigation measure relates to evening works and is therefore not applicable to this project.
R2	Respite Period 2 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.	The R2 mitigation measure relates to night works and is therefore not applicable to this project.

Abbreviation	Additional mitigation measure and description	Commentary
DR	Duration respite 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. RDC staff should engage with the community where noise levels are expected to exceed the NML to demonstrate support for Duration Respite.	The DR mitigation measure relates to longer duration projects. Given the relatively short construction duration of this project, this mitigation measure is therefore not applicable.
AA	Alternative accommodation Alternative accommodation options may be offered (as a last resort) to residents living in close proximity to construction works (within the distance nominated by the noise estimator) that are likely to experience highly intrusive noise levels.	Not recommended by the noise estimator tool.
V	Verification Verification may be required for building or asset condition where works are likely to cause vibration impact or for noise levels following reasonable complaints.	Not specifically recommended by the noise estimator tool.

4.3 Reasonable and Feasible assessment

A Reasonable and Feasible Assessment has been completed to determine the appropriate additional mitigation measures. Additional measures recognised in this assessment has been included in Table 7 below.

The adopted mitigation measures from the Reasonable and Feasible Assessment should form part of the CEMP, and any changes to the mitigation option from the assessment will be documented with sufficient justification as to why changes are required.

Table 7 Reasonable and feasible table

Mitigation option	Feasible mitigation test (can it be done)	Reasonable mitigation test (should it be done)	Adopted/ Partially Adopted/ Not Adopted	Justification or comment
Planning the work				
Consideration of alternatives / options	***No***	***No***	***Not Adopted***	The immediate solution provides the most time effective response to the uncontrolled overflow events. There are no other reasonable and feasible alternative options available, other than not completing the work.
Do nothing	***No***	***No***	***Not Adopted***	Do nothing is not a feasible option. The existing condition of the NSOOS is likely to result in further uncontrolled overflows and associated adverse outcomes (beach erosion, restrictions to public access around the foreshore, inhibiting the use of Clontarf Beach). The proposal provides an immediate solution to reduce the likelihood of uncontrolled overflows to Middle Harbour to <2 occurrences per year (on average), providing an interim arrangement (in place for 5-7 years) until the underlying cause of overflows can be addressed by longer term works as part of the NSOOS De-silting and Rehabilitation program.
Conduct the works during standard daytime hours	***Yes***	***Yes***	***Partially Adopted***	The majority of the works will be carried out during standard construction hours. Additional daytime working hours on Saturdays (7am-8am and 1pm-4pm) are also proposed to accelerate the construction program in response to community feedback that the solution immediate solution be implemented as quickly as possible.

Mitigation option	Feasible mitigation test (can it be done)	Reasonable mitigation test (should it be done)	Adopted/ Partially Adopted/ Not Adopted	Justification or comment
Conduct the works during the evening and night	***Yes***	***No***	***Not Adopted***	Construction works during evening and night time periods would result in unnecessary noise impacts to nearby sensitive residential receivers. It is The proposed working hours identified in the REF are considered appropriate to complete the required activities and deliver the associated benefits within a reasonable timeframe.
Consultation/ notifications/ complaints management				
Community consultation prior to works	***Yes***	***Yes***	***Adopted***	Community engagement will commence before work starts, with notification to impacted residents within the zone of influence. This will outline duration, timing, construction hours, and construction impacts.
Consultation with residents during works	***Yes***	***Yes***	***Adopted***	Engagement during construction will be ongoing and include proactive management of issues to minimise complaints. Where complaints and enquiries arise, action will be taken to address these with appropriate mitigation adopted.
Project updates	***Yes***	***Yes***	***Adopted***	Project updates will be sent to surrounding community as required.
Notification to residents prior to out of hours work	***Yes***	***Yes***	***Adopted***	Residents will be notified of night work at least seven days' in advance of work starting. An Out of Hours Work Plan (OHWP) will be completed in advance of work starting.

Mitigation option	Feasible mitigation test (can it be done)	Reasonable mitigation test (should it be done)	Adopted/ Partially Adopted/ Not Adopted	Justification or comment
Ongoing community complaints management	***Yes***	***Yes***	***Adopted***	A Community Engagement Advisor will be assigned to the project. All consultation with community and stakeholders will be recorded on Sydney Water's Consultation Manager database. The Confluence Water community information line (1800 943 119) and email address (confluence@sydneywater.com.au) are available contact points for enquiries and complaints. This contact information will be included on all project notifications, updates, signage and shade cloth.
Daily register of planned activities on site	***Yes***	***Yes***	***Adopted***	Register incorporated as part of site diary entry and pre-start meetings to discuss and record potential community and environmental issues and impacts. Mitigation measures to be adopted will be discussed, based on planned construction activities, weather and site conditions. Mitigation measures will be put in place in advance to address potential issues**.**
Selection of construction methodology / plant and equipment				
Underbore the total alignment	***No***	***No***	***Not adopted***	The total length of the below ground pipe section is approximately 20 m which is too short to feasibly construct using underboring techniques. Open trenching is therefore the preferred methodology.
Two work fronts	***Yes***	***Yes***	***Adopted***	To maintain access along the foreshore of Clontarf Beach (encompassing the Spit to Manly Walk), excavation works will be carried out over two stages. Temporary pedestrian detours will be implemented to appropriately guide pedestrians along the foreshore during the construction period.
Smaller excavator	***Yes***	***Yes***	***Adopted***	The project has adopted a small excavator (6 tonne) which is suitable for the required activities whilst also emitting less noise that a larger excavator.
Noise and vibration verification / monitoring				

Mitigation option	Feasible mitigation test (can it be done)	Reasonable mitigation test (should it be done)	Adopted/ Partially Adopted/ Not Adopted	Justification or comment
Attended noise and vibration monitoring	***Yes***	***No***	***Not Adopted***	The majority of works will be undertaken during standard construction hours with out of hours works limited to daytime periods. Recreational users of Clontarf Reserve will only be highly affected by noise impacts when immediately adjacent (i.e. 15 m or less) from the worksite. Vibration impacts are described in Section 3.6 and are expected to be negligible. Attended monitoring is therefore considered to be unnecessary unless reasonably warranted in response to complaints.
Unattended continuous noise monitoring	***Yes***	***No***	***Not Adopted***	Continuous monitoring will be considered if complaints are received.
HSEQ Site Presence	***Yes***	***Yes***	***Adopted***	Increase of site presence and inspections occurring to ensure proactive management of site issues. A Project Environmental Mentoring session will be held in advance of work starting to induct all site crew members on the requirements of the REF and CEMP**.**
Noise attenuation at source/ site				
Noise barriers at work front	***Yes***	***No***	***Not Adopted***	This noise assessment identifies that overall noise impacts will be minor. The installation of noise barriers is not considered warranted.
Noise barriers along alignment	***No***	***No***	***Not Adopted***	The proposal construction footprint does not include an extended lineal pipe alignment. Consideration of noise barriers along an alignment is not applicable.
Purpose built noise wall	***No***	***No***	***Not Adopted***	As the work will occur over a relatively short duration, building a permanent noise wall along the alignment is not practicable.
Respite periods				
Duration respite periods	***Yes***	***No***	***Not Adopted***	Duration respite periods relate to longer duration projects. Given the relatively short construction duration of this project, this mitigation measure is not applicable.

Mitigation option	Feasible mitigation test (can it be done)	Reasonable mitigation test (should it be done)	Adopted/ Partially Adopted/ Not Adopted	Justification or comment
Respite periods – Noisy works completed prior to midnight	***Yes***	***No***	***Not Adopted***	All noisy/annoying work (see section 1.3) will be completed during daytime hours. Consideration of respite for noisy works is not applicable.
Respite periods for high impact noise works – other options (such as three hour blocks with a one hour respite period)	***Yes***	***No***	***Not Adopted***	All noisy/annoying work (see section 1.3) will be completed during daytime hours. Consideration of respite for noisy works is not applicable.
Respite – Alternate Accommodation	***Yes***	***No***	***Not Adopted***	No night time works are proposed. Consideration of alternate accommodation is not applicable.
Consultation for high impact noise works	***No***	***No***	***Not Adopted***	All noisy/annoying work (see section 1.3) will be completed during daytime hours. Consideration of respite for noisy works is not applicable.
Architectural treatments at properties – ie double glazing, soundproofing, door/window sealing	***No***	***No***	***Not Adopted***	Architectural treatments are not warranted as the proposed works will be temporary (~3 month construction period). There will be no change to operational noise upon construction completion.

5 Conclusion

An assessment was completed to review the potential noise impacts for the proposal at Clontarf Syphon House to be undertaken within and outside of standard construction hours. The assessment identified that the construction of the proposal will have the potential to generate noise which will be noticeable at nearby sensitive receivers, however overall noise construction noise impacts are expected to be minor.

The TfNSW Construction and Maintenance noise estimator tool has been used to predicted noise levels and maps for each relevant time period. It should be noted that these noise levels are for the worst-case scenario without mitigation measures applied. Standard and additional measures are recommended to mitigate and manage noise during construction.

6 Appendix

Figure 1: Activity 1 (Site Establishment and Mobilisation) – Recreational receivers within affected distance during Standard Construction Hours and Out of Hours (daytime)

Figure 2: Activity 2: (Use of Temporary Construction Compound) – Recreational receivers within affected distance during Standard Construction Hours and Out of Hours (daytime)

Figure 3: Activity 3: (Installation of Drainage Infrastructure) – Residential and recreational receivers within affected distance during Standard Construction Hours and Out of Hours (daytime)

Figure 4: Activity 4: (Cutting of syphon house stairway) – Residential receivers within affected distance during Standard Construction Hours

Figure 5: Activity 4: (Cutting of syphon house stairway) – Recreational receivers within affected distance during Standard Construction Hours