

Review of Environmental Factors

Rehabilitation of Willoughby Oviform Wastewater Pipeline (June 2026)

SW 208 06/26

sydneywater.com.au

June 2026

Sydney WATER

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Sydney Water respectfully acknowledges the Traditional Custodians of the land and waters on which we work, live and learn. We pay respect to Elders past and present.

Sydney Water recognises the physical and cultural connection of local Aboriginal communities to waters and the land.

Determination

This Review of Environmental Factors (REF) assesses potential environmental impacts from rehabilitation of the Willoughby Oviform Wastewater Pipeline. 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.

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 section 171A (Appendix B) of the EP&A Regulation. The information it contains is neither false nor misleading.

Prepared by:	Reviewed by:	Endorsed by:
[redacted]	[redacted]	[redacted]
Helen Steinberg Environmental Scientist Sydney Water Date: 15/05/2026	Kristen Foley Senior Environmental Scientist Sydney Water Date: 29/05/2026	Alen Hodzic Project Manager Sydney Water Date: 29/05/2026

Decision Statement

The main potential construction environmental impacts of the proposal are related to soils, heritage, noise, vibration, traffic and access. The proposal should have a positive environmental impact during operation by improving the operational and hydraulic capacity of the existing pipeline. The proposal will 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) is 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.

Determined by:		
	[redacted]	Date: 2 June 2026
	Jill Berwick, A/Senior Manager Environment and Heritage, Sydney Water	

1. Executive summary

Sydney Water proposes to rehabilitate maintenance holes (MH) and about 1.5 km of the Willoughby Oviform Wastewater Pipeline within the Willoughby City Council (WCC) local government area (LGA).

Construction will primarily occur within existing road corridors, along an existing shared user path, and within Flat Rock Creek Reserve. A bypass system is required to maintain wastewater services during construction. Works are expected to commence in 2026 and take about 20 months.

The proposal will extend the life of existing assets and improve operational and hydraulic capacity of the existing pipeline. This will support future growth within the Willoughby LGA.

The main potential construction environmental impacts of the proposal are associated with soils, heritage, noise, vibration, traffic and access. These can be adequately managed by the proposed mitigation measures. Operational impacts are expected to be negligible, as the proposal involves maintenance of existing below-ground infrastructure only.

2. Introduction

2.1 Context

Sydney Water provides water, wastewater, recycled water and some stormwater services to over five million people. We operate under the *Sydney Water Act 1994* and have three equal objectives to protect public health, protect the environment and be a successful business.

We are a statutory State-owned corporation and are classified as a public authority, and a determining authority for the proposal under Division 5.1 of the EP&A Act. This REF assesses the potential environmental impacts associated with the Willoughby Submain Rehabilitation Project (the proposal) and identifies mitigation measures that avoid or minimise potential impacts.

2.2 Proposal background and need

The proposal involves rehabilitating MHs and a 1.5 km section of existing wastewater pipeline. The existing pipeline has an oviform profile, made of precast units constructed between 1900-1910.

Table 2-1 summarises the proposal need, objectives and consideration of alternatives.

Table 2-1 Proposal need, objectives and consideration of alternatives

Aspect	Relevance to proposal
Proposal need	The proposal is part of the Wet Weather Overflow Abatement (Source Control) program. The proposal is required to rehabilitate network assets near their end of service life. The pipeline requires rehabilitation to address issues with infiltration, erosion, biogenic acid attack, cracking and root ingress. Ongoing deterioration could result in soil-voids, weakening of the sub-soil, settlements and possible local sinkholes at the surface and pipeline destabilisation.
Proposal objectives	The proposal will: • extend the life of the assets by 50 years • reduce Sydney Water's safety and risk profile • improve operational and hydraulic capacity of the submain.
Consideration of alternatives/options	Sydney Water assessed possible options for rehabilitating the pipeline, including: **A. Do Nothing – Deemed not acceptable** • Continued deterioration would increase infiltration, void formation and risk of pipeline and surface collapse beneath roads and properties. • High safety, service and cost risk. Likely to trigger emergency works at significantly higher cost. **B. Patch lining – Deemed not acceptable** • Localised, short-term fix that does not address full-length deterioration. • High risk of ongoing or new infiltration, labour-intensive installation and future rehabilitation constraints.

Aspect	Relevance to proposal
	C. Dig and replace (Open Cut) – Deemed not acceptable • Very high cost and major disruption due to pipeline depth and alignment under roads and residences. • Not favoured where trenchless options are viable. **D. Replace along new alignment – Last resort option** • Significant engineering complexity, high cost and major community disruption in a built-up area. • Only viable as a last-resort option. **E. Cured in place pipe (CIPP) lining system – Preferred option** An Investigations and Options Report was prepared following the optioneering process. The preferred option is to install a continuous lining inside the existing pipeline using a CIPP lining system. The CIPP lining system is the most suitable type of full lining system due to its flexibility in matching the internal oviform geometry and its minimal site impact. This option is effective at reducing infiltration and is cost effective.

2.3 Consideration of Ecologically Sustainable Development

The proposal has been considered against the principles of ecologically sustainable development (ESD) as presented in Table 2-2.

Table 2-2 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. The proposal is essential to prevent the pipeline from future failures. The options analysis identified a preferred methodology that minimises environmental impacts. Construction environmental impacts will be minimised by implementing the mitigation measures in this REF.
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 help to meet the needs of future generations by providing a reliable wastewater service that enables growth and network resilience.
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. The project will require the removal and/or trimming of vegetation and trees immediately surrounding the MHs, bypass system, laydown/storage areas, site compounds and for access. The extent of the removal/trimming has been minimised by selecting areas and routes that have been previously disturbed/cleared wherever possible.

Principle	Proposal alignment
	Vegetation and tree removal will be offset in accordance with Sydney Water's non-statutory offset guide.
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 will provide cost efficient use of resources and provide optimum outcomes for the community and environment. The cost of implementing environmental mitigation measures has been included in the delivery business case. The proposal will extend the life of existing assets and improve operational and hydraulic capacity of the existing pipeline. This will enable future growth within the Willoughby LGA.

3. Proposal description

The proposal is described in Table 3-1. The locations of key elements are presented in Figure 3-1 to Figure 3-4.

Table 3-1 Description of proposal

Aspect	Detailed description
Proposal description	The proposal involves rehabilitating 1.5 km of the Willoughby Oviform Wastewater Pipeline. It follows the alignment of Flat Rock Creek from Chelmsford Avenue in the west, to Dawson Street in the east, in Naremburn, Northbridge, Willoughby, and Artarmon suburbs in the Willoughby LGA. The proposal includes: • rehabilitating maintenance holes • lining the existing wastewater pipeline using a CIPP • installing a temporary pressurised bypass system to maintain customer wastewater services while the works are undertaken. **Key elements** MH preparation 28 MHs along the proposal alignment require works to address deteriorating step irons, root ingress, access covers and frames, and concrete. In some locations, works include replacing equipment. In other locations, partial demolition and MH reconstruction is required, including to facilitate access for lining activities as outlined below. The works require excavation up to a maximum depth of 6 m and have varying disturbance footprints depending on the extent of repair required (e.g. partial reconstruction) and associated equipment and access requirements. Wastewater pipeline relining The existing pipeline is about 400 mm to 700 mm diameter. It will be CIPP lined between MH01 – MH21. Some MHs will require excavation and partial demolition to facilitate access for the liner and bypass system installation. The lining works typically require a 600 mm diameter opening in each MH to allow for the liner to be inserted between the MH. Impacted MHs will be restored after the lining work is finished. Temporary bypass The proposal requires a temporary wastewater bypass system during cleaning, repairs and lining works to maintain customer wastewater services. It comprises 2 hoses about 300 mm in diameter and pumps which connect between existing MHs. Plugging and pumping activities (using major bypass MHs and minor bypass MHs) will temporarily isolate sections of the pipeline and divert wastewater flows to the bypass system. Most of the bypass hose will be laid on the ground surface apart from where the system needs to buried to enable pedestrian, vehicle or construction access and activities. Some sections will be installed across the top of the existing stormwater channel using scaffolding. MH rehabilitation If needed, MHs will be rehabilitated after the relining is finished, including reinstating the MH shaft to remove the 600 mm access points for the liner.

Aspect	Detailed description
	Key proposal elements are presented in Figure 3-1 to Figure 3-4. These figures show the 'Impact Area' which is the total footprint where the construction activities will be undertaken. **Proposal phases** • Site establishment and enabling works, including: — delineate site and set up construction compounds and laydown areas — conduct dilapidation and utility surveys — obtain landowner agreements, Council, TfNSW and other stakeholder approvals — obtain relevant licences and permits — install environmental and traffic controls — undertake vegetation clearing and establish site access and access tracks. • Phase 1: MH preparation (MH1 – MH21), lining works, associated operation of the bypass system, and MH rehabilitation works once lining is completed (MH13 - MH21). • Phase 2: lining works, associated operation of the bypass system and MH rehabilitation works once lining is completed (MH01 – MH13). • Progressive demobilisation and site rehabilitation/restoration.
Location and land ownership	The proposal traverses under Gore Hill Freeway, Willoughby Road and Flat Rock Drive. Gore Hill Freeway and Willoughby Road are State Roads, and Flat Rock Drive is a Regional Road. These three roads are under the control of TfNSW. All other nearby roads and most reserves are the responsibility of WCC. The proposal is within mapped areas of Crown land (Artarmon Reserve) and a Crown watercourse (Flat Rock Creek) (refer to Figure 3-1 to Figure 3-4). Crown Lands and Public Services confirmed that the crown land and crown waterway areas are also managed by WCC. The proposal is on land zoned as public recreation (RE1), infrastructure (SP2), environmental conservation (C2), low density residential (R2), medium density residential (R3).
Site establishment and access tracks	Site establishment activities are outlined above. Access and bypass routes will use existing access tracks, shared paths and cleared areas where practicable (e.g. existing shared paths and localised cleared areas). However new temporary access tracks about 3 m wide are also required (refer to Figure 3-1 to Figure 3-4). These may require stabilising with engineered materials, localised temporary pavements and minor vegetation trimming/clearing. Scaffolding will be erected on steep/unstable grounds or over creeks within the 3 m wide access tracks or bypass route. Scaffolding routes and footing will be spaced to limit impacts to sensitive vegetation. Temporary access to the existing open concrete stormwater channel is required to construct scaffolding for creek crossings, and to construct sections of the bypass which will run along the north side of the channel. The channel profile will be temporarily

Aspect	Detailed description
	reinstated at the end of each work shift, and the wall will be permanently reinstated once the works are complete. Private property access will be required for many of the MHs. This will include temporary fence modifications to provide access between the rear of properties and MHs and the stormwater channel (Flat Rock Creek).
Ancillary facilities (compounds)	Construction compounds, site offices and laydown/storage areas will be required to house site sheds, construction amenities, and materials. Several laydown/storage areas will be required at strategic locations throughout the works alignment. These will be positioned mainly in grassy clearings to limit vegetation impacts. Two primary compounds will be established for the proposal, one in the cleared area next to the Willoughby Leisure Centre, and a second compound beneath the Gore Hill Freeway overpass with access off the end of Park Road. Indicative locations for the compounds and laydown areas are shown in Figure 3-1 to Figure 3-4.
Construction methodology	The construction methodology involves the following activities: • establish construction access into the existing open concrete stormwater channel near MH12 during Phase 2: — access the existing open concrete stormwater channel via private property on Parks Road — establish work area next to the stormwater channel — remove a section of the channel wall — construct a temporary ramp into the channel — temporarily reinstate the channel profile at the end of each work shift using segment wailers or shoring end panels • install scaffolding for access and bypass support: — at MH02, MH03 and MH05 — across the stormwater channel between MH07 and MH08 — along top of stormwater channel and the stair access off shared path between MH07 – MH12 and off MH16C up to existing council carpark — into stormwater channel from temporary access at rear of 17 Park Road — at bypass system pickup points at MH03, MH04 and MH05 — at MH19A and MH19B including construction worker access off Flat Rock Drive — at the interface of Market St East and shared path — across the open stormwater channel between MH02 and MH05 — at MH12 and through an existing culvert under Willoughby Road — at 3 crossing stormwater swale crossings next to the existing shared path east of Flat Rock Drive

Aspect	Detailed description
	— on Market Street • undertake civil enabling works around MHs for lining or bypass system set up. The following disturbance footprints have been accounted for, for all MH works: — general disturbance buffer of 6 m (3 m around MH) — a greater disturbance area of 12 m (6 m around MH) at MH 18 and MH 20 — a general vertical clearance of 10 m above each disturbance footprint for vegetation trimming • excavate (and shore excavations where they are greater than 1.5 m depth): — MH01, MH02, MH04, MH06, MH08, MH14, M16, MH16A, MH16B, MH19 and MH19B to a depth of about 1.4 m — MH16C and MH21A to a depth of about 2 m — MH18 to a depth of about 3.5 m — MH16D, MH17 and MH20 to a depth of about 4 – 6 m — where the bypass route changes alignment or is buried to facilitate access, up to about 1.4 m deep • set up and operate the bypass system • use tankering or vacuum trucks where flow would not require a pump, or access for over pumping cannot be achieved. Discharge at a nominated discharge MH • CIPP lining: — undertake minor internal MH repairs and prepare for access for the liner (e.g. remove existing step irons, ladders etc) — set up generator — clean the pipeline to remove silt and bulk materials — use CCTV to inspect and identify the condition of the pipeline to identify the need for repairs before the lining works are undertaken (e.g. excess root penetration) — undertake internal minor repairs of the pipeline (e.g. internal patch repairs) depending on the findings of the CCTV inspection — winch the CIPP product into the pipe in its uncured state, then cap at each end and inflate with low pressure air to ensure it is a tight fit to align with the oviform shape — cure the lining using a UV lighting system which will be progressively pulled along the length of the pipe between each MH • test and commission the relined pipeline then decommission and remove the bypass system • rehabilitate MH following the lining works

Aspect	Detailed description
	• conduct progressive demobilisation and site rehabilitation/restoration (see below).
Commissioning	Once the liner has been installed and the bypass removed, a portion of the line will be pressure tested and CCTV inspections will be carried out.
Restoration	As construction progresses, disturbed areas will be restored to a condition as similar as practicable to the pre-construction state. This will include the following: • backfill and reinstate areas disturbed during construction • reinstate any other disturbed areas to pre-existing conditions (eg construction compounds etc) • reinstate topsoil • restore groundcover • reuse cleared vegetation as mulch where possible • reinstate any damaged shared path assets / pavements.
Materials/ equipment	• confined spaces safety equipment (e.g. gantry/davit) • skip bins • sediment tank • concrete pumps • air compressors • generators • concrete saws • backhoes • jackhammers • hand tools • welding equipment and stations • scaffolding • telehandlers • belly dumpers • site facilities and amenities • storage containers • excavators (5 t – 20 t) • tip trucks • concrete agitator trucks • street sweepers • light vehicles • compactor • cranes – mobile all terrain, hiab, franna, city, miaita • vac / combo jetter trucks • bypass / over pumping systems • mini tankers • sewage tankering trucks • rubber tracked dumpers.
Work hours	Most work and deliveries will be scheduled to occur across during standard daytime hours where practicable: • 7 am to 6 pm, Monday to Friday • 8 am to 1 pm, Saturdays • No work Sundays or public holidays.

Aspect	Detailed description
	However, some activities require works outside standard daytime hours, such as partial road closures to minimise traffic disruptions during daytime hours. Continuous shifts are required for activities that need to be completed in one sequence such as a section of lining and curing between two MHs. Continuous shifts will vary between 24-56 hours and will be undertaken during weekends where possible to minimise impacts. No work will be conducted on public holidays. Sydney Water's Project Manager can approve work outside of standard daytime hours. The approval process is described in the mitigation measures in Section 6.
Proposal timing	Works are expected to start in August 2026 and take about 20 months. Multiple activities may be performed concurrently. Typical durations of activities are outlined below. • **MH (preparation)** – ~10–14 days per MH (removing step irons, platforms access to enable access for the lining works). About 7 MHs where additional access, widening or excavation is required may require up to 15-20 days extra. • **Bypass installation** – ~25 days per section. There would be 4 sections covering all lining works with about 7 MHs • **Bypass operation** – ~20–25 days per section — Cleaning & internal repairs – ~8–10 days per section (undertaken while the temporary bypass is operational) — CIPP lining & testing – ~12–15 days per section (undertaken while the temporary bypass is operational) • **Bypass removal** – ~25 days total • **MH rehabilitation** – ~ 4 days per MH • **Final reinstatement** – ~30 days paving repairs, revegetation, and rehabilitation.
Operational requirements	Once operational, all infrastructure will be inspected, maintained, and repaired in accordance with Sydney Water's standard operating procedures.



Figure 3-1 Location of proposal (MH01 – MH21A)

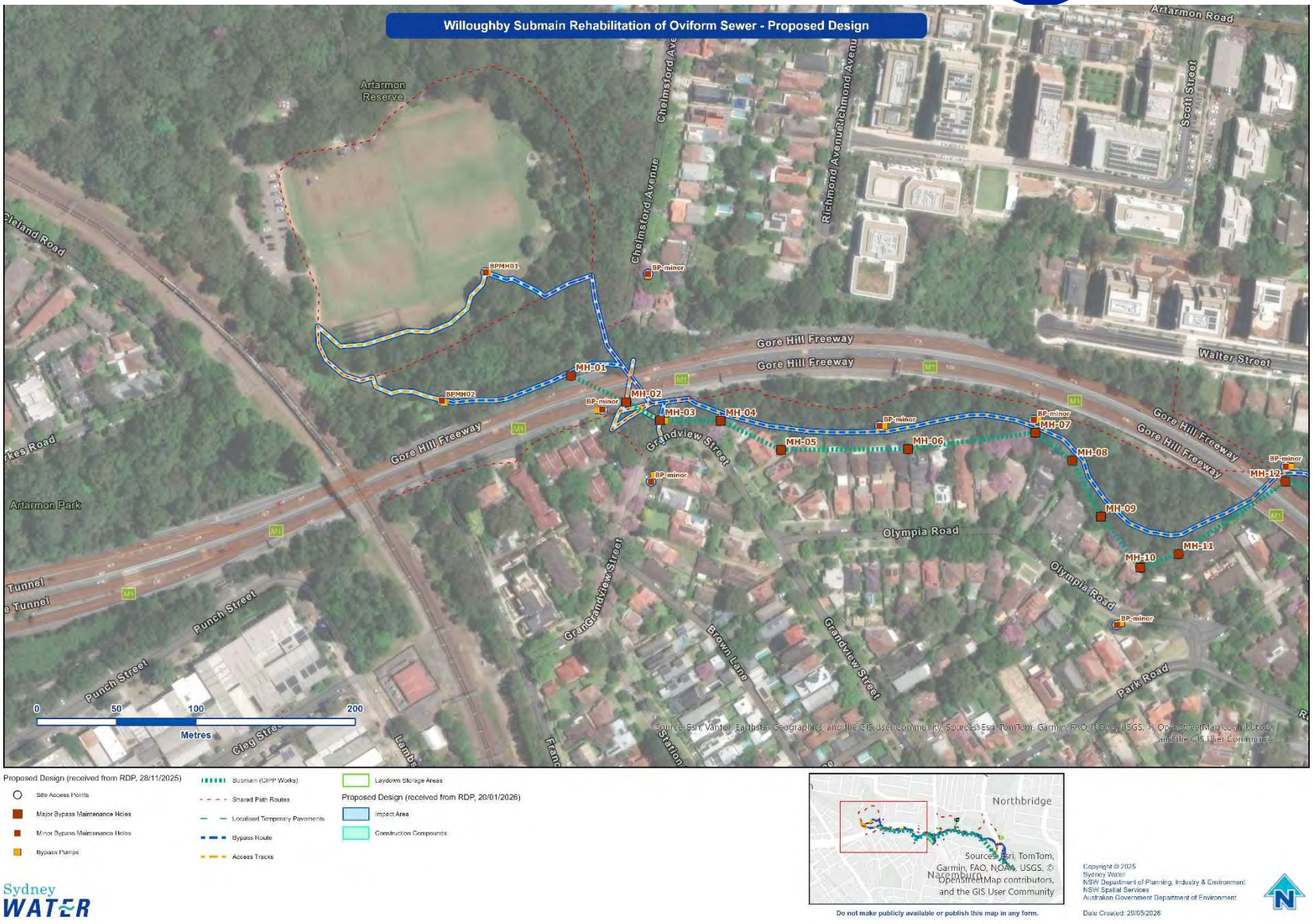


Figure 3-2 Location of proposal (Western extent: MH01 – MH12)

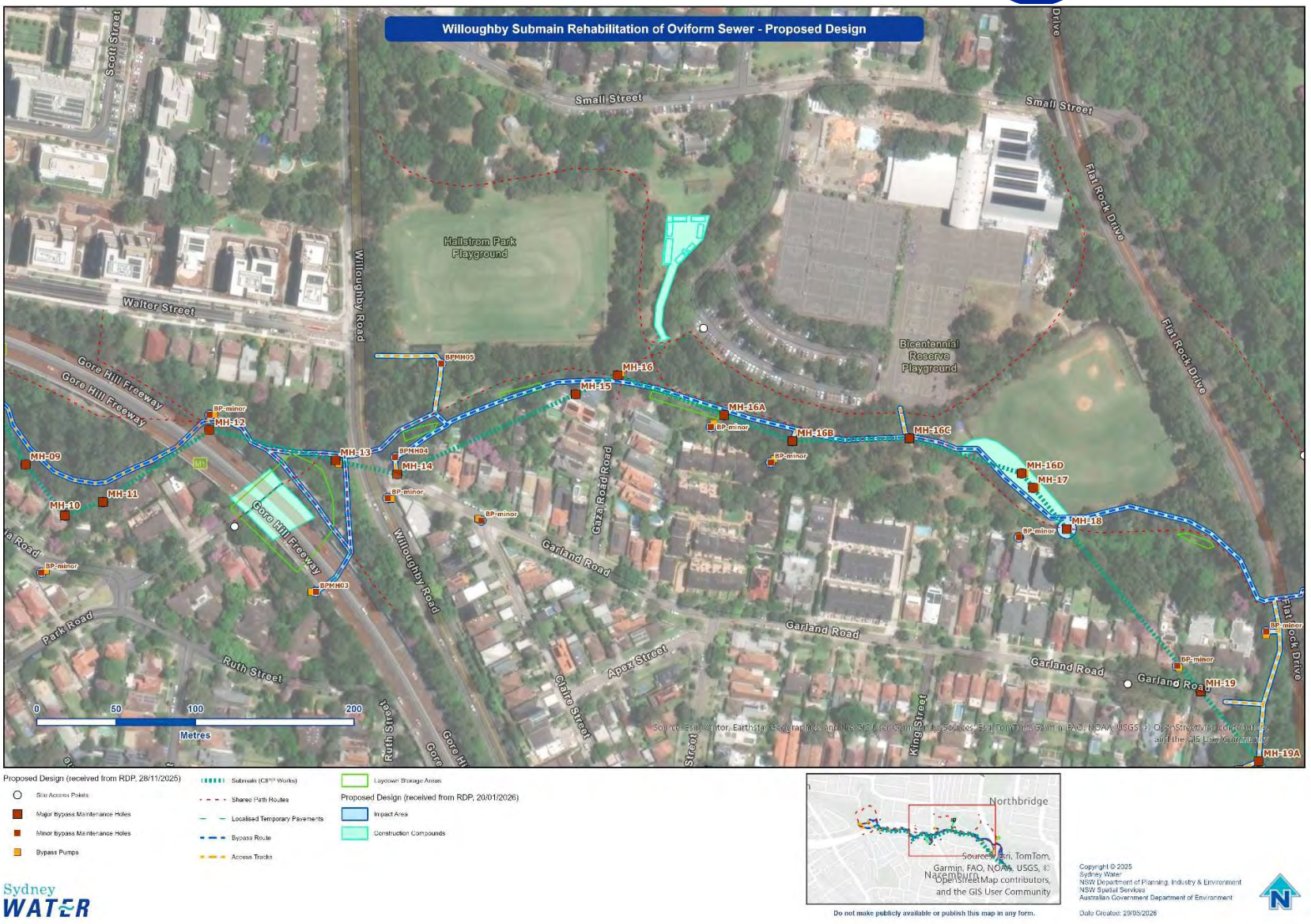


Figure 3-3 Location of proposal (Central extent: MH09 – MH19A)

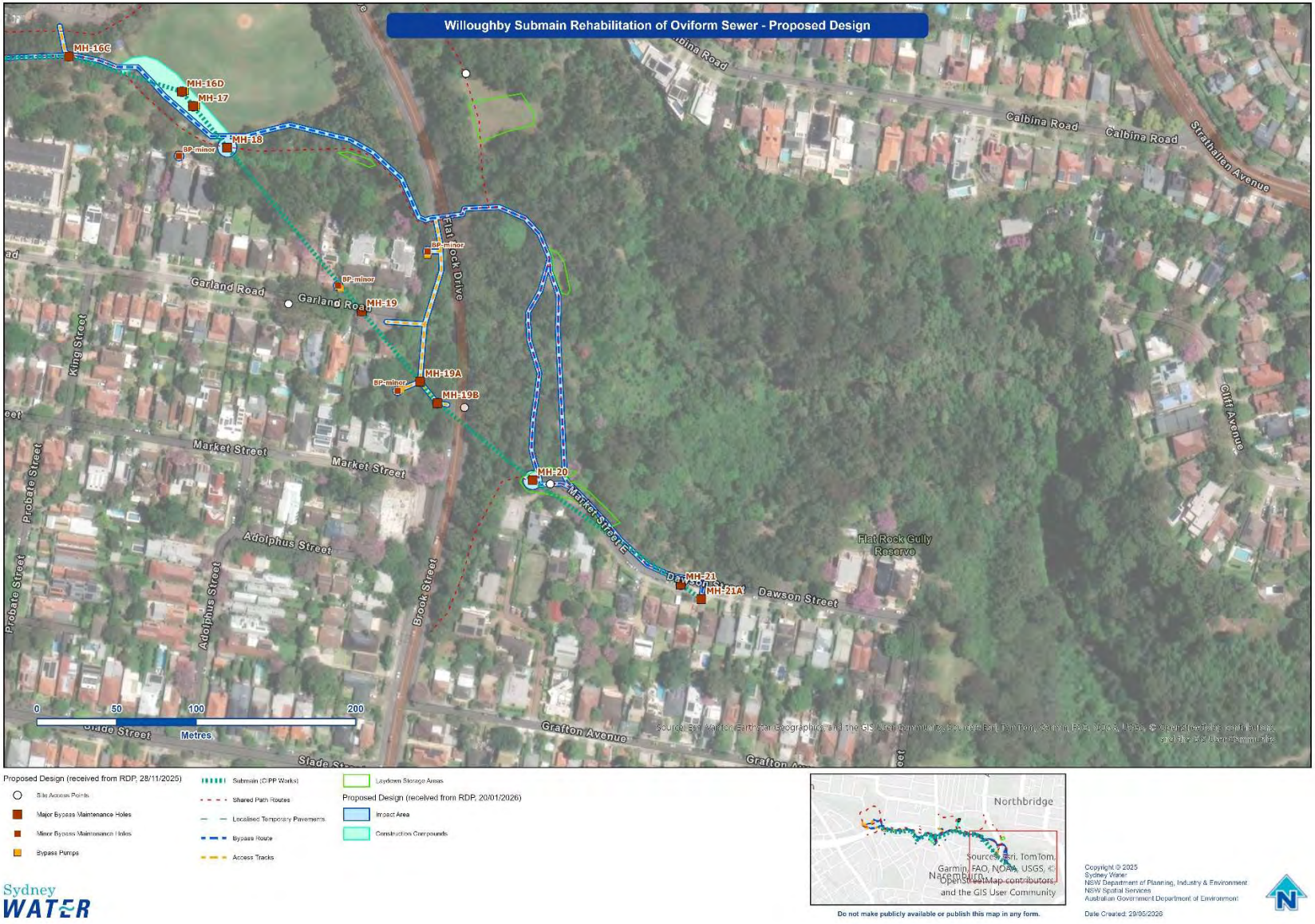


Figure 3-4 Location of proposal (Eastern extent: MH16C – MH21A)

4. Consultation

4.1 Community and stakeholder consultation – general

Our approach to community and stakeholder consultation is guided by Sydney Water's community and stakeholder engagement guidelines (Sydney Water, 2021).

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. Where our work impacts the community in some way, we will engage with affected groups throughout the proposal. This includes engaging the broader community and stakeholders during plan or strategy development or before making key decisions.

We will also provide WCC with reasonable notice when we would like to commence works. WCC will continue to be consulted about matters identified in environmental planning instruments such as temporary works on council land, full or partial road closures of council managed roads, and impacts to pedestrian and cyclist access such as disruption to the use of the shared path along Flat Rock Creek (refer to Section 4.2 below).

4.2 Community and stakeholder consultation – proposal

Sydney Water has consulted with WCC about a range of matters relating to the proposal. These matters and Sydney Water responses are presented in Table 4-1.

Sydney Water has consulted with a range of other stakeholders including:

- NSW Environment Protection Authority (EPA) – matters relating to the contamination at the Bicentennial Reserve Baseball Diamond ('baseball field'), including granting approval to exhume waste for the purposes of site investigations.
- Transport for NSW (TfNSW) – mainly concerning proposed works required on/under Willoughby Road and Flat Rock Drive. TfNSW confirmed their approval under Section 138 of the *Roads Act 1993* is not required for these areas (confirmed 10 April 2026 with an 'Out of Scope' letter).
- Metropolitan Local Aboriginal Land Council (MLALC) – site inspection attendance for the preparation of the Aboriginal Heritage Due Diligence assessment. The MLALC cultural officer agreed with the archaeological findings of the site inspection and provided verbal input into the Aboriginal Heritage Due Diligence assessment (refer to Appendix E).

- sending letters to the local community and installing temporary signage – informing the community of planned investigation works and associated impacts and to provide contact details. This pre-construction engagement did not elicit any recorded complaints or enquiries.
- Engaging with directly impacted landowners where access may be required on or through private property. This included developing Pre-Construction Agreements or Summaries (PCAs or PCSs) to detail expected impacts and restoration requirements.

Consultation with key stakeholders will continue throughout detailed design, construction and commissioning. Based on historical Sydney Water projects in the area, we understand the surrounding community is highly engaged. We will continue to engage with community members where the proposal impacts them, including:

- residents, businesses and landowners near the works who may experience impacts such as noise, vibration, light, traffic and pedestrian changes, or vegetation loss
- nearby sports clubs (Willoughby United Netball Club and the North Sydney Junior Baseball Club). These clubs will be engaged prior to site mobilisation and throughout construction to confirm the timing of key weekday and weekend activities
- cycling groups as advised by Bike NSW, Bike North and WCC to inform them of potential impacts to pedestrian and cyclist access such as disruption to the use of the shared path along Flat Rock Creek
- local Bushcare groups and progress associations, such as the Willoughby South Progress Association.

We will also:

- consult with WCC about other reserve and sports field bookings to identify stakeholders using their recreational areas
- consult with adjacent councils – North Sydney Council, Lane Cove Council and Ku-ring-gai Council will be notified, as requested by WCC.

A Community and Stakeholder Action Plan (CSAP) will be developed for the proposal. We will continue to inform the community and stakeholders about:

- the proposed start date of construction
- where works will be occurring and when
- what to expect during each stage of the proposal's progress
- on-site measures that will be in place to mitigate impact.

Feedback will be used to improve our performance and all complaints during the construction of the proposal and following its commissioning will be managed according to Sydney Water's Customer Complaint Policy and Procedure.

4.3 Consultation required under State Environmental Planning Policies and other legislation

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 the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP).

Consultation with WCC is required under section 2.10 of the TISEPP, as the proposal:

- 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 (section 2.10(1)(e))
- involves excavation of the surface of, or a footpath adjacent to a road for which a council is the roads authority that is not minor or inconsequential (section 2.10(1)(f)).

Sydney Water notified WCC on 11 May 2026 in line with TISEPP requirements and they are supportive of the proposal. Additionally, WCC and Sydney Water meetings already included matters relevant to the TISEPP consultation requirements (refer to Table 4-1).

Table 4-1 Sydney Water's response to WCC comments

Matters raised by WCC	Sydney Water response
Community and recreational impacts: • Willoughby Leisure Centre major upgrade works (2024-2025) may impact proposed construction works. • proposed pedestrian and cyclist detours on shared pathways require consultation with user groups and have clear signposting and provisions for approved routes. • Netball association usage – season/peak times. • Baseball association usage – season/peak times. • Restriction on use of permanent occupation of existing car park areas for proposed works for elements such as site compounds and storage areas.	**Works timing and restrictions** • Intrusive excavation works will not be undertaken during the baseball season. • Any access to the Flat Rock Baseball Field ('baseball field') during the season will be assessed on a shift-by-shift basis, in consultation with WCC. • Works are expected to commence after the Willoughby Leisure Centre major upgrades are complete. **Pedestrian and cyclist management** • Notifications of planned detours will be distributed to relevant cycling groups, including Bike NSW, to ensure broader awareness beyond the immediate local area. • Shared paths will be widened at key locations, where feasible, to maintain safe access. • Signage will be installed during construction to clearly indicate detours and safety measures, consistent with the approved Traffic Guidance Scheme and TMP. • Site personnel will be available to assist mobility-impaired users in safely navigating detours or passing through work areas.

Matters raised by WCC	Sydney Water response
	• Pedestrian and cyclist movements along shared pathways will be managed in accordance with a Traffic Management Plan (TMP) approved by WCC. **Parking and access** • Contractors and subcontractors will avoid parking within reserve areas during peak usage periods, except within designated compounds. • Existing car parks will not be used for general construction parking. However, limited use by work vehicles may occur during quiet periods (e.g. crew vehicles or specialist equipment such as jetting trucks for lining works on the baseball field). **Material storage** • No material storage or laydown areas will be established within reserve areas during out-of-hours works or where works overlap with peak public usage periods. **Site compound and storage** • Site compounds will be located outside of existing car park areas to minimise disruption to public access and parking. **Peak period coordination** • A schedule of peak usage periods will be developed in consultation with key stakeholders, including: — Willoughby United Netball Club — North Sydney Junior Baseball Club.
Existing Environmental Constraints: potential construction impacts on the environment: • Existing stormwater catchment considerations including flood impacts and overland flows on sections of the site. • Existing stormwater channel performance. Requirement to keep the channel free from construction materials (e.g. bypass system) that impact flow capacity. • Contaminated areas of the site under an EMP (e.g. baseball field). • The culvert under Willoughby Rd is a heritage item and no impacts to the culvert are permitted for any temporary works. • The pedestrian bridge under Willoughby Rd is only light duty (3Kpa live loading) and	**Flood impacts** • A flood assessment has been completed for the proposal (refer to Appendix H). **Stormwater channel performance** • The bypass system will be subject to an engineered design process, which is reviewed and approved by Sydney Water Operations in accordance with the Flow Isolation &/or Flow Management (FIFM) process. This process considers the robustness and suitability of the bypass system, including its alignment and proximity to the channel and potential exposure to environmental hazards. • As part of the FIFM process a procedure will be established to outline criteria for when bypass works can proceed. Works will not commence where rainfall of ≥10 mm is forecast. **Contamination impacts**

Matters raised by WCC	Sydney Water response
cannot accommodate any additional loading from temporary works. • Surrounding private properties and construction noise impact considerations. • Impacts on vegetation for works and requirement of AQF Level 5 Arborist for any assessments. • Impacts / damage from construction plant on existing infrastructure like the concrete shared pathways and requirements for restoration.	• Works within the EMP boundary will be undertaken in accordance with requirements outlined in the EMP. **Structural protection** • The pedestrian bridge will not be used or subjected to any loading during construction. • Impacts associated with scaffolding within the culvert under Willoughby Rd were assessed in a non-Aboriginal Heritage Statement of Advice (Appendix G), with impacts expected to be minor. Mitigation measures outlined in Table 6-7 will be adopted to further minimise impacts. **Noise and vibration management** • Mitigation measures outlined in the Noise and Vibration Assessment (NVA) will be adopted to minimise noise and vibration impacts during construction. **Vegetation and arboriculture** • An AQF Level 5 qualified Arborist will be engaged to oversee and manage any vegetation impacts associated with the works. **Rehabilitation and restoration** • All disturbed areas will be reinstated to pre-existing condition or better. • Vegetation will be replanted using the same species, with saplings or tube stock, in accordance with Sydney Water offsetting guidelines. **Heritage impacts to the culvert under Willoughby Road** • The design has been modified to incorporate scaffolding fixings within non-visible areas (such as beneath the bridge structure) and to use existing concrete elements that do not form part of the heritage fabric. This avoids impacts to heritage components and values.
Traffic Management Constraints: potential construction impacts: • Controlled access to site entry points including deliveries. • Peak recreational traffic periods (Friday nights and Saturdays during winter months). • Pedestrian and cyclist detours as required for works and requirements for consultation with affected parties.	**Traffic management planning** • A TMP will be prepared and submitted to WCC for approval and acceptance prior to works commencing. • The TMP will be presented to the Local Traffic Committee (LTC) before construction commences. **Permits and approvals** • The Delivery Contractor will obtain ROLs and related approvals from the relevant authorities. **TfNSW coordination**

Matters raised by WCC	Sydney Water response
• Short term site compounds and set ups (e.g. lining works) and impacts on surrounding traffic. • Road Occupancy Licences (ROL) are obtained • Willoughby Rd / Garland Rd (MH14) set up – signalised intersection on State Road – TfNSW approvals for extended ROL requirements for lining and curing works • Garland Rd cul-de-sac (MH19) with MH in middle of road – minimise impacts on surrounding road users and residents at this confluence point • Market St East (MH20 & MH21) - minimise impacts on surrounding road users and residents at these static locations.	• The TfNSW Gate 0 submission portal will act as the central coordination point for all project documentation and approvals. • Ongoing consultation and communication will be maintained throughout the Gate 0 process.

5. Legislative requirements

5.1 Environmental legislation

Sydney Water is the proponent and determining authority under the EP&A Act. The proposal does not require development consent and is not classified as State significant infrastructure. We have assessed this proposal under Division 5.1 of the EP&A Act. This REF has concluded that the proposal is unlikely to have a significant impact on the environment.

The following environmental planning instruments (Table 5-1) and legislation (Table 5-2) are relevant to the proposal. Table 5-2 documents licences and permits required for the proposal, and timing and responsibility for obtaining them.

Table 5-1 Environmental planning instruments relevant to the proposal

Environmental Planning Instrument	Relevance to proposal
Willoughby Local Environmental Plan 2012 (WLEP 2012)	The proposal is on land zoned: • Public Recreation (RE1) • Low Density Residential (R2) • Medium Density Residential (R3) • Infrastructure (SP2 – Classified Road) • Environmental Conservation (C2). Bushland in urban areas (formerly Chapter 6 of the BC SEPP) is now assessed under clause 5.23 of the Willoughby LEP 2012. Sydney Water has considered the matters listed in subsection 5.23(7) of the Willoughby LEP relating to soil erosion, waterway impacts and spread of weeds (refer to Section 6.1.1, 6.1.2 and 6.1.3 of the REF).
State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP)	Section 2.126 of the TISEPP permits development by or on behalf of a public authority for development for the purposes of a sewerage reticulation system without consent on any land. The assets are defined as part of the sewerage reticulation system, and Sydney Water is a public authority therefore the proposal is permissible without consent.
State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BC SEPP)	**Vegetation in non-rural areas (Chapter 2)** Chapter 2 of this SEPP aims to protect the biodiversity and amenity value of trees and other vegetation in non-rural areas of the State. The proposal is in the Willoughby LGA as listed in section 2.3(1)(a), and in part, the zones listed in section 2.3.(1)(b). However, subsection 2.4(1) states: 'This Policy does not affect the provisions of any other SEPP….', and as the works are permissible under the TISEPP, a council permit to clear vegetation under this SEPP is not required. **Water catchments (Chapter 6)** Chapter 6 of this SEPP applies as the proposal is within the Sydney Harbour Catchment, a regulated catchment. Section 6 of this REF assessed potential environmental impacts on water quality and quantity,

Environmental Planning Instrument	Relevance to proposal
	aquatic ecology, flooding, access, cultural heritage, flora and fauna, and scenic quality. The assessment confirmed that potential impacts are minimal and meet the requirements of part 6.2 of the SEPP. Section 171A of the EP&A Regulation requires a determining authority to take into account the likely environmental impact from the proposal for work in a regulated catchment. As the proposal is in the Sydney Harbour Catchment, sections 6.6 to 6.9 of this SEPP have been considered (refer to Appendix B).

Table 5-2 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 aims to, among other matters, protect, restore and enhance the quality of the environment in NSW. It includes offences for polluting the environment and establishes a regime of environment protection licences. The proposal involves maintenance activities associated with the existing wastewater network which operates under existing EPL 378 for the North Head sewerage system. However, no EPL variations will be required for construction of the proposal as it meets the EPL compliance requirements. Noise and odour impacts will be minimised through mitigation measures described in Section 6.1.5 and 6.1.6 of this REF. The Contractor is responsible for immediately reporting such incidents in accordance with SWEMS0009 – Responding to incidents with an environmental impact.	N/A	N/A
Biodiversity Conservation Act 2016 (BC Act)	The BC Act protects listed species, populations and ecological communities in NSW. Section 3.7 of the BC Act requires a Test of Significance (ToS) if there are potential impacts. An ecological assessment, including ToS was prepared for the proposal (Appendix D). Impacts to flora and fauna are assessed in Section 6.1.3.	REF	Pre-construction, Sydney Water
National Parks and Wildlife Act 1974 (NPW Act)	The NPW Act provides for the establishment, preservation, and management of areas such as national parks, state conservation areas, nature reserves, and Aboriginal areas. The proposal is not within a national park, state conservation area or nature reserve. Under Section 86 of the NPW Act, it is an offence to desecrate an Aboriginal place or	REF	Pre-construction, pre-construction

Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
	object unless authorised by an Aboriginal heritage impact permit (AHIP), or where it is reasonably determined that no Aboriginal object will be harmed. Aboriginal Heritage Due Diligence assessments are provided in Appendix E and Appendix F and Aboriginal heritage impacts are assessed in 6.1.4. The proposal would not require an AHIP.		
Heritage Act 1977	A Non-Aboriginal Heritage Statement of Advice was prepared for the project (refer to Appendix G). The assessment identified non-Aboriginal heritage items within the proposal, however negligible impacts are expected. Heritage is assessed in 6.1.4.	REF	Pre-construction, Sydney Water
Water Act 1912/Water Management Act 2000	The groundwater depth at the site has not been confirmed. If excavation is expected to encounter groundwater, an application for a Water Supply Works Application (WSWA) will be obtained prior to any dewatering activities.	Water Supply Works Approval	Prior to any groundwater dewatering, contractor
Roads Act 1993	Section 138 of the Roads Act states a person must not carry out work in, on or over a public road without consent of the responsible roads authority. Potential impacts of the proposal on traffic and access, including road works, are assessed in Section 6.1.8. Gore Hill Freeway and Willoughby Road are classified roads managed by TfNSW. An ROL will be required prior to the start of works requiring full or partial closures of public roads.	ROL	Pre-construction, contractor
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The EPBC Act provides for the protection of matters of national environmental significance. Under the EPBC Act, an action that is likely to have a significant impact on a matter of national environmental significance must be referred to the Commonwealth Minister for the Environment and Water. The proposal is not likely to have a significant impact on a matter of national environmental significance and has accordingly not been referred. Assessments of Significance were undertaken for the proposal (refer to Appendix D). Impacts to protected matters related to flora and fauna listed under the EPBC Act are assessed in Section 6.1.3.	REF	Pre-construction, Sydney Water

Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
Crown Land Management Act 2016	The proposal is within mapped areas of Crown land (Artarmon Reserve) and a Crown watercourse (Flat Rock Creek). Crown Lands and Public Services confirmed these areas are managed by WCC (refer to Figure 3-1 to Figure 3-4). Matters related to timing, access and potential community impacts have been discussed with WCC (refer to Section 4).	N/A	N/A
Aboriginal Land Rights Act 1983	[redacted]	REF	Pre-construction, Sydney Water

6. Environmental assessment

Section 6.1 describes the existing environment and assesses direct and indirect impacts of construction and operation. It also identifies mitigation measures to minimise impacts. These will be incorporated into contract documents and a Construction Environmental Management Plan (or similar) prior to starting work.

6.1 Environmental aspects, impacts and mitigation measures

6.1.1 Topography, geology and soils

Geology and soil constraints were informed by a Preliminary Site Investigation (PSI) undertaken for a separate Sydney Water project in the wider area in 2025, and Geotechnical Desktop Study (Golder Associated Pty Ltd, 2022) involving desktop and on-site investigations. Further limited on-site investigations were undertaken by Confluence Water from 2023 to 2025 for the purpose of soil waste classification.

Existing environment

Topography

The proposal runs from the Gore Hill Freeway and North Shore Railway in the west, to Flat Rock Gully Reserve in the east, along the hillslopes of the modified creek line of Flat Rock Creek. The broader topography includes gentle inclines, sloping upwards from the creek bed. However, construction of the freeway, railway line and residential infrastructure has significantly modified the original topography. The freeway is raised above Flat Rock Creek. Flat Rock Gully is built on top of a former landfill site, with the creek line modified and directed through a concrete stormwater channel. The proposal area ranges from 10 Australian Height Datum (AHD) to 70 AHD.

Geology

The surface geology of the proposal area consists of Hawkesbury Sandstone and human-made fill on Hawkesbury sandstone (mf/rh) (Herbert, 1980). The Hawkesbury Sandstone weathers to form overhangs, flatted-topped platforms and isolated boulders (McDonald, 2008).

Soils

The proposal is within a Class 5 Acid Sulfate Soil (ASS) area under the Willoughby Local Environmental Plan 2012. ASS is not typically expected at the surface or during excavation. A review of NSW eSPADE 2.2 data confirms no known occurrence of ASS within the proposal area.

Contaminated sites

The key contamination sources are landfill waste and incinerator waste in connection with a former landfill site, Bicentennial Reserve. Other sources of contamination within the proposal area include road construction and residential development involving hazardous materials such as asbestos. These are considered low risk and manageable with the mitigation measures identified.

An EMP was developed by Consulting Earth Scientists in 2023 on behalf of WCC for Bicentennial Reserve. The site assessed in the EMP includes a portion of the proposal (refer to Figure 6-1 and Figure 6-2**)**. The EMP identifies key risk activities and mitigation measures for the management of contaminated landfill material, potential landfill gas and landfill waste. The area is largely covered by grass, bushland, paved areas, and synthetic surfaces, limiting exposure to underlying soils. The activities occurring within these areas are recreational, and use is typically short term and non-intrusive.

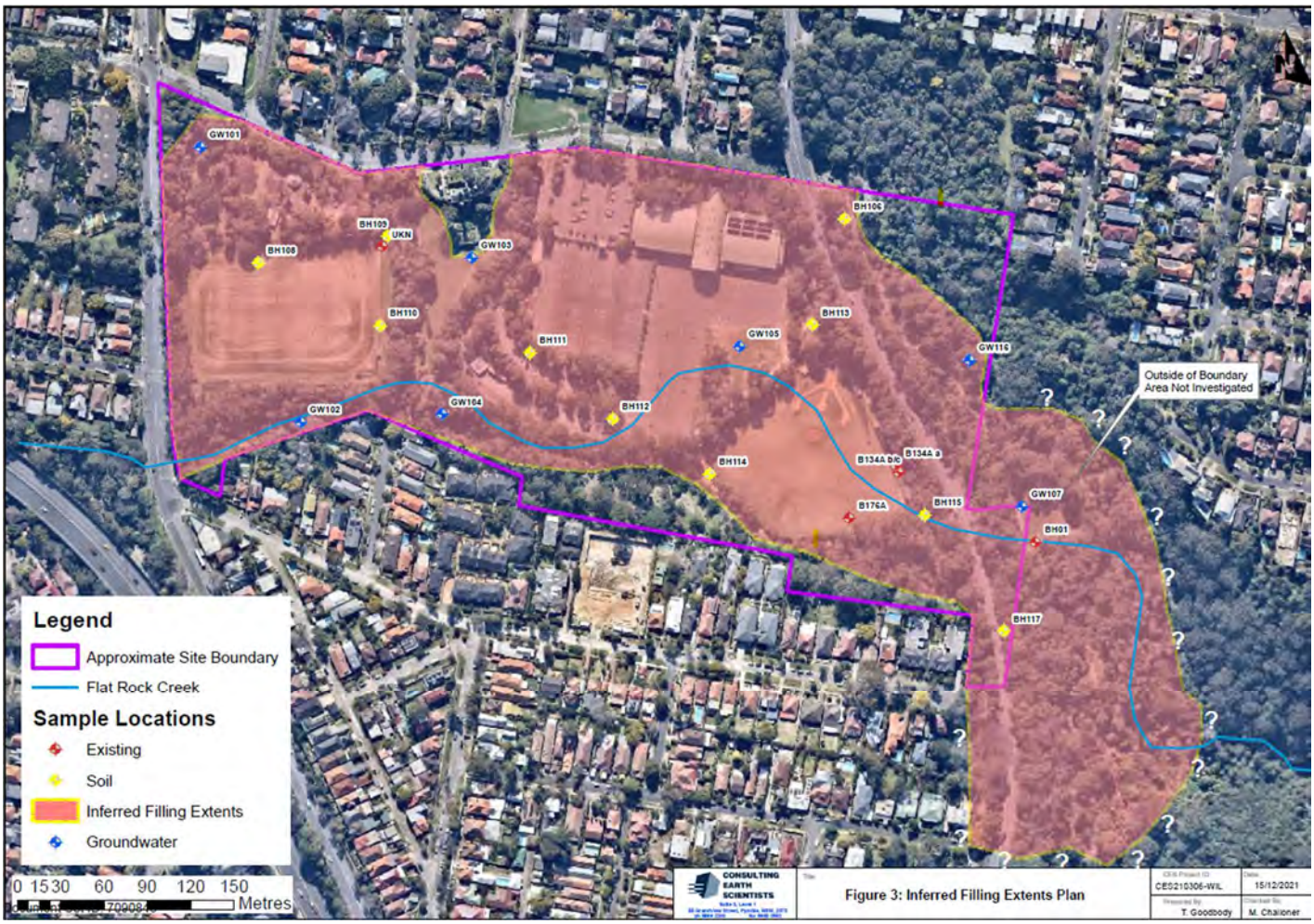


Figure 6-1 Approximate site boundary for the EMP and inferred former landfill extent

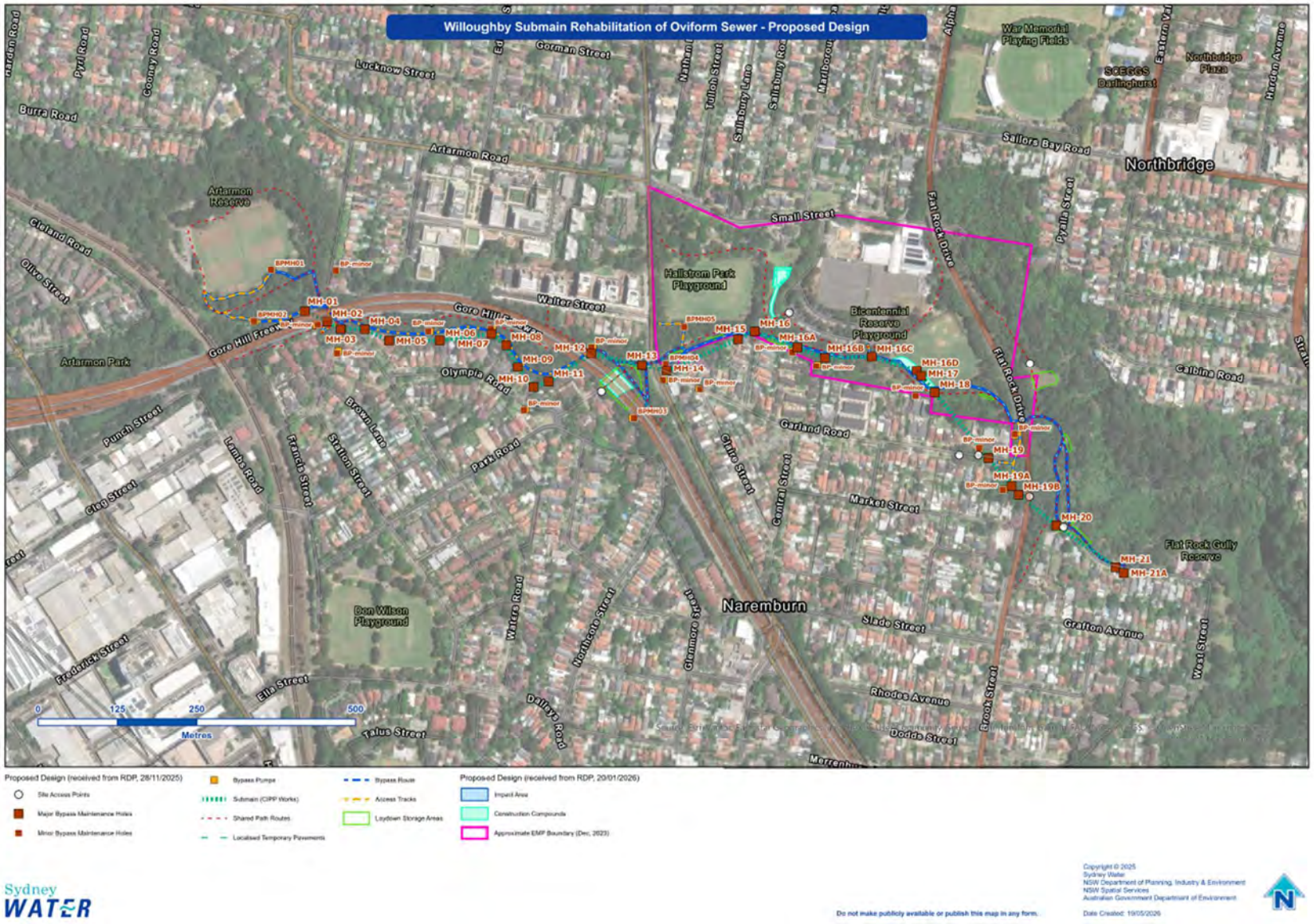


Figure 6-2 Approximate EMP boundary and proposal

The key contamination sources within Bicentennial Reserve are landfill waste and incinerator waste. The contaminants identified in the EMP included asbestos, hydrocarbons, PCBs, metals (including chromium) and nutrients such as ammonia. Limited asbestos chrysotile fibres were detected below reporting thresholds in one sample. Risk of airborne asbestos exposure was deemed negligible due to encapsulation and ground cover. However, further assessment was recommended if soil becomes exposed.

Under the EMP, capping layers at playing fields extend to at least 0.6 m depth and act as an effective barrier to underlying landfill materials, provided they are maintained in accordance with the EMP.

The EMP notes that most of the landfill gases generated during decomposition of the landfilled waste are likely to have migrated vertically to the atmosphere. The EMP notes that ongoing monitoring and assessment of the landfill gas risks to the Leisure Centre should continue.

Declaration of significant contamination at Bicentennial Reserve by the NSW EPA on 20 October 2023 highlights significant contamination of ammonia leachate migration to offsite groundwater and surface waters. The EPA found that ammonia, originating from the landfill, is discharging via leachate downstream towards Flat Rock Creek.

Confluence Water undertook a soil characterisation investigation for contamination and waste classification near MH3 in 2023 (refer to Figure 6-3). It concluded that there was a low risk of harm from contamination to human health and ecological receptors at MH3 to a depth of 2.5m. However an unexpected finds protocol should be implemented during works in this area.



Figure 6-3 2023 soil investigation at MH3

Confluence Water also undertook a soil characterisation investigation at MH17 and MH16D in Bicentennial Reserve in 2023. Both were overlain by fill materials. In 2024, MH16D was confirmed as buried to about 4 m below ground. Soil classification in 2025 found chemical contamination near MH17 and MH16D (refer to Figure 6-4).

- BH3/3.5-3.8 m deep - benzo(a)pyrene toxicity equivalence quotient concentration (11 mg/kg) exceeding HIL-A criteria (3 mg/kg), but below HIL-D criteria (40 mg/kg).
- Numerous lead exceedances against HIL-A criteria (300 mg/kg) (but below HIL-D criteria of 1,500 mg/kg):
    - BH2/1.7-2 m deep at 710 mg/kg.
    - BH3/1.5-1.8 m deep at 340 mg/kg.
    - BH3/3.5-3.8 m deep at 330 mg/kg. A laboratory triplicate re-run sample undertaken by Envirolab (389630-44) returned a higher concentration of 350 mg/kg.

No asbestos was identified however trace anthropogenic materials (e.g. fabric and plastic scraps, wood chips) were identified in sub-surface soils at all locations to 4 m deep.



Figure 6-4 2025 investigation locations

Potential impacts

Construction phase

During construction, the main potential impacts to topography, geology and soils are associated with erosion and sedimentation. If inadequately managed, ground disturbance, vegetation removal, stockpiling and transport of excavated material have the potential for off-site transport of sediment. If sediments reach waterways such as Flat Rock Creek, there are potential water quality and ecological impacts. Rainfall leaching of contaminants of any stockpiled material into adjacent land and waterways.

Part of proposal area is above the former landfill site. Trench excavation about 1 m deep by 3 m wide is needed in this area for the temporary bypass system. Excavation to about 4 m deep is required for MH rehabilitation at MH16D, MH17 and MH20. These excavations are expected to extend beneath the capping layers and into the underlying landfill material. While MH20 is outside the EMP site and not subject to the

investigations undertaken to date, it is still within the inferred extent of the former landfill identified in the EMP. If inadequately managed, contaminated sediment and water may be transported off-site leading to potential ecological impacts and impacts to human health associated with exposure to contaminants. Risks to construction workers will be managed through mitigation measures outlined in the EMP.

We will reuse excavated material wherever possible, reducing the amount of imported fill. Soil will be excavated, temporarily stockpiled on site, and backfilled, where it is deemed suitable for reuse and contaminated material is not identified. Excavated material from open trenching will be stockpiled adjacent to the trenches within the proposal area, either within the road verge, or alongside the shared path where possible. Subject to consultation with WCC, some excavated material will be stockpiled in lay down areas and reused for backfilling, ensuring material separation from non-contaminated material with clean fill for final recapping.

Operational phase

The proposal will not impact topography, geology and soils during operation The proposal will not permanently change the surface topography and drainage patterns of the area. Disturbed areas will be progressively backfilled and restored to a pre-construction condition or similar.

Mitigation measures

With the implementation of the mitigation measures below, potential impacts to topography, geology and soils can be adequately managed. Residual impacts are expected to be minor and temporary.

Table 6-1 Environmental mitigation measures — topography, geology and soils

Mitigation measures
Excavated material will be stockpiled as far as practicable from waterways to minimise potential erosion and sedimentation impacts.
Skip bins will also be close to the work location to store surplus of excavated materials that can be removed at a later date or used as fill material, if required. Any surplus material will be disposed of in accordance with its classification.
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: • develop a Soil and Water Management Plan (SWMP) as part of the CEMP • divert surface runoff away from disturbed soil and stockpiles • 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.

Mitigation measures
Delivery Contractor 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 the Delivery Contractor 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 the Contamination and Hazardous Materials team) to agree on proposed management approach.
A Construction Contamination Management Plan (CCMP) must be prepared by a suitably qualified person as part of the CEMP and reviewed by Sydney Water's Environmental Representative in consultation with Contamination and Hazardous Materials team. The plan must identify the type and location of known/potential contamination, land-owner notification, management requirements (waste minimisation, waste segregation and classification) and reuse, offsite recycling and/or disposal measures. It must be consistent with the EMP for Bicentennial Reserve and include an unexpected finds protocol.
Ground disturbance within the site boundary of the Environmental Management Plan (EMP) Bicentennial Reserve Former Landfill Small Street, Willoughby NSW (Consulting Earth Scientists, 2023) must be in accordance with the EMP requirements.
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.

6.1.2 Water and drainage

Existing environment

Surface water

The proposal is within the 7 km^2 Flat Rock Creek catchment. It extends across multiple suburbs, in WCC and North Sydney Council LGAs. The catchment generally drains from west to east, with a stormwater channel running parallel to Flat Rock Creek and discharging to Long Bay in Middle Harbour. Flat Rock Creek flows within a culvert across the proposal site, close to shared paths, recreational facilities, public spaces and residential housing. The natural drainage system has been extensively modified by residential, commercial, and industrial urban development. Surface flows travel through a combination of open channels, culverts, piped stormwater systems and drainage lines, and detention basins.

Flooding

WCC prepared a Flood Study for the Flat Rock Creek WCC in 2018, and a Floodplain Risk Management Study and Plan in 2020. The studies found that urban development has significantly modified natural drainage, with flows managed through a series of engineered channels and culverts. Flooding is typically flash-driven, with rapid rises and short peak durations. While residential overland flow depths are generally less than 600 mm in a 1% Annual Exceedance Probability (AEP) event, inundation exceeding 1.0 m occurs in other developed areas, including along the proposal alignment. Several locations within the proposal area lie within the 1% AEP flood extent, with potential inundation of private properties and recreational areas such as Artarmon and Bicentennial Reserves (refer to Figure 6-5 to Figure 6-6).

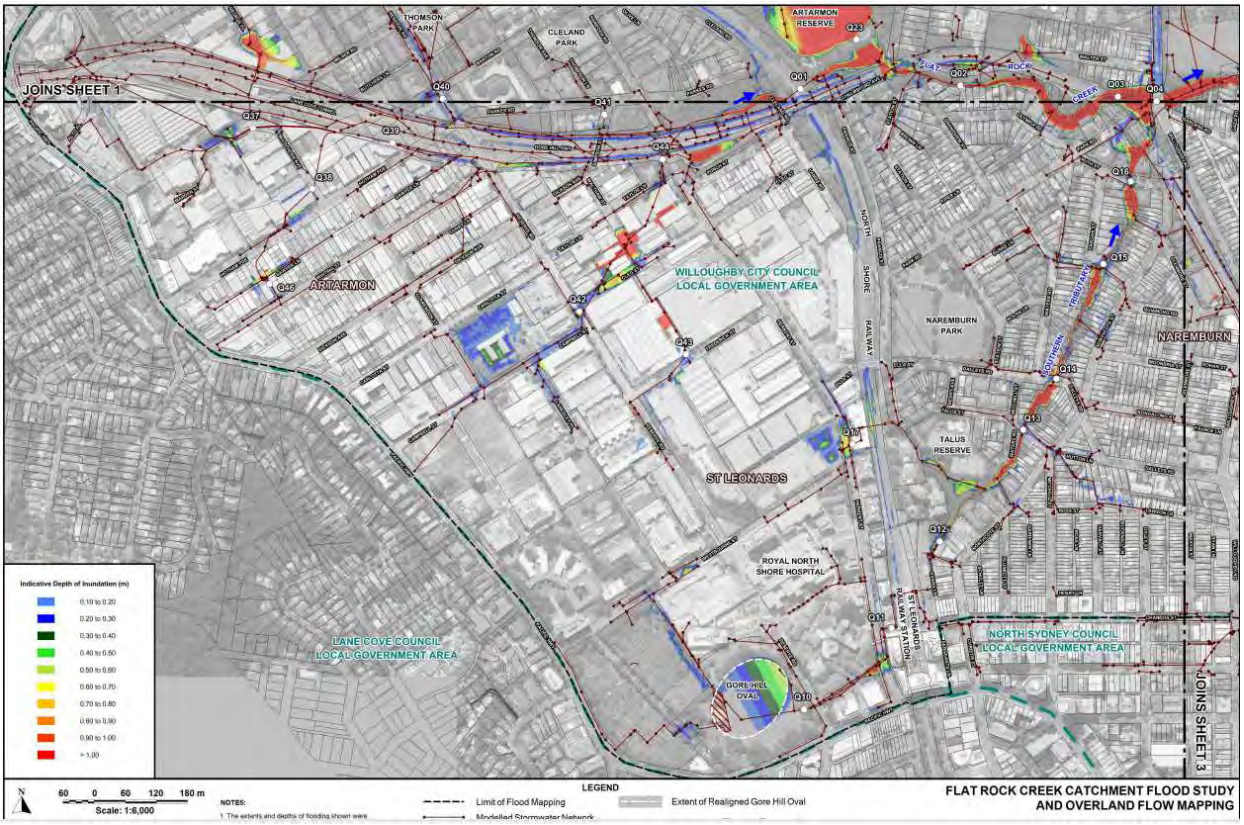


Figure 6-5 Areas of the proposal mapped within the 1% AEP flood extent (Source: Lyall & Associates, 2018)

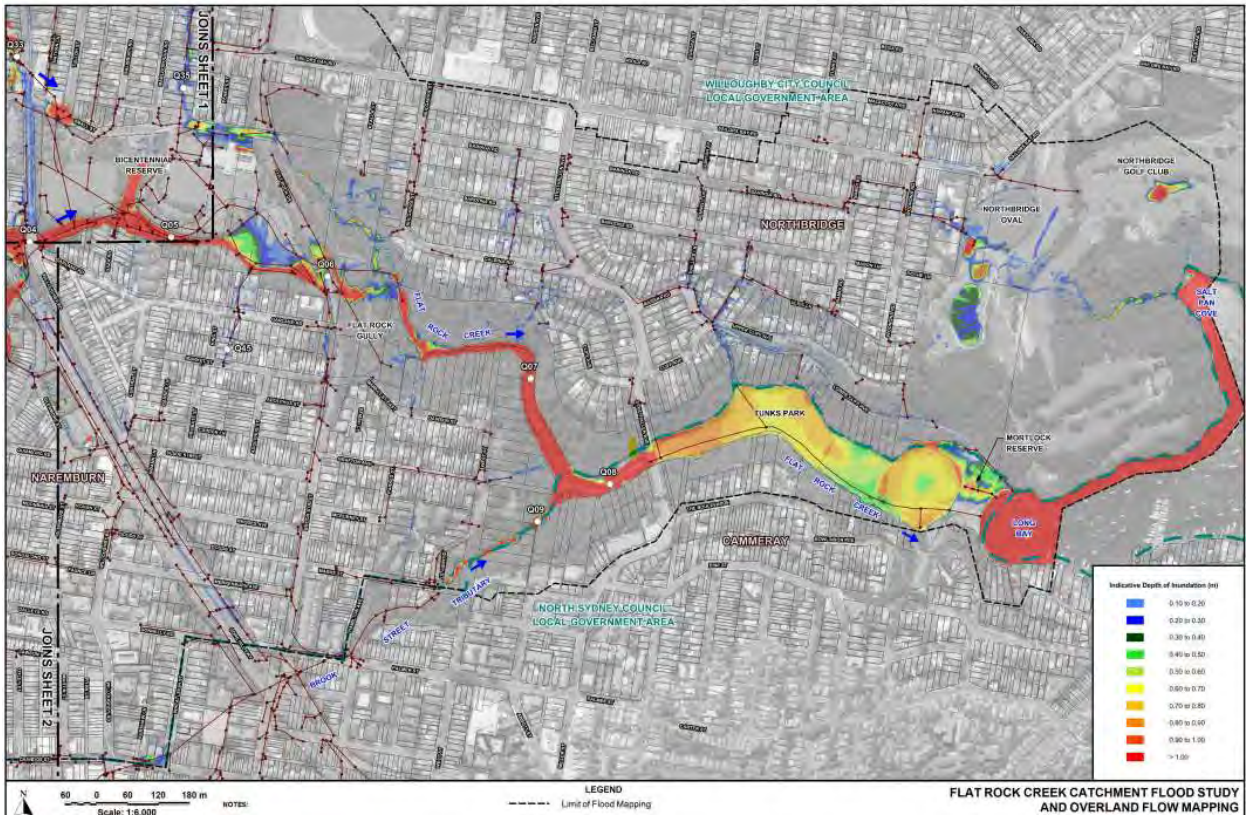


Figure 6-6 Areas of the proposal mapped within the 1% AEP flood extent (Source: Lyall & Associates, 2018)

Groundwater

Catchment hydrology has been modified by urban development, with increased impervious surfaces resulting in higher runoff and reduced groundwater recharge. The hydrogeology comprises a shallow perched aquifer within fill materials, underlain by the unconfined Hawkesbury Sandstone aquifer, with groundwater and leachate discharging to Flat Rock Creek.

Groundwater investigations (Golder Associates, 2022) indicate localised zones of higher permeability along the pipeline alignment that respond rapidly to rainfall. Groundwater levels are therefore expected to fluctuate during storm events, particularly within low-lying areas and the creek floodplain, with temporary recharge dissipating quickly to the creek. Excavations to depths of up to 6 m may encounter groundwater.

An environmental site investigation of groundwater identified heavy metal concentrations (cadmium, chromium, copper, lead, and zinc) above the adopted assessment criteria at one sampling location north-east of the Bicentennial Reserve Oval. Concentrations in downgradient monitoring wells were generally below adopted criteria, with the exception of chromium which was detected above the adopted criterion one location directly north west of the baseball field (Consulting Earth Scientists, 2022).

Potential impacts

Construction phase

The potential impacts on waterways, including Flat Rock Creek, from erosion and sedimentation are assessed above. The proposal has the potential to impact water and drainage from:

- spills or leaks from inappropriate chemical and fuel storage
- mismanagement of contaminated groundwater if encountered

- modifying overland flow paths due to temporary bypass system, access tracks, equipment, and site compounds, especially during flood events
- leak or failure of the bypass system
- groundwater dewatering impacting water tables.

The proposal includes temporary scaffolding, support structures and dual 300 mm bypass pipelines. These are small relative to the channel and culvert flow areas.

The proposal includes waterway crossings and infrastructure within the 1% AEP flood extent during construction. This includes scaffolding and bypass support structures within the existing stormwater channel. However, these small-scale elements would be installed over and across the top of the stormwater channel and are therefore unlikely to affect minor stormwater flows. In addition, the bypass system will not be in operation when there is more than 10 mm of rain forecast.

The proposal also involves the construction of the bypass system and associated support structure through the culvert under Willoughby Road. Flood modelling undertaken to identify the potential impacts of this, indicates that the temporary works would result in negligible changes to flood levels and behaviour (maximum increase of about 0.01 m), which is within accepted flood impact criteria (refer to Appendix H).

Groundwater may be intercepted in areas where the depth of excavation extends to 6 m including works at MH16D, MH17 and MH20 which may require excavations of 4-6 m deep.

Operation phase

The proposal will not impact water and drainage during operation. The wastewater system will continue to operate and comply with North Head system EPL 378. All temporary structures will be removed following construction, with no ongoing impacts expected on flood behaviour or drainage conditions.

Mitigation measures

With the implementation of mitigation measures listed below, potential construction impacts are expected to be minor.

Table 6-2 Environmental mitigation measures — water and drainage

Mitigation measures
Use appropriate controls to avoid potential sedimentation to waterbodies (e.g. floatation boom).
Where creek crossings are required, consider options and alternatives to minimise disturbance and impacts to Flat Rock Creek.
Bund open maintenance holes if there is a risk of wastewater spills.
Keep functioning spill kit on site for clean-up of accidental chemical/fuel spills. Keep the spill kits stocked and located for easy access.
Locate portable site amenities, chemical storage and stockpiles of erodible materials away from watercourses, drainage lines and flood prone areas.

Mitigation measures

Keep stockpiles to a minimum and ensure adequate contingency measures are in place to prevent sedimentation of waterways in the event of a large flood event.

Sydney Water will obtain a groundwater Water Supply Works Approval if there is a potential for intercepting groundwater. The Delivery Contractor is responsible for:

- preparing a Dewatering Management Plan prior to construction
- complying with the conditions of the approvals (such as protecting water quality; minimising aquifer extraction volumes, monitoring extraction with flow meters and recording volumes).

Minimise groundwater ingress during detailed design. As part of the CEMP, prepare a Dewatering Management Plan for groundwater dewatering. This should include elements such as how water quality will be protected and how extraction volumes will be monitored.

Seek approval and discharge criteria from the relevant Sydney Water Network Area Manager prior to discharge of water to the wastewater system. Otherwise tanker by a licensed waste contractor and dispose off-site to an appropriately licensed facility.

For the temporary wastewater bypass system:

- pressure test hoses before, and monitor during bypass
- monitor wastewater flows to ensure critical flows are not reached
- stop bypass if leaks occur
- bund access chambers
- contain wastewater spills and pump back to wastewater system or disposal tanker
- do not operate the bypass system during heavy rainfall or flood events.

Store all chemicals and fuels in accordance with relevant Australian Standards and Safety Data Sheets. Record stored chemicals on site register. Ensure bunded areas have 110% capacity of the largest chemical container, or an additional 25% capacity of the total volume stored within (whichever is greater). Tightly secure chemicals and fuels in vehicles. Clearly label all chemicals.

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

Bypass works will not commence where rainfall of ≥10 mm is forecast.

Ensure scaffolding, support structures and bypass are positioned above design flood levels or aligned to minimise impacts to flow conveyance.

Do not access the existing open concrete stormwater channel during higher rainfall events, or when higher rainfall events are forecast.

Mitigation measures

Ensure the existing open concrete stormwater channel profile is temporarily reinstated at the end of each work shift.

6.1.3 Flora and fauna

A Biodiversity Assessment Report was prepared for the proposal (Appendix D) and is summarised here. The biodiversity features are presented in Figure 6-7.

Existing environment and potential impacts

Vegetation

Desktop mapping and site surveys confirmed the presence of two plant community types (PCTs) within the impact area: PCT 3136 *Blue Gum High Forest* and PCT 3594 *Sydney Coastal Sandstone Foreshore Forest.* PCT 3136 occurs in low to moderate condition and includes both replanted areas and remnant mature trees. PCT 3594 is limited to the eastern extent of the proposal.

PCT 3136 corresponds with the Threatened Ecological Community (TEC): *Blue Gum High Forest in the Sydney Basin Bioregion*, listed as Critically Endangered under both the BC Act and EPBC Act. Potential impacts are about 0.37 ha of BC Act-listed Blue Gum High Forest, of which 0.19 ha is also EPBC Act-listed. Impacts to the TECs have been assessed in the BC Act Test of Significance and EPBC Act Assessment of Significance (refer to Appendix D).

The impact area also includes about 0.07 ha of regenerated native vegetation, which does not meet a best-fit PCT classification but provides habitat value for native fauna. Small areas of planted gardens dominated by exotic species occur primarily in the western extent of the proposal, from MH01 to MH12. A further 0.13 ha of exotic disturbed grassland is present and will be cleared for site laydown during construction.

Vegetation impacts are largely confined to understorey and shrub layers with limited removal of mature trees. Of the trees to be removed, none displayed significant fauna habitat features such as hollows or stick nests.

Access is mostly along existing open channel areas and shared pathways, with foot access through private properties. This reduces extensive vegetation clearing or use of heavy machinery. Vegetation impacts are worst-case, and opportunities to minimise (e.g. trim rather than remove) will be employed during construction. Native vegetation will be offset within nearby bushland where feasible.

Following completion of works, all disturbed areas will be rehabilitated and revegetated in the same disturbed footprint where possible. Appropriate native species will be used, and ground and mid-strata vegetation is expected to return to pre-existing condition within about five years.

The preliminary estimates for biodiversity offsetting in accordance with Sydney Water's Biodiversity Offset Guide are in Table 6-3.

Table 6-3 Preliminary estimates for biodiversity offsetting

Offset group	PCT	Impact area	Offset ratio	Offset required
Threatened Native Vegetation	PCT 3136 (Low) (corresponding with Blue Gum High Forest)	0.18 ha	3:1	0.54 ha

Offset group	PCT	Impact area	Offset ratio	Offset required
Non-threatened Native Vegetation	PCT 3136 (Moderate)	0.19 ha	3:1	0.57 ha
	Native Revegetation	0.07 ha	2:1	0.14 ha
	PCT 3594 (Moderate) (corresponding with Sydney Coastal Sandstone Foreshores Forest)	0.16 ha	2:1	0.32 ha
Exotic grassland area	N/A	0.13 ha	N/A	N/A - rehabilitate
Locally native	Private property	3 trees	3:1	9 trees
Exotic trees	Private property	3 trees	1:1	3 trees

Groundwater dependent ecosystems

There are no terrestrial or aquatic GDEs within proposal area, and only one terrestrial GDE mapped 100 m east of the proposal along Flat Rock Gully east of Flat Rock Drive (Bureau of Meteorology, 2025). Works at the nearest location (MH20) are likely to be 3 m deep, potentially up to 6 m deep, which is the expected groundwater level. Groundwater dewatering will be minimal, if needed at all, due to the small excavation area, limited opening time and depth relative to groundwater. The GDE identified is also terrestrial, and therefore not fully reliant on groundwater sources to function (Appendix D). Direct or indirect impacts on this GDE are therefore not expected.

Threatened flora and fauna

No threatened flora were recorded in the desktop assessments and no threatened flora species were determined to have a moderate or high likelihood of occurrence. Two Macadamia species, potentially *Macadamia tetraphylla* (BC Act – Vulnerable, EPBC Act – Vulnerable) were recorded during the site survey however this species does not naturally occur in the region and these records are likely planted.

No threatened fauna were observed during surveys and no targeted fauna surveys were undertaken. The biodiversity assessment identified 14 threatened fauna species with moderate to high likelihood of occurrence (refer to Table 6-4).

Table 6-4 Threatened species with moderate to high likelihood of occurrence

Taxa	Scientific name	Common Name	BC Act*	EPBC Status
Highly likely to occur				
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V

Taxa	Scientific name	Common Name	BC Act*	EPBC Status
Aves	*Ninox strenua*	Powerful Owl	V	-
Moderately likely to occur				
Aves	*Daphoenositta chrysoptera*	Varied Sittella	V	-
Mammalia	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V	-
Mammalia	*Miniopterus australis*	Little Bent-winged Bat	V	-
Mammalia	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V	-
Mammalia	*Myotis macropus*	Southern Myotis	V	-
Aves	*Ninox connivens*	Barking Owl	V	-
Aves	*Glossopsitta pusilla*	Little Lorikeet	V	-
Gastropoda	*Pommerhelix duralensis*	Dural Land Snail	E	E
Mammalia	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V	-
Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	-
Aves	*Tyto novaehollandiae*	Masked Owl	V	-

V: Vulnerable, E1: Endangered, CE: Critically Endangered, E2: Endangered Population, *No FM Act species are moderately or highly likely to occur.

While no locally native threatened fauna species were identified during the field surveys, some limited habitat within the impact area may be used by threatened fauna for opportunistic foraging. Vegetation along Flat Rock Creek Gully and the adjacent Gore Hill Freeway provides a localised movement and refuge corridor for mobile fauna. Existing bridges, culverts and overpasses may also offer opportunistic roosting habitat for microbats.

Vegetation clearing may result in temporary disturbance to fauna, particularly birds. However this risk is considered low as clearing will largely be limited to groundcover and shrub layers and tree removal will largely be avoided. Fauna habitat features identified during the field surveys will also be retained (refer to Figure 6-7), with none of the trees to be removed containing hollows or significant habitat features.

During construction, works may indirectly impact fauna from lighting, noise, and movements of workers, vehicles and machinery. However, as the proposal is largely located within a high traffic area with frequent

noise expected from park users and traffic from the adjacent roads (e.g. Gorehill Freeway), any additional noise is expected to have minor impacts on native fauna. Furthermore, given the mobile nature of native birds, should they be present and disturbed, they are highly likely to disperse to nearby suitable habitat.

Potential roosting features such as overpasses, bridges and culverts may provide opportunistic, although marginal, roosting habitat for microbat species. A short program of night works and minor works within several culverts are proposed, in addition to a construction compound under Gorehill Freeway. However surveys recorded no evidence of regular use and suitable features are very limited and the potential to roost is low. Night works may temporarily reduce the suitability of some foraging habitat, however this impact will be minor and temporary. Potential impacts from light and noise associated with night works, and the temporary disturbance within culverts, is assessed as minor.

A highly modified section of Flat Rock Creek is in the proposal area. The creek provides limited instream habitat and restricted fish passage during low-flow conditions. Works in the channel involve channel wall removal, ramp installation and access to construct scaffolding. Given the channel is concrete lined and there is limited instream habitat or fish passage, impacts to aquatic fauna are expected to be negligible.

Assessments of significance were carried out for threatened fauna with a moderate to high likelihood of occurrence that could potentially be impacted (refer to Table 6-4). The assessments concluded that the proposal is unlikely to result in a significant impact to threatened fauna species or their habitats.

Weeds

Twenty-two exotic flora species were observed across the study area, with one *(Asparagus aethiopicus*) identified as a Weed of National Significance (WoNS) (Weeds Australia 2021). No signs of pathogens or dieback were observed. The proposal has the potential to spread weeds, but potential impacts can be managed by the proposed mitigation measures.

Operational phase

No impacts to flora and fauna are anticipated during operation.

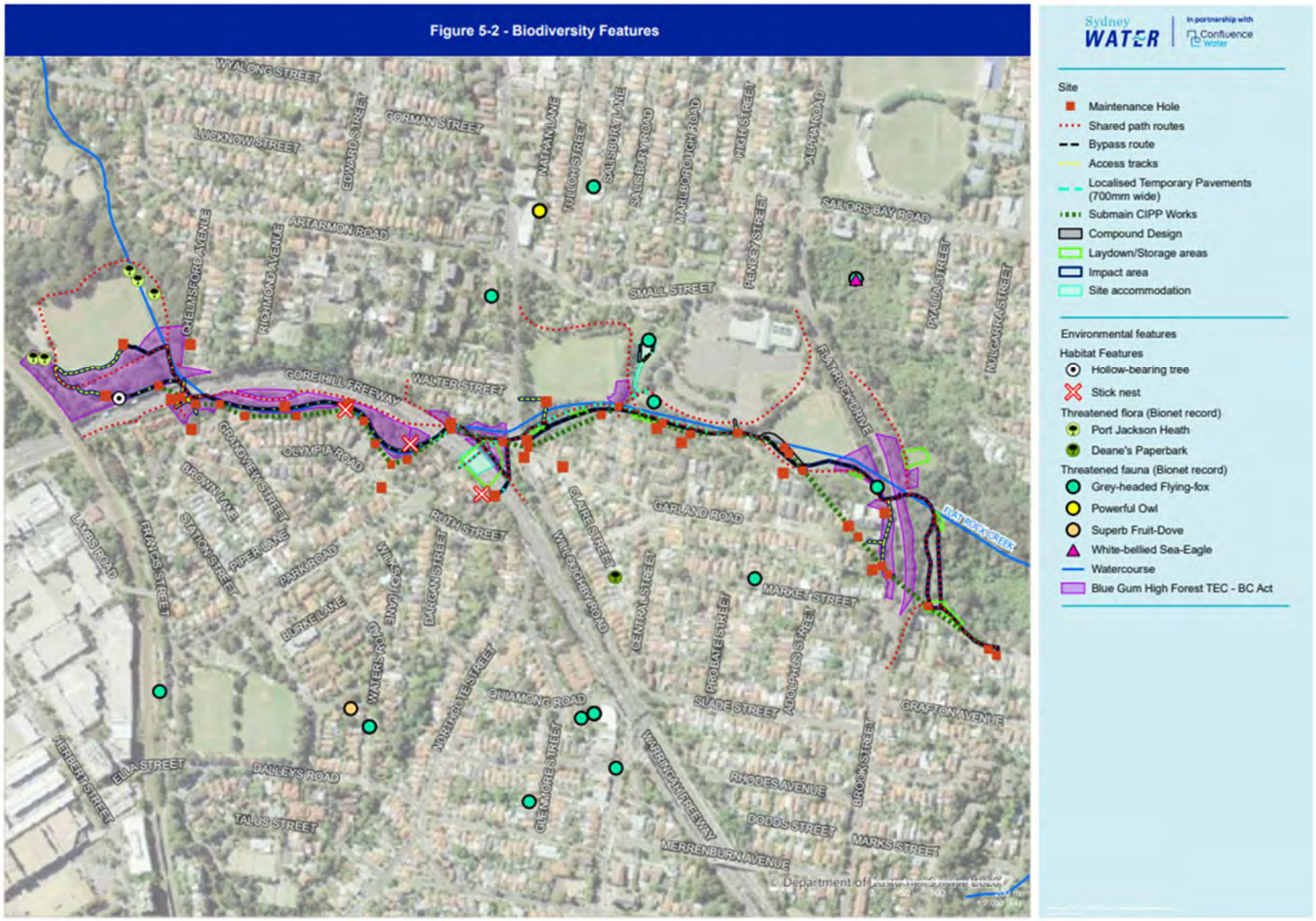


Figure 6-7 Summary of biodiversity features near the proposal

Mitigation measures

With the implementation of the mitigation measures below, impacts to flora and fauna can be adequately managed, and residual impacts are expected to be minor.

Table 6-5 Environmental mitigation measures — flora and fauna

Mitigation measures
Prepare a revegetation management plan to rehabilitate the impacted areas after construction. This plan will be designed based on the existing environment and aim to restore the vegetation and habitats to better than existing condition. The plan will be in accordance with the 'Guideline for managing native re-vegetation for construction projects'. It will set specific requirements for plant survival and weed densities over the course of at least two years.
Map and report native vegetation clearing greater than 0.01 ha in extent (and any associated rehabilitation) to the Sydney Water Environmental Representative (information from this Ecological Assessment can be used for this). During construction, track vegetation clearing as per SWEMS0015.26 Contractor Native Vegetation Clearing and Rehabilitation template.
Protect trees in accordance with the requirements of Australian Standard 4970-2009 for the Protection of Trees on Development Sites. Do not damage tree roots unless necessary and engage a qualified arborist where roots > 50 mm are impacted within the Tree Protection Zone. Protect trees in accordance with the Program Delivery Guidance Standard 9.3 Biodiversity Management (EV-GS-003).
Should additional vegetation impacts be proposed outside the assessed area, further assessment will be required in consultation with the environmental representative.
Retain fauna habitat features identified during the field surveys (refer to Figure 6-7). Where possible also retain dead tree trunks, bush rock or logs in-situ unless they are in the disturbance corridor and moving is unavoidable. Reposition material elsewhere on the site or approved adjacent sites.
Minimise vegetation clearance and disturbance, including impacts to standing dead trees and riparian zones. Where possible, limit clearing to trimming rather than the removal of whole plants.
Adjust methodology (e.g., avoid area, access via foot, trim or tieback vegetation, implement exclusion fencing, etc), as required and possible to protect sensitive areas (such as mature trees and ecological communities identified).
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 Sydney Water's 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,

Mitigation measures

  - 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).

If any damage occurs to vegetation outside of the disturbance corridor (as shown in the CEMP), notify the Sydney Water Project Manager and Environmental Representative so that appropriate remediation strategies can be developed.

If native mobile fauna is encountered on site, work in that specific area must be temporarily halted and fauna allowed to move away undisturbed. Engage WIRES or a licensed ecologist if assistance is required to move fauna.

If roosting bats are encountered during works, all activity in the immediate area must cease and a suitably qualified ecologist must be contacted to assess the roost and provide further direction before works can resume. No attempt should be made to disturb or relocate bats without ecological advice.

Identification of the Dural Land Snail is difficult for all personnel, so any snail observed within the impact areas must be assumed to be the Dural Land Snail.

If a snail is observed during works, the contractor will photograph and send it to Project Ecologist for identification. The ecologist will move any specimens outside the works area to a nearby area that will not be disturbed. The Project Ecologist will further advise if an Ecologist is required onsite for the remainder of vegetation clearance works.

All contractors/staff involved in vegetation disturbance works must be made aware of their responsibilities prior to commencing, either through a toolbox talk or other method of communication.

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 in sealed bags or skip bins and disposing at a licenced waste disposal facility.

Record Pesticides and Herbicides use in accordance with SWEMS00017.

To prevent spread of weeds and pathogens:

- Clean all equipment including PPE prior to entering the work sites.
- When clearing and trimming, separate all plant parts that may be infested with weeds and weed propagules and dispose at a licensed waste disposal facility.

Engage a suitably qualified bush regenerator contractor (if required) to undertake the revegetation works in accordance with the revegetation management plan.

Carry out revegetation in accordance with Sydney Water's *SWEMS0025.11 Guideline for native revegetation following construction* procedure. Revegetation will be undertaken progressively as works are completed.

Rehabilitate the impact area using native planting with suitable native species that align with the mapped PCT type, and undertake clearance of weeds as required. Maintain plants following rehabilitation (including weed management) to ensure successful growth.

Mitigation measures
Offset residual impacts to native vegetation and trees in accordance with the Biodiversity Offset Guideline (SWEMS0019.13).

6.1.4 Heritage

Non-Aboriginal heritage

Existing environment

A Non-Aboriginal Heritage Statement of Advice was prepared for the proposal (Appendix G) and the assessment is summarised here. Two non-Aboriginal listed heritage items were identified within the proposal area and 8 were identified nearby (refer to Table 6-6 and Figure 6-8).

Table 6-6 Non-Aboriginal heritage items within or adjacent to the proposal area

Item name	Address	Heritage list/significance/Identifier	Within or adjacent to the proposal area
Walter Burley Griffin Incinerator	2 Small Street, Willoughby	State Heritage Register/ State (SHR#00084)	Immediately adjacent
Bridge	Willoughby Road, over Flat Rock Creek, Willoughby	Willoughby LEP 2012/Local (I#232)	Within
Artarmon Heritage Conservation Area	West of Chelmsford Avenue, Willoughby	Willoughby LEP 2012/Local/C1	Within
House (including original interiors)	26 Dawson Street, Naremburn	Willoughby LEP 2012/Local (I#157)	Immediately adjacent
Dry stone wall and water channel	Off Dawson Street, Flat Rock Gully, Naremburn	Willoughby LEP 2012/Local (I#158)	About 42 m north
“Fatty” Dawson’s Ruins	Off Dawson Street, Flat Rock Gully, Naremburn	Willoughby LEP 2012/Local (I#159)	About 125 m northeast
Naremburn Central Township Conservation Area	Crows Nest, NSW	Willoughby LEP 2012/Local (I#C9)	About 10 m west
House (including original interiors)	33 Market Street, Naremburn	Willoughby LEP 2012/Local (I#161)	About 110 m southwest

The Walter Burley Griffin Incinerator is of State heritage significance based on being one of two municipal incinerators designed by Walter Burley Griffin and Eric Nicholls. Its heritage values relate to its historical, aesthetic and social significance, as well as its research potential and representative values. The bridge over Flat Rock Creek is of historical, aesthetic and social significance, as well as having rarity and representative values. Artarmon Heritage Conservation Area is one of the few remnants of natural bushland

associated with Willoughby. Naremburn Central Township Conservation Area is among Crows Nest's earliest commercial and residential settlements.

Dawson Street heritage values are exemplified by 26 Dawson Street, Naremburn, the dry-stone wall along Flat Rock Creek and the ruins of the piggery run by Henry "Fatty" Dawson. Both 26 Dawson Street, Naremburn and the "Fatty" Dawson ruins represent tangible evidence of early settlement in the Naremburn area, demonstrating historical, historical association and aesthetic significance, as well as research potential for early agricultural properties. The dry-stone wall and water channel are physical reminders of both water management practices and the Unemployment Relief Schemes in place during the 1930s depression.

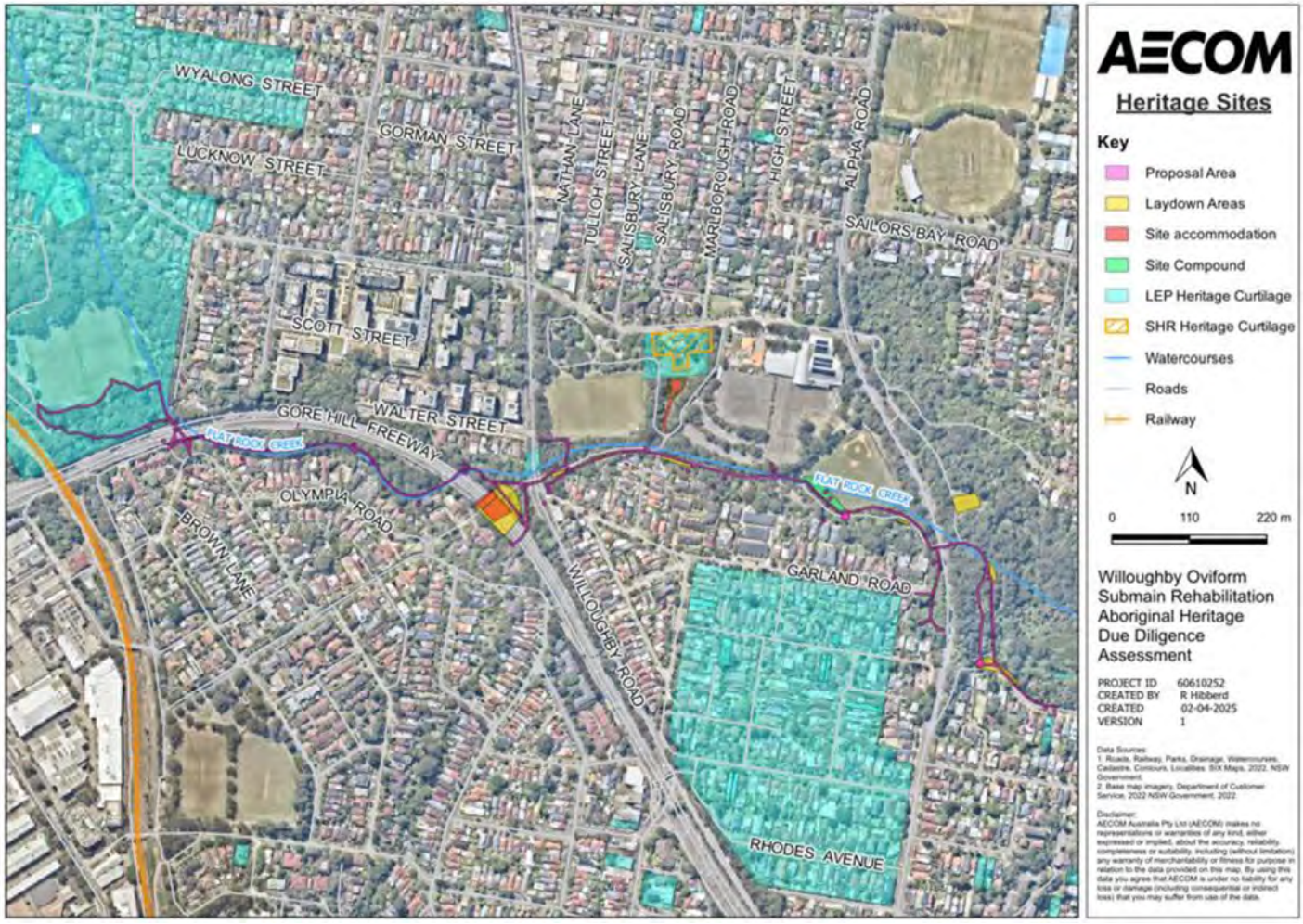


Figure 6-8 Non-Aboriginal heritage items

Potential impacts

A visual inspection in October 2025 informed a Non-Aboriginal Heritage Statement of Advice, to assess any non-Aboriginal heritage impacts from the proposal (refer to Appendix G). The visual inspection considered the potential for unregistered heritage sites and potential for areas of subsurface archaeological deposits within the proposal area. Key findings of this assessment are outlined below.

Two items have the potential to be directly impacted by the proposal:

- A standstone culvert beneath Willoughby Road of local significance listed under Willoughby LEP 2012 ('Bridge' (I#232)) – works in this location include the installation of a support structure for the bypass system, to be installed via handheld drilling into concrete benching and beneath an existing steel pedestrian bridge that traverses through the culvert.
- Artarmon Heritage Conservation area of local significance listed under Willoughby LEP 2012 - works in this area involve vegetation clearing to establish access tracks, MH rehabilitation and bypass installation.

Access within the Artarmon Heritage Conservation Area will largely use existing tracks, with some minor vegetation trimming that is not expected to adversely affect the existing bushland values. Minor additional vegetation trimming or clearing is required in the south-eastern corner of the item parallel to Gore Hill Freeway along about 55 m of an informal walking path maintenance holes and install the bypass. This area has been previously disturbed by historical construction associated with Artarmon Reserve and the Gore Hill Freeway and is not representative of original bushland. The affected area is not visible from public pathways and is screened by the freeway, resulting in no visual impact to the heritage item. With vegetation removal limited to the minimum extent required, impacts to the Artarmon Heritage Conservation Area are expected to be minor.

The fabric of the sandstone culvert ('Bridge') will be drilled in to secure a scaffold for the bypass system. These impacts are assessed as minor with no visual impacts. The proposed works are unlikely to alter the existing heritage significance of the bridge. Provided that the below recommended management measures are implemented, the impacts should be minor.

No direct impacts are expected for other adjacent items including the Walter Burley Griffin Incinerator, 26 Dawson Street, Naremburn, the Dry-Stone Wall and Water Channel or the "Fatty" Dawson Ruins, provided the works remain outside of the SHR and LEP heritage curtilages.

Potential indirect impacts from vibration are assessed in the Section 6.1.5.

Aboriginal heritage

Existing environment

An [redacted] Aboriginal Due Diligence Assessment Memorandum (AHDD Memorandum) informs the assessment of potential impacts on Aboriginal heritage [redacted] (Appendix F).

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Redacted to protect sensitive Aboriginal heritage information

[redacted]

Figure 6-9 [redacted]



Figure 6-10

Potential impacts

Construction phase

.

[redacted]

Operational phase

No impacts to non-Aboriginal heritage and Aboriginal heritage are anticipated during operation.

Mitigation measures

With the implementation of the mitigation measures below, impacts to heritage can be adequately managed, and residual impacts are expected to be minor.

Table 6-7 Environmental mitigation measures — heritage

Mitigation measures
Do not make publicly available or publish, in any form, Aboriginal heritage information on sites / potential archaeological deposits, particularly regarding location.
Repeat the basic AHIMS search if it is older than 12 months. Conduct additional assessment if new sites are registered and could be impacted by the works.
Stop work if access requires vegetation impacts in unassessed areas, traversing rock outcrops, under or working in rock shelter/cave and/or walking over ground containing old shells is required.
If any Aboriginal object 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 site personnel must be inducted by a heritage specialist (or delegate) before starting work on site. The induction material will be developed by the Delivery Environmental Representative. It should include clear explanation of heritage constraints, go and no-go areas, measures to avoid impacts, stop work procedures, and contact details to obtain further heritage guidance if needed.
For access tracks in the Artarmon Heritage Conservation Area, keep vegetation clearing to a minimum by removing only scrub, weeds and young regrowth.
In areas overlapping [redacted], carry out surface works only and manage vegetation above ground without removing roots. Where possible, delineate work areas overlapping the PAD with barriers, ensuring no ground disturbance including vehicle use. If no existing ‘hardstand’ tracks are available then use a wheelbarrow hand carry equipment and walk to the work area.
No ground disturbance is permitted within the curtilage of [redacted] including vehicle use. Works are not currently proposed in the amended PAD curtilage, however if access over this area is required, use existing paved shared path where possible and clearly mark the access area without disturbing the ground. If no existing ‘hardstand’ tracks are available then use a wheelbarrow hand carry equipment and walk to the work area. Further investigations and an AHIP application will be required before works start if subsurface works are required within the PAD curtilage.

Mitigation measures
Fill holes drilled in the heritage listed Willoughby Road bridge culvert with colour matched fill after the bypass system is removed.
Consult with WCC in relation to the potential impacts to the heritage listed Willoughby Road bridge.
The listed Willoughby Road bridge will not be used or subjected to any loading during construction.
Undertake a structural engineering assessment (SEA) before drilling holes in the Willoughby Road heritage culvert to confirm no indirect vibration effects of the drilling. If indirect impacts are possible, engage a suitably qualified heritage specialist to provide further advice and approvals if required.
Where possible, clearly delineate any work areas with the potential to impact nearby non-Aboriginal heritage items.
Works will be confined to the existing disturbance footprint [redacted]

6.1.5 Noise and vibration

Existing environment

The existing noise environment is characteristic of an established urban setting, influenced by road traffic noise and other urban activity. Surrounding land uses are predominantly residential, interspersed with commercial premises, educational facilities, childcare centres, medical facilities, places of worship and recreational areas.

A Noise and Vibration Impact Assessment (NVIA) was undertaken for the proposal in May 2026 (refer to Appendix I). Background noise monitoring was undertaken at three representative locations across the proposal area (refer to Figure 6-11). Background noise levels vary across the proposal area. Areas near the Gore Hill Freeway have higher and more consistent ambient noise levels. Areas screened from major road corridors generally exhibit lower background noise levels, particularly during night-time periods.

The proposal area was divided into three Noise Catchment Areas (NCAs) summarised in Table 6-8.

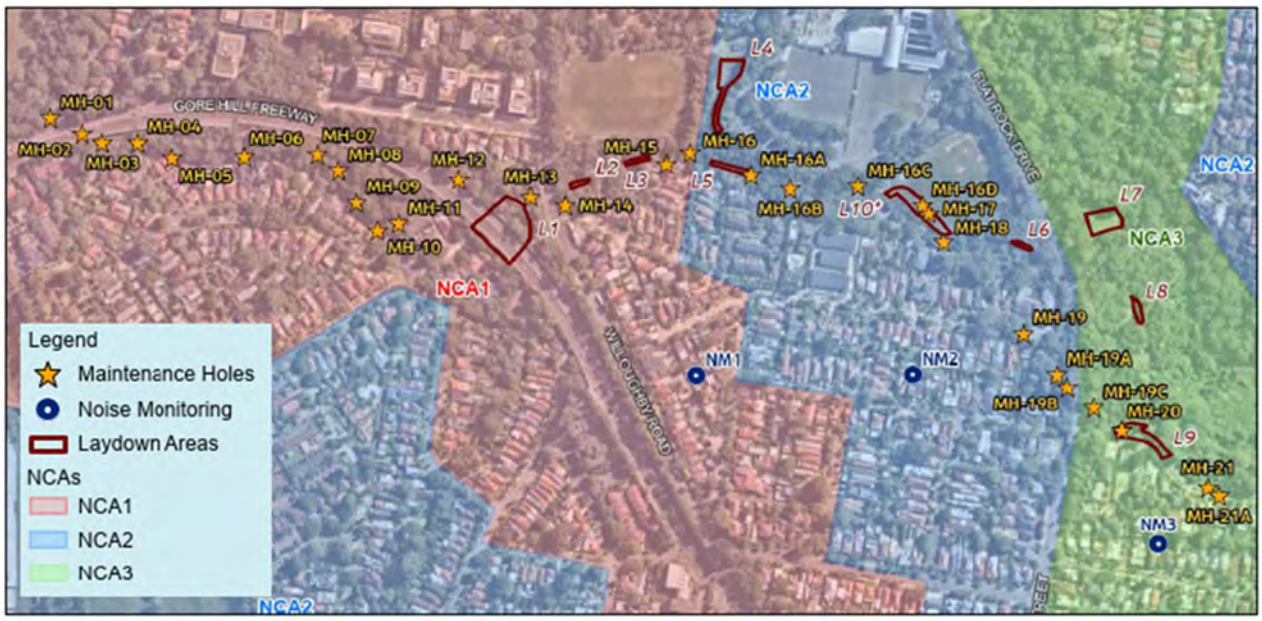


Figure 6-11 Noise monitoring locations and catchment areas

Table 6-8 Noise catchment areas

NCA ID	Expected noise environment – based on logger locations
NCA1	Characterised by receivers predominantly influenced by freeway traffic noise.
NCA2	This NCA is the quietest of the 3 catchments. Characterised by receivers shielded from freeway noise by intervening buildings. The eastern and western-most areas were assigned NCA2 as a conservative approach where no noise loggers were installed.
NCA3	Characterised by receivers whose ambient noise environment is not primarily influenced by Flat Rock Drive.

Noise loggers were installed at representative locations across the proposal area to establish Rating Background Levels (RBLs) and equivalent continuous noise levels (LAeq) for each NCA (refer to Table 6-9).

The proposal area contains a large number of noise-sensitive receivers within about 900 m of the proposed works. These receivers are predominantly residential dwellings, and some non-residential receivers including childcare centres, schools, medical facilities and recreational areas. Construction noise has the potential to be readily perceptible, particularly during evening and night-time periods. This is due to the density and distribution of receivers and the relatively low night-time background noise levels (refer to Table 6-9 and Figure 6-12).

Table 6-9 NCA ambient and background noise levels

Residential area	Rating Background Level – Day dB(A)	Rating Background Level – Evening dB(A)	Rating Background Level – Night dB(A)	Ambient Noise Level LAeq,15 min – Day dB(A)	Ambient Noise Level LAeq,15 min – Evening dB(A)	Ambient Noise Level LAeq,15 min – Night dB(A)
NCA1	43	43	33	56	50	46
NCA2	40	41	30	54	53	46
NCA3	43	42	35	52	55	45

Table 6-10 Sensitive receivers within 900 m of the proposal area considered in the model

Sensitive receiver classification	Number of receivers
Residential (NCA1)	565
Residential (NCA2)	2,375
Residential (NCA3)	449
Industrial	19
Commercial	192
Place of worship	0
Childcare	7
Educational	5
Hospital	10
Active and passive recreation[1]	25
Total	**3,647**

Note 1: Includes buildings where recreation activities take place and areas such as fields and parks

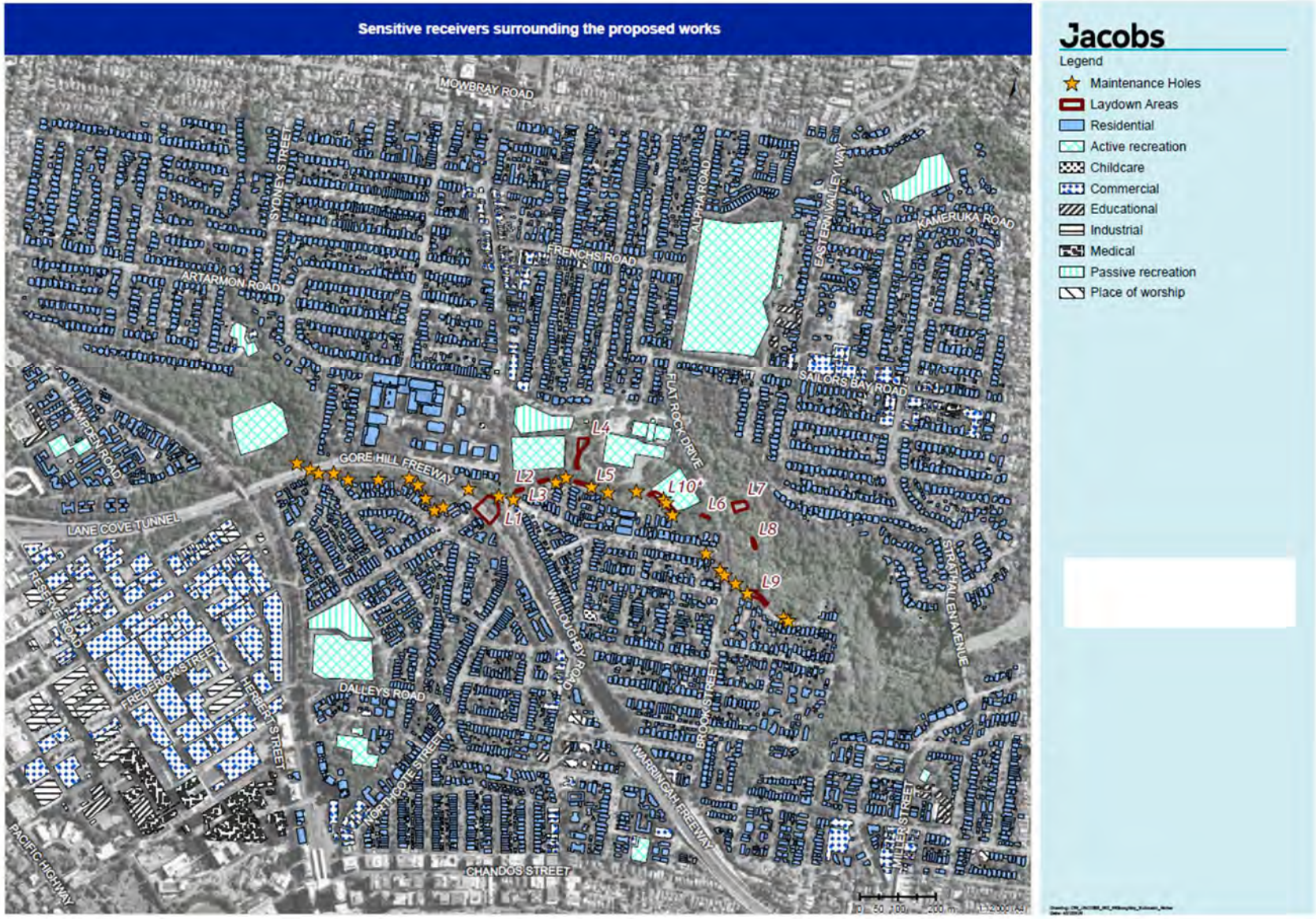


Figure 6-12 Sensitive noise receivers surrounding the proposal

Potential impacts

Construction noise

Construction traffic noise impacts were assessed using a screening approach in accordance with the *NSW Road Noise Policy* (RNP; DECCW, 2011). It considers whether construction-related traffic would increase existing road traffic noise levels by more than 2 dB(A). Construction traffic comprises predominantly trucks accessing the project compound, with anticipated vehicle movements well below existing traffic volumes on surrounding roads (refer to Section 6.1.8). Construction traffic is not expected to increase road traffic noise levels by more than 2 dB(A) or exceed the applicable RNP criteria for nearby roads. Accordingly, noise impacts from construction traffic are considered negligible and have not been assessed further.

Predicted noise levels for construction activities were assessed at all identified sensitive receivers and compared against the Noise Management Levels (NMLs) for each NCA (refer to Table 6-11). The anticipated duration of works is summarised in Section 3 under 'proposal timing'. This informs the expected duration of construction noise for each activity, noting multiple work fronts may operate concurrently.

The NVIA adopted a conservative approach, assuming that the plant used for each construction activity operates concurrently. The predictions are work-area specific and do not inherently account for the potential overlap of concurrent activities at multiple locations.

The maximum predicted LAeq,15min noise levels represent upper-bound conditions, with actual construction noise levels expected to be lower and more variable in practice. To assess the range of potential noise impacts, the following general scenarios were considered:

- **Typical average case**: construction works where most plant are used concurrently at reasonable duty (i.e. operating for a proportion of the time consistent with normal construction practice, rather than continuously at full power) and typical activity durations. This scenario is intended to estimate the average noise level likely to be experienced at a receiver. This scenario does not represent minimum noise levels, and lower levels are expected in practice.
- **Worst case**: Represents a short-duration period in which all relevant plant is assumed to operate near-continuously and concurrently, reflecting a rare, peak operating condition. It is not expected to persist for extended periods and is used to indicate the maximum short-term noise that could occur.

Construction stages and modelling scenarios were defined from inputs provided by the Delivery Contractor, and overall A-weighted sound power levels (SWLs) were predicted for each construction scenario. SWLs were estimated for the key noise-generating activities in each phase by compiling an equipment inventory (plant types and quantities) consistent with the planned work methods (refer to Table 6-12 for maintenance hole (MH) and laydown (L) works).

Activities will take place during standard hours, with some out of hours (refer to Section 3). Construction hours used in the NVIA include the following:

- **Standard Hours:** Monday–Friday 7:00 am–6:00 pm; Saturday 8:00 am–1:00 pm
- **OOHW Period 1 - Day**: Saturday 7:00 am; Saturday 1:00–6:00 pm; Sunday and public holidays 8:00 am–6:00 pm
- **OOHW Period 1 - Evening**: Monday–Saturday 6:00–10:00 pm
- **OOHW Period 2 - Night**: Monday–Saturday 10:00 pm–7:00 am; Sunday and public holidays 6:00 pm–8:00 am.

Where NML exceedances are predicted, these are generally temporary and localised to receivers close to active work fronts.

Table 6-11 Noise Management Levels

Receivers / receiver type	Standard hours	OOHW period 1-day	OOHW period 1-evening	OOHW period 2-night	Highly noise affected dB(A) at any time
Residential (nca1)	53	48	47	40	75
Residential (nca2)	50	44	45	36	75
Residential (nca3)	53	47	47	40	75
Industrial	75 (when in use)				
Commercial	70 (when in use)				
Educational/ childcare	55[1] (when in use)	-	-	-	
Medical	55[1] (when in use)				
Place of worship	55[1] (when in use)				
Active recreation	65 (when in use)		-		
Passive recreation	60 (when in use)		-		

Note 1: derived from internal noise nml, with a nominal 10 db transmission loss across a façade

For non-residential receivers, the mitigation measures outlined in Table 6-21 should be reviewed and applied on a case-by-case basis, tailored to the specific function and operating hours of the receiver.

Table 6-12 Noise emissions for each construction scenario

Scenario ID	Scenario	Period	Description	# Equipment and percentage of time used in any 15 min period	Ref SWL dB(A)
MH-S1	Typical Average Case	Standard Hours	Typical Dayshift Scenario	2 Air compressor (silenced) 50%	114
				2 Generator 50%	
				4 Hand tools 20%	
				3 bypass / over-pumping system 100%	
				1 Mini tanker 20%	
				1 Sewage tankering truck 20%	
				2 Tipper truck 30%	
				1 Cranes / telehandler 20%	
				1 Crane truck / flatbed truck 0%	

Scenario ID	Scenario	Period	Description	# Equipment and percentage of time used in any 15 min period	Ref SWL dB(A)
MH-S2	Worst Case	Standard Hours	Worst Case Dayshift Scenario	2 Air compressor (silenced) 80%	126
				1 Generator 100%	
				4 Hand tools 80%	
				3 bypass / over-pumping system 100%	
				1 Mini tanker 100%	
				1 Sewage tankering truck 60%	
				2 Tipper truck / bogie 100%	
				1 Concrete saw[1] 50%	
				1 Jackhammers[1] 50%	
				1 Excavators (5–25 t) 70%	
				1 Street sweepers 50%	
				1 Vacuum trucks 100%	
				1 Cranes / telehandler 20%	
				1 Crane truck / flatbed truck 40%	
MH-S3	Typical Average Case	All OOHWs*	Typical Nightshift Scenario	1 Air compressor (silenced) 100%	117
				2 Generator 100%	
				4 Lighting towers 100%	
				2 Hand tools 30%	
				3 bypass / over-pumping system 100%	
				2 Sewage tankering truck 50%	
				2 Vacuum trucks 50%	
				1 Crane / telehandler 30%	
				1 Tipper truck 20%	
				1 Excavator (5–25 t) 20%	
MH-S4	Worst Case	All OOHWs*	Typical Nightshift Scenario	3 Air compressor (silenced) 100%	126
				2 Generator 100%	
				4 Lighting towers 100%	

Scenario ID	Scenario	Period	Description	# Equipment and percentage of time used in any 15 min period	Ref SWL dB(A)
				2 Hand tools 40%	
				4 bypass / over-pumping system 100%	
				2 Mini tanker 40%	
				2 Sewage tankering truck 70%	
				1 Tipper truck / bogie 70%	
				1 Concrete saw[1] 50%	
				1 Jackhammers[1] 50%	
				1 Excavators (5–25 t) 90%	
				1 Street sweepers 50%	
				2 Vacuum trucks 50%	
				1 Cranes / telehandler 30%	
				1 Crane truck / flatbed truck 30%	
L-S1	Worst Case	All Periods*	Laydown (loading/unloading materials), staff amenities (night works) and onsite welding	1 Tipper truck / bogie 50%	114
				1 Excavators (5–20 t) 50%	
				2 Generator 100%	
				2 Welding machine 80%	
				4 Lighting towers 100%	
				1 Telehandler 50%	
L-S2	Worst Case	Standard Hours	Site establishment, laydown construction, access track construction	1 Belly dumper 100%	120
				2 Hand tools 50%	
				1 Tipper truck / bogie 50%	
				1 Concrete saw[1] 50%	
				1 Excavators (5–20 t) 70%	
				1 Street sweepers 40%	
				1, 7 t padfoot roller 60%	
				1, 12 t smooth drum roller 30%	

Scenario ID	Scenario	Period	Description	# Equipment and percentage of time used in any 15 min period	Ref SWL dB(A)
				1 Crane 20%	

* Excluding Sundays and public holidays

^ +5 dB penalty is applied

Standard Hours

During standard construction hours, exceedances of residential and non-residential NMLs are predicted for several scenarios. Highly noise-affected conditions (LAeq,15min ≥ 75 dB(A)) are predicted at a limited number of receivers immediately adjacent to maintenance holes and laydown areas where works are occurring, particularly during worst-case scenarios involving high-energy plant such as jackhammers, vacuum trucks, excavators and concrete saws (refer to Appendix E in Appendix I to view maps of affected receivers).

Table 6-13 Number of residential receivers predicted to experience noise greater than Standard Hours NML

Receiver type	Construction scenario	Highest predicted noise levels dB(A)	Receivers predicted to experience noise > Standard Hours NML (LAeq,15min)				Receivers[1] predicted to be 'Highly Noise Affected' (LAeq,15min 75 dB(A))[2]
			0 dB(A)	≤10 dB(A)	>10 to 20 dB(A)	>20 dB(A)	
Residential (NCA1)	MH-S1	96	387	121	37	20	17
	MH-S2	108	107	250	133	75	61
	L-S1	79	484	57	20	4	4
	L-S2	85	395	125	28	17	14
Residential (NCA2)	MH-S1	82	2096	240	28	11	7
	MH-S2	94	498	1424	404	49	33
	L-S1	78	2155	199	18	3	1
	L-S2	84	1582	705	79	9	4
Residential (NCA3)	MH-S1	83	393	36	12	8	7
	MH-S2	95	197	178	49	25	25
	L-S1	81	387	52	7	3	3
	L-S2	87	313	108	23	5	4

Note 1: lots that contain at least one impacted residential building.

Note 2: Highly Noise Affected is independent of NML and NCA, as it reflects an absolute noise level.

Table 6-14 Number of non-residential receivers predicted to experience noise greater than Standard Hours NML

Construction scenario	Non-Residential Receivers predicted to experience greater than Standard Hours NML [LAeq,15min]							
	Industrial	Commercial	Place of worship	Childcare	Educational	Medical	Active recreation	Passive recreation
MH-S1	0	1	0	1	0	0	3	0
MH-S2	0	1	3	3	6	0	5	2
L-S1	0	1	0	1	0	0	2	0
L-S2	0	1	0	1	0	0	4	1

Out-of-Hours Works – Period 1 (Day / Evening)

During OOHW Period 1, NML exceedances increase compared with standard hours, particularly for night-shift scenarios involving continuous plant operation, however impacts remain localised. Refer to Appendix F and Appendix G in Appendix I to view maps of affected receivers.

Table 6-15 Number of residential receivers predicted to experience noise greater than OOHW Period 1 – Day NML

Receiver Type	Construction Scenario	Highest predicted noise levels dB(A)	Receivers predicted to experience noise greater than OOHW1 NML [LAeq,15min]				Receivers predicted to be 'Highly Noise Affected' (LAeq,15min 75 dB(A))
			<5 dB(A)	>5 to 15 dB(A)	>15 to 25 dB(A)	>25 dB(A)	
Residential (NCA1)	MH-S3	99	341	140	58	26	22
	MH-S4	108	107	256	129	73	61
	L-S1	79	489	52	20	4	4
Residential (NCA2)	MH-S3	85	1726	593	38	18	9
	MH-S4	94	419	1418	484	54	33
	L-S1	78	2098	253	20	4	1
Residential (NCA3)	MH-S3	86	337	80	21	11	9
	MH-S4	95	157	200	63	29	25
	L-S1	81	373	66	6	4	3

Table 6-16 Number of non-residential receivers predicted to experience noise greater than OOHW Period 1 – Day NML

Construction Scenario	Non-Residential Receivers predicted to experience greater than OOHW1 NML [LAeq,15min]							
	Industrial	Commercial	Place of Worship	Childcare	Educational	Medical	Active Recreation	Passive Recreation
MH-S3	1	0	0	1	0	0	3	0
MH-S4	0	1	3	3	6	0	5	2
L-S1	0	1	0	1	0	0	2	0

Out-of-Hours Works – Period 2 (Night)

Night-time construction is the most noise-sensitive assessment period. Exceedances of night-time NMLs are predicted at many residential receivers and some non-residential receivers as shown in Table 6-17 and Table 6-18 respectively. Use of jackhammers and other noisy equipment is not expected to be continuous or frequently dominant at each work location. Actual maximum noise levels are therefore expected to be lower

and dependent on the specific plant in use. Refer to Appendix F and Appendix H of Appendix I to view maps of affected receivers.

Table 6-17 Number of residential receivers predicted to experience noise greater than OOHW Period 2 – Night NML

Receiver Type	Construction Scenario	Highest predicted noise levels dB(A)	<5 dB(A)	>5 to 15 dB(A)	>15 to 25 dB(A)	>25 dB(A)	Receivers predicted to be 'Highly Noise Affected' (LAeq,15min 75 dB(A))
Residential (NCA1)	MH-S3	99	126	249	123	67	22
	MH-S4	108	42	105	249	169	61
	L-S1	79	351	159	36	19	4
	MH-S3	85	457	1416	450	52	9
	MH-S4	94	73	478	1419	405	33
	L-S1	78	1160	1023	174	18	1
Residential (NCA3)	MH-S3	86	215	162	47	25	9
	MH-S4	95	29	212	145	63	25
	L-S1	81	273	127	40	9	3

Table 6-18 Number of non-residential receivers predicted to experience noise greater than OOHW Period 2 – Night NML

Construction scenario	Non-Residential Receivers predicted to experience greater than OOHW2 NML1– Night [LAeq,15min]							
	Industrial	Commercial	Place of worship	Childcare	Educational	Medical	Active recreation	Passive recreation
MH-S3	1	0	0	–	–	0	–	–
MH-S4	0	1	3	–	–	0	–	–
L-S1	0	1	0	–	–	0	–	–

Note: 1. Recreational receivers have no NML during Night time

In addition to the above exceedances, there is also the potential for some sleep-disturbance, with the greatest disturbance expected for those receivers located closest to proposed night-time works (refer to Appendix I of Appendix I to view maps of affected receivers that may experience sleep awakening reactions). Based on guidance provided by ICNG (2009), CNVG-R (2026) and RNP (2011), a night-time 'awakening reaction' level of LAmax 65 dB(A) has been used to identify the receivers where there is potential for sleep disturbance, to determine whether further consideration is required. However, this is only a screening exercise to determine the need for further assessment, as there are other factors to consider when assessing the extent of impact on sleep, including:

- how often noisy events occur at night

- more detail on the likely maximum noise levels at night.

Where exceedances are confirmed and are likely to occur for more than two consecutive nights, consideration of further assessment to identify additional measures, including respite periods and alternative accommodation is recommended (refer to Table 6-21). Some residual impacts may remain even after applying mitigation measures.

Cumulative impacts

Where activities are in close proximity, a cumulative increase of up to about 3 dB may theoretically occur. However, this is unlikely in practice, as concurrent works rarely involve identical high-noise plant operating simultaneously. The assessment already adopts conservative assumptions by modelling all plant operating concurrently (refer to Table 6-12).

Where different construction scenarios occur concurrently, the louder activity is expected to dominate noise levels and will not materially increase the predicted maximum noise levels.

Cumulative construction noise impacts are expected to be negligible. This is primarily because predicted noise levels are reported in 5–10 dB impact bands, within which any potential cumulative increase would be unlikely to change the impact classification. Where receivers may be subject to comparable influence from multiple concurrent works, it is recommended that mitigation measures be selected and verified through attended site monitoring, with controls refined as necessary.

Vibration impacts

The proposal has the potential to impact buildings, heritage structures and human receivers when using vibration-intensive equipment such as vibratory rollers and excavators. Table 6-19 describes minimum setback distances to reduce the risk of vibration impacts. For heritage-listed or otherwise particularly sensitive structures, supplementary setbacks derived from DIN 4150-3 (consistent with the Construction and Maintenance Noise Estimator tool developed by TfNSW, CMNE(R) Tool) have been applied to ensure a conservative allowance for cosmetic damage protection.

Table 6-19 Recommended setback distances

Plant	Rating / description	Residential and light commercial (Ref: BS7385-2: 1993)	Heritage items (Ref: DIN 4150, Group 3)	Human response (Ref: NSW EPA guidelines)
Vibratory roller	<50 kN (typically 1–2 tonne)	5 m	14 m	15 m to 20 m
	<100 kN (typically 2–4 tonne)	6 m	16 m	20 m
	<200 kN (typically 4–6 tonne)	12 m	33 m	40 m
	<300 kN (typically 7–13 tonne)	15 m	41 m	100 m

Plant	Rating / description	Residential and light commercial (Ref: BS7385-2: 1993)	Heritage items (Ref: DIN 4150, Group 3)	Human response (Ref: NSW EPA guidelines)
	>300 kN (typically 13–18 tonne)	20 m	54 m	100 m
	>300 kN (>18 tonne)	25 m	68 m	100 m
Any roller with vibration OFF		1 m (nominal)	1 m (nominal)	1 m (nominal)
Small hydraulic hammer	300 kg – 5 to 12 tonne excavator	2 m	5 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18 tonne excavator	7 m	19 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 tonne excavator	22 m	60 m	73 m
Jackhammer	Handheld	1 m (nominal)	2 m	3 m
Asphalt paver	Vogele Super 1800-3	1 m	–	–
Large excavator with bucket		5 m	5 m	10 m

Structurally sound buildings such as non-heritage structures, relatively modern residential dwellings, and light commercial premises are within the recommended working distances for cosmetic building damage for vibratory roller (in vibratory mode) and excavator with bucket operation.

Some vibration-sensitive structures, including the heritage listed Walter Burley Griffin Incinerator and Willoughby Bridge, may be within recommended setback distances (refer to Table 6-20). Provided the vibratory roller is operated with vibration disabled (non-vibratory mode), additional vibration measures at the structures identified in Table 6-21 are not considered necessary. However, as detailed condition assessments are not yet available, the vulnerability of these structures to vibration remains uncertain.

Human response to intermittent vibration depends on the accumulated vibration energy over the day and night assessment periods. Accordingly, the distances in Table 6-19 are indicative only and influenced by the actual duration of exposure. Where elevated vibration levels persist for a substantial portion of an assessment period at receivers within these indicative distances, the recommended vibration targets may be exceeded, potentially leading to complaints.

With the implementation of mitigation measures in Table 6-21, impacts from vibration are expected to be minor.

Table 6-20 Minimum setback distances for vibration-sensitive heritage structures

Equipment	Construction stage	Work area	Heritage ID	Heritage listing	Minimum setback distance (m)
Vibratory roller <300 kN (typically 7–13 tonne) with vibration ON	LS2	Laydown area L4	I228	Walter Burley Griffin Incinerator	41
		Laydown area L1	I232	Bridge	41
		Laydown area L2	I232	Bridge	41

Mitigation measures

With the implementation of the mitigation measures below, impacts to noise and vibration can be adequately managed. No noise or vibration impacts are expected during operation.

Table 6-21 Environmental mitigation measures — noise and vibration

Noise and vibration
Clarify the classification of non-residential receivers through community engagement, especially where potential NML exceedances are modelled. This should include verification of key premises characteristics, such as operating hours, business type, and occupancy patterns, to ensure the assessment accurately reflects receptor sensitivity and informs appropriate mitigation responses.
OOHW must comply with the EPA Construction Noise Guideline (Draft, 2021), including scheduling work and deliveries during standard daytime working hours of 7am to 6pm Monday to Friday and 8am to 1pm Saturday where possible. 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 • Noise Policy for Industry (EPA, 2017). All reasonable and feasible noise mitigation measures should be justified, documented and implemented on-site to mitigate noise impacts.
Induct staff and contractors on the noise and vibration mitigation measures, approval conditions, permissible hours, sensitive receiver locations, parking and loading arrangements and good practice behavioural measures (e.g. avoiding shouting, radios, slamming doors, turning off plant when not in use).
Incorporate standard daytime hours noise management safeguards into the CEMP, including but not limited to: Identify and consult with the potentially affected residents prior to commencement of works. This should: — describe the nature of works, the expected noise impacts, approved hours of work, duration, complaints handling and contact details — determine need for, and appropriate timing of respite periods (eg times identified by the community that are less sensitive to noise such as mid-morning or mid-afternoon for works near residences). • Attended monitoring at the start of construction.

Noise and vibration

- Implement a noise complaints handling procedure and undertake short-term noise monitoring following complaints.
- 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, including lower-noise alternatives, electric or hydraulic plant where possible, and minimum size and power for the task).
- 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).
- Use natural landforms/ mounds or site sheds as noise barriers (construct temporary noise barriers or hoarding between works and receivers if required).
- Schedule noisy activities around times of surrounding high background noise (local road traffic or when other noise sources are active).
- Avoid concurrent operation of multiple noisy plant.
    - Handle material carefully (e.g. do not load from height).

Prior to and during construction, update the CEMP as required to reflect changes to noise and vibration management measures.

Night works will be limited to four consecutive nights to reduce prolonged impact to nearby sensitive receivers. Aside from works requiring continuous shifts, these activities will occur between 7 pm to 5 am. For these night works the Delivery Contractor will:

- 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.

If we are doing activities with special audible characteristics (e.g. high frequency, tonal) or vibration-generating plant (e.g. jack/rock hammering, vibratory rolling):

- undertake in ≤3-hour blocks followed by ≥1-hour respite.
- for no more than two consecutive nights per NCA within a 7-day period unless approved.

If we are doing activities that exceed the 65 dB LAmax screening criteria after 10 pm for more than two consecutive nights:

- consider further more detailed assessment of sleep disturbance to identify additional measures, including respite periods and alternative accommodation.

If night works or works on Sundays are needed (beyond those identified in this REF), the Delivery Contractor would:

- justify the need

Noise and vibration

- 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 /Sunday work (not emergency works))
- notify all potentially impacted residents and sensitive noise receivers not less than one week prior to commencing work
- seek approval from the Sydney Water Project Manager in consultation with the environment and communications representatives.

Apply the mitigation measures below where the assessment confirmed NML exceedances (refer column 4 below).

Construction hours	Receiver perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
Standard hours	Noticeable	5 to 10	0	–
	Clearly audible	10 to 20	< 10	–
	Moderately intrusive	20 to 30	10 to 20	N, V
	Highly intrusive	> 30	> 20	N, V
	Highly noise affected	N/A (noise level > 75 dB(A))	–	N, V, PC, R0
OOHW Period 1	Noticeable	5 to 10	< 5	–
	Clearly audible	10 to 20	5 to 15	N, R1, DR
	Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
	Highly intrusive	> 30	> 25	V, IB, N, R1, DR, PC, SN
OOHW Period 2	Noticeable	5 to 10	< 5	N
	Clearly audible	10 to 20	5 to 15	V, N, R2, DR
	Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
	Highly intrusive	> 30	> 25	AA, V, IB, N, PC, SN, R2, DR

Note:
AA = Alternative accommodation
V = Validation of predicted noise levels
IB = Individual briefings
N = Notification box drops
PC = Phone calls
SN = Specific notifications
R1 = Respite period 1
R2 = Respite period 2
DR = Duration respite
RO = Project specific respite offer

During construction, undertake attended vibration measurements to confirm vibration levels and assess potential impacts where minimum setback distances listed in Table 6-19 cannot be achieved.

Monitor compliance with the recommended vibration levels in DIN 4150-3 1999: Structural Vibration – Part 3; Effects of vibration on structures. Where monitoring indicates elevated vibration levels, review and adjust equipment selection and/or construction methodologies as necessary to minimise potential impacts. Where the monitoring identifies exceedances in the relevant criteria, or where impacts are identified, identify additional management measures will be identified and implemented to appropriately manage impacts.

Prior to and during construction, undertake the following vibration mitigating activities:

- consider less vibration intensive methodologies where practicable and use only the necessary sized and powered equipment

Noise and vibration

- schedule the use of vibration-causing equipment at the least sensitive times of the day (wherever possible)
- sequence operations so that vibration-causing activities do not occur simultaneously
- locate high vibration sources away from sensitive receivers.

In relation to vibration impacts to the heritage items listed in Table 6-20, any use of the vibratory roller within minimum setback requirements must be done so with vibration disabled (non-vibratory mode).

6.1.6 Air and energy

Existing environment

The proposal is in a primarily residential and commercial area. Potential sensitive receivers include the following:

- residents
- users of the surrounding road network
- recreational users (i.e. sports fields, parks, shared paths)

Existing air quality in the surrounding area is expected to be generally good, based on extensive areas of native vegetation and land designated for environmental conservation. NSW Environment and Heritage air quality monitoring at Cammeray, about 1.5 km east is consistently rated as 'good'. Traffic associated with the Lane Cove Tunnel, Gore Hill Freeway and nearby roads, as well as the Artarmon industrial precinct south-west of the proposal area, may locally affect air quality.

Potential impacts

Construction phase

The proposal has the potential to impact air quality from:

- dust (e.g. from excavation, stockpiles, vegetation clearing, construction vehicles on unsealed surfaces, spoil transport. The dust may be affected by historical contamination from Bicentennial Reserve)
- emissions from construction vehicles (e.g. waste and spoil transport workers' light vehicles) movements for the transport of materials, waste, and personnel to and from site
- emissions from generators
- localised odour (e.g. from open maintenance holes, pipeline cleaning, bypass system operation).

The most sensitive receivers are likely to have maintenance holes on or near their land. Other sensitive receivers include pedestrians and cyclists using the shared path and nearby recreational users.

Localised odour impacts may occur during MH rehabilitation and operation of the temporary bypass, where wastewater is exposed or disturbed. These impacts would be short-term and confined to the immediate work areas. With standard controls and the temporary nature of the works, the risk of noticeable odour at nearby receivers is considered minor.

Landfill gas generated during historical waste decomposition is expected to have largely dissipated. However, landfill gas risks will be monitored in accordance with the mitigation measures in Section 6.1.1.

Exhaust emissions from construction plant, equipment and vehicles are expected to be minor and are unlikely to result in noticeable air quality impacts given the existing surrounding urban land uses and road corridors.

Where practicable, dust-generating activities will be minimised, especially if stockpiling fill within the former landfill extent (refer to Figure 6-1 to Figure 6-2). This can be managed by the proposed mitigation measures and compliance with the EMP. The progressive nature of construction along the pipeline alignment will limit dust impacts at any single location, and these impacts are temporary. Restoration activities, including backfilling, will also occur progressively to reduce the duration of dust exposure and air quality impacts.

Energy use during construction will primarily relate to fuel consumption by vehicles, machinery and plant. Due to the staged delivery of the works and the limited extent of construction activities, overall energy use is expected to be minimal. Temporary energy requirements, such as those associated with site compounds, lighting and tools, will be met through grid connections and generators in accordance with standard construction practices and will not strain existing energy supply.

Operation phase

No operational air and energy impacts are expected.

Mitigation measures

With the implementation of the mitigation measures below, potential impacts to air and energy during construction and operation can be adequately managed. Residual impacts are expected to be minor and temporary.

Table 6-22 Environmental mitigation measures — air and energy

Mitigation measures
Use alternatives to fossil fuels where practical and cost-effective.
Track energy use as per SWEMS0015.28 Contractor NGER template.
Minimise the potential for odours (e.g. minimise the number of open access chambers, close maintenance holes overnight.)
Ensure odour control measures are available and ready to use during the works.
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.

Mitigation measures

- Modify site layout (place stockpiles away from sensitive receivers).
- Vegetate exposed areas using appropriate seeding.
- Comply with any dust-related measures in the EMP for Bicentennial Reserve.

Cover all transported waste.

6.1.7 Waste and hazardous materials

Existing environment

Based on a review of historical information and former environmental investigations, the key source of contamination within the proposal area is at the site of the former landfill and incinerator. Key contaminants are discussed in more detail in Section 6.1.1. Other waste contaminants may be present in the proposal area, which have not been detected during environmental site investigations. Landfill contaminants may exist in small pockets, layers, blocks or may be diffuse through the waste materials.

Since the 1930s, the proposal area overlapping the landfill extent has undergone significant modification because of the area's former use as a landfill. Over the course of about 40 years (from 1930 to about 1970), substantial landfilling and waste incineration on-site has resulted in the clearing and repurposing of almost the entire native bushland. The extent of the former landfill is most clearly defined in the 1965, 1970 and 1978 historical aerial photographs (refer to Figure 6-1). Following completion of the landfill operations, the site was subject to extensive additional filling and landscaping/recontouring between 1985 and 1988, with an estimated 192,500 m^3 of clean fill imported to the site.

Potential impacts

Construction phase

The potential impacts from the proposal relating to hazardous materials are considered in Section 6.1.1. The proposal will potentially generate the following wastes to manage:

- excavated waste material (about 200 m^3)
- general construction waste (e.g. concrete, paper, plastic and metal)
- green waste (e.g. cleared vegetation)
- domestic waste (e.g. food scraps, plastic and paper containers generated by workforce)
- contaminated materials (about 40 m^3 of contaminated material)
- wastewater contaminated silt/debris from cleaning the pipeline.

Excess spoil may be generated during excavation and trenching. Spoil is likely to be classified as general solid waste (non-putrescible) and excavated natural material. However sampling and analysis will be required. If asbestos-containing material is encountered at the surface or within soils during construction, soils excavated within the area would be classified as 'Special Waste – Asbestos Waste'.

Green waste material will be reused or mulched on site where possible. Material removed from the pipeline during cleaning will be disposed to a facility licenced to accept it.

The contractor will seek opportunities to reduce, recycle and reuse materials. This will be documented in the Waste Management Plan or CEMP. Any waste not able to be reused or recycled will be temporarily stockpiled or taken directly offsite to a facility licenced to accept the waste. All construction waste will be classified and disposed of at an appropriately licensed facility.

The impact of construction waste generated by the proposal is expected to be minor.

Operation phase

The proposal will generate minimal waste from ongoing routine maintenance activities.

Mitigation measures

With the implementation of the mitigation measures below, impacts to waste and hazardous materials can be adequately managed, and residual impacts are expected to be minor.

Table 6-23 Environmental mitigation measures — waste and hazardous materials

Mitigation measures
Prepare a Waste and Resource Recovery Plan (WRRP) as part of the CEMP to appropriately manage and classify any materials including soils, construction/demolition wastes and associated stockpiles. The plan will be prepared by the Delivery Contractor (or nominated environmental consultant) and approved by the Sydney Water Project Manager in consultation with the Environmental Representative and the Contamination and Hazardous Materials team. The WRRP should include the following: • expected waste types and their location • delineation of waste /resource types including identification of likely vertical and lateral extents (where warranted) • visual monitoring of materials during excavation and measures to be undertaken to prevent co-mingling / cross-contamination of waste / resource types • ex-situ waste and resource recovery classification program, including timing relative to project / excavation phases as well as proposed hold points • waste minimisation and resource recovery methodologies (including consideration of onsite reuse or management if contaminated) • roles and responsibilities in relation to stockpile and material management and monitoring program • proposed onsite reuse locations and reuse methodology (if applicable) • proposed offsite reuse, offsite recycling and / or offsite disposal locations / facilities • legislative compliance requirements • consideration of future maintenance • restoration.
Manage waste in accordance with relevant legislation and maintain records to show compliance e.g. waste register, transport and disposal records. Record and submit SWEMS0015.27 Contractor Waste Report.
Provide adequate bins for general waste, hazardous waste and recyclable materials.

Mitigation measures
Minimise stockpile size and ensure delineation between different stockpiled materials.
Minimise the generation of waste and sort waste streams to maximise reuse/recycling in accordance with the legislative requirements.
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 where appropriate. Recycle soils at a licensed soil recycling facility or dispose at an appropriately licenced landfill facility.
Prevent pollutants from escaping including by covering skip bins.
Dispose excess vegetation (non-weed) that cannot be used for site stabilisation at an appropriate green waste disposal facility.
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 the Contamination and Hazardous Materials team propertyenvironmental@sydneywater.com.au).

6.1.8 Traffic and access

Existing environment

Surrounding road network

The proposal traverses under Gore Hill Freeway, Willoughby Road and Flat Rock Drive. Gore Hill Freeway and Willoughby Road are State Roads under the control of TfNSW, and Flat Rock Drive is a Regional Road. Willoughby Road and Flat Rock Drive provide a key east-west connection between Epping Road and Lane Cove Road to the west and several large roads to the north and east including the Pacific Highway, Warringah Road and Military Road.

Vehicle movements on the surrounding road network are primarily associated with local residents, businesses and buses. Traffic volumes on local streets are generally low, with peaks during typical commuter periods, while higher volumes occur on regional and classified roads such as Willoughby Road and the Gore Hill Freeway.

The Willoughby South road network predominantly supports north–south movements, with local east–west connections. Willoughby Road functions as the key arterial corridor linking residential areas with surrounding centres and has been identified as a crash hotspot, with a higher concentration of incidents compared to other roads (Cardno 2020).

Access

Access to the proposal will be required for each individual work site (e.g. at each MH for rehabilitation and lining works) and to each of the construction compounds and laydown areas. The main vehicle access points for the proposal would be:

- Willoughby Road/Garland Road, at the signalised intersection

- Flat Rock Drive
- Garland Road, at the cul-de-sac
- Market Street East/Dawson Street, toward the shared path
- private properties (MH04-MH11 and MH15).

Parking

There are no parking lanes within the proposal along Willoughby Road and Flat Rock Creek Drive. Light vehicle public parking is available nearby Artarmon Reserve and the Bicentennial Reserve Playground. There is a carpark for Willoughby Leisure Centre and the netball courts. Informal grass and gravel parking areas are along surrounding local roads including Garland Road, Chelmsford Avenue, Market Street East and Dawson Street.

Active transport

The shared path generally follows the existing pipeline alignment and is within the Flat Rock Creek gully. The path is heavily used by cyclists and pedestrians. It has defined cycling lanes and paved pedestrian sections extending east to west along the proposal from Artarmon Reserve to Flat Rock Gully Reserve to the east of Flat Rock Creek Drive near Dawson Street.

Public transport

There is a bus stop at Willoughby Rd near the Garland Rd intersection with a high frequency of bus traffic as the road is a main thoroughfare from the Lower North Shore suburbs to both the CBD and Northern Beaches.

Potential impacts

Construction phase

Traffic and access

The proposal methodology, timeframe and duration informs the potential traffic impacts (refer to Section 3 description). As construction involves daytime, night-time and continuous shift activities, the timing of peak traffic movements will vary throughout the construction period. Deliveries may occur during both daytime and night-time works. Static plant and equipment will generally be mobilised and demobilised at the start and end of construction.

We expect up to 5 work crews will be present on site across different work sites during peak construction periods. The proposal requires the use of up to 10 light vehicles and 4 to 6 heavy vehicles at any one time to transport workers and equipment, as well as up to 3 cranes or hiab trucks. Vehicle movements for non-peak relining activities and for the MH rehabilitation works are estimated to be about 5-6 per shift. We expect up to 5 light vehicles and 4 heavy vehicle movements per hour at peak time e.g. for site set up and for relining activities. These are likely to be spread across a larger area, rather than being concentrated on one particular transport route. The exception to this is the movement in and out of the two main compounds next to the Willoughby Leisure Centre, and beneath the Gore Hill Freeway overpass. However, use of the laydown areas along the proposal area will reduce the movements in and out of the main compounds. This, combined with the availability of several major transport routes with greater capacity for heavy and light

vehicles (including Willoughby Road and Flat Rock Drive), and the scheduling of night-time works to avoid peak usage periods, would result in minor and temporary traffic impacts on the local road network.

Vehicle movements are not expected to impact existing traffic noise (refer to Section 6.1.5). Site compounds are outside of existing public car park areas to minimise disruption to public movements in and out of these areas.

The proposal requires some partial road closures and continuous shifts at some locations of up to 56 hours. The most challenging traffic and pedestrian access interfaces expected during construction will be at the Willoughby Road/ Garland Road intersection, Flat Rock Drive, and Market Street East/Dawson Street.

The Willoughby Road and Garland Road intersection involves out-of-hours and continuous shift arrangements. This includes temporary intersection closure, lane closures on Willoughby Road and Garland Road, and the contraflow traffic arrangements to maintain northbound and southbound access. Detours will be implemented where required.

Flat Rock Drive requires lane closures to support enabling works, materials handling and lining activities associated with multiple maintenance holes. These works will include out-of-hours works and continuous shift arrangements, with contraflow traffic management to maintain continuous access in both directions.

The Garland Road cul-de-sac will be temporarily closed during enabling, lining, and restoration works to facilitate access, materials handling, and partial MH demolition and construction. Temporary closures will also occur along Market Street East and Dawson Street to support lining works and the construction and removal of the temporary bypass system. These works will involve out-of-hours works and continuous shift arrangements.

Road closures will occur during non-peak periods at night time and weekends. Reduced speed limits will apply during works, and detours and traffic controllers will be used as necessary to maintain local access and minimise disruption. Resident access will be maintained throughout closure periods. The Delivery Contractor will liaise with WCC and TfNSW to accommodate traffic and access requirements and obtain ROLs or TMPs.

Due to construction activities and partial road closures associated with works at MH04–MH11 and MH15, temporary restrictions to residential access may be required at:

- 17 Grandview Street
- 25A Olympia Road
- 15 Olympia Road
- 13 Olympia Road
- 7 Olympia Road
- 3 Olympia Road
- 1 Olympia Road

Where changes to private property access are required, affected property owners and residents will be consulted before the start of construction. Notifications will advise of upcoming works in their area and outline road closures, detours and expected construction vehicle movements. Access arrangements will be managed on a case-by-case basis. In some circumstances, pre-construction access plans will be agreed with affected property owners.

Parking

Parking associated with construction shifts will generally occur on surrounding residential streets. Heavy vehicles will park on residential streets during shifts and be stored in laydown or compound areas, or off-site, outside construction hours. Trucks delivering equipment and involved in night works would use existing roads and car parks selected as designated parking zones to minimise impacts on road users. Designated parking zones are not yet known.

During peak sporting activities, traffic and parking can be oversaturated in the local area with limited street parking available. Traffic control measures will be put in place to maintain access to private properties. Since these restrictions will be temporary and only last for a few consecutive days for each area, this will have a minor impact on the community and visitors.

Active transport

The proposal has been designed to minimise impacts on path users by limiting the number of temporary bypass crossings and locating site compounds within previously cleared areas, away from established parking areas and residential streets.

To minimise excavation, the bypass system will be installed aboveground where it does not impede access to existing shared paths, however some pedestrian and cyclist detours will be required around sections of the bypass and other work sites. Where disruption is unavoidable, sections of the bypass will be installed belowground via open trenching. This will result in temporary impacts to users of the shared paths while the bypass is being installed/dismantled, particularly in the following areas:

- adjacent to the shared path between the Gore Hill Freeway and Dawson Street, including at MH12, MH13 and MH15–MH18
- shared path at the footpath intersection near the end of Gaza Road, adjacent to MH16, during a 56-hour continuous construction shift for lining and curing works
- shared path on Market Street East and Dawson Street over 5 weekday night shifts to install the temporary bypass connection to MH21A.

Following completion of the lining and bypass works, these areas will be reinstated to allow for continued use.

Ongoing traffic management will be required to safely manage pedestrian movements at worksite access points and to maintain cyclist detours within the reserve. Pedestrian traffic controllers will be present for the duration of construction to manage vehicle movements along the shared path and to ensure pedestrian and cyclist safety within the reserve.

Public transport

There may be temporary impacts to bus services due to partial road closures (e.g. the bus stop on the corner of Willoughby Rd and Garland Rd may be relocated during lining works at the intersection). However, road closures will occur during non-peak periods at night time and weekends, minimising bus service impacts.

Given the limited number of large vehicles, the temporary duration and shift based nature of construction, and the capacity of the surrounding road network with several larger roads servicing the area, traffic and access impacts are anticipated to be minor.

Operation phase

No traffic and access impacts are expected during operation.

Mitigation measures

With the implementation of the mitigation measures below, impacts to traffic and access can be adequately managed, and residual impacts are expected to be temporary and minor.

Table 6-24 Environmental mitigation measures — traffic and access

Mitigation measures
Prepare a Traffic Management Plan (TMP) in consultation with the relevant traffic authority. Meet NSW Roads and Maritime Service's Traffic Control at Worksites Manual v5 requirements for TfNSW roads. The Delivery Contractor will obtain a ROL from TfNSW, including if works are within 100m of traffic signals when construction commences. Present the TMP to the LTC before construction commences.
The Delivery Contractor will obtain ROLs and related approvals from the relevant authorities.
Develop management measure to minimise traffic impacts near residential properties, schools and businesses by consulting with them (e.g. no major materials deliveries at school drop off or pick up times etc).
Consult with the relevant traffic authority about managing impacts to pedestrian traffic, signposting, meters, parking, line-marking or if traffic control or pavement restoration is required.
Erect signs to inform road users of the proposed works and any temporary road closures or detours.
Ensure work vehicles do not obstruct vehicular or pedestrian traffic, or private driveway, public facility or business access unless necessary and only if appropriate notification has been provided.
Schedule construction traffic movements outside of peak road network periods (6:30 am – 10 am and 3 pm – 7 pm) where possible
Schedule road closures during non-peak periods at night time and weekends.
Site compounds will be located outside of existing car park areas to minimise disruption to public access and parking.
Minimise parking of construction vehicles at recreational facilities including Willoughby Leisure Centre, particularly during sport events or other periods of high use.
Use signage to alert pedestrians of heavy vehicle access. Traffic controllers may be required in key conflict areas (e.g. at the shared path during periods of higher use).
After site sign-on procedures, heavy vehicles and trucks will be directed straight to the active work sites to minimise unnecessary circulation through surrounding areas.
As agreed with WCC, existing public car parks will not be used for routine construction parking; however, limited use by work vehicles may occur during non-peak periods, such as for crew vehicles or specialist equipment (e.g. jetting trucks required for lining works near the baseball field).

Mitigation measures
Contractors will avoid parking within Flat Rock Gully Reserve areas during peak community usage periods, except within designated construction compounds.
Encourage the use of public transport and carpooling workers to construction areas to minimise additional traffic.
Minimise use of Willoughby Leisure Centre car park. If any access is required for heavy vehicles, prior notice will be provided and approval will be sought from the Leisure Centre.
Construction scheduling will take into account peak traffic-generating activities, such as organised sporting events on Friday evenings and Saturdays during the winter season.
Track matts will be set up around the work area during temporary widening of the shared path and Flat Rock Gully walking track with traffic controllers present to assist with safe access.
Clear signage will be provided to inform the community of any temporary changes to bus stop locations at the intersection of Willoughby and Garland Road for lining works.
Ongoing consultation and communication with TfNSW will be maintained throughout the Gate 0 process.

6.1.9 Social and visual

Existing environment and potential impacts

The land uses surrounding the proposal comprise a mix of low-to-medium density residential areas, public recreation spaces, environmental conservation land, and infrastructure.

Local reserves and the creek provide recreational, environmental, cultural and aesthetic value to the local community. These areas accommodate a range of facilities, including the Willoughby Leisure Centre, a swimming school, sporting fields and courts, a baseball field, playgrounds, shared paths and walking tracks.

The proposal area and surrounding area also contain several heritage items, including the heritage-listed incinerator, which operates as a shared community arts space and café.

Overall, the proposal area comprises and is surrounded by a combination of natural and built environments that contribute to the area's social and visual amenity.

Potential impacts

Construction phase

Social

The potential impacts to social amenity associated with noise, vibration, traffic, access and air quality are assessed in earlier sections.

Other potential social impacts are associated with temporary reduction in available recreational facilities and some shared access paths during construction. The proposal requires use of sections of parks and other recreational areas for construction compounds, laydown areas and other small work sites. These areas were selected as they are already cleared of native vegetation and would minimise biodiversity impacts.

The compounds and laydown areas may not occupy entire recreational areas, and remaining portions of these areas can still be used. In addition, impacts will be temporary, and disturbed areas will be progressively rehabilitated as works are completed. Work scheduling will consider sporting groups to ensure works and detours are communicated to affected groups, and to identify the timing of key sporting activities. Works in the Flat Rock Creek Baseball field will also be restricted during the baseball season, with intrusive excavation works to be undertaken only during the off-season to minimise impacts.

Visual

Temporary impacts to visual amenity are expected during construction from plant and machinery, scaffolding, laydown and site compounds, the bypass system, traffic management infrastructure and lighting. There may be mid to long-term visual impacts from vegetation removal or trimming.

The area is valued for outdoor recreation natural landscape, and these temporary changes may affect visual amenity for residents, visitors and recreational users. This may result in short-term changes to use, sense of place and visitation, especially for nearby sports clubs (Willoughby United Netball Club and the North Sydney Junior Baseball Club).

Compounds and site facilities will be in existing cleared areas, and the bypass system will be above ground where practicable. While this approach will result in visible surface infrastructure and may temporarily restrict access to some public areas, it avoids more intensive ground disturbance and reduces the potential for longer-term environmental impacts.

After finishing Phase 1, the bypass system, equipment and laydown and storage areas will be relocated as works progress. Backfilling and site restoration will also be undertaken progressively rather than at the end of the construction period. This staged approach will reduce the duration and extent of visual impacts at any one location.

The proposal will be delivered in two consecutive phases, with construction activities undertaken progressively. This staged approach will limit the duration of impacts at any single location, with disruptions to sensitive receivers typically limited to short periods, at maximum only for a few days at a time. With the implementation of the proposed mitigation measures, impacts on social amenity are expected to be temporary and minor.

Operation phase

The proposal will not require any new permanent above-ground structures and will not result in long-term changes to the visual character of the surrounding environment. Upon completion of construction, all temporary facilities will be decommissioned and the site will be restored to pre-construction conditions.

Vegetation affected by construction will be reinstated through biodiversity offset replanting, with trees and vegetation expected to regrow progressively during operation. Although replanting may not occur in identical locations, it will take place within the same general area, ensuring that the visual character of the natural environment is restored over time.

In the long term, the proposal will improve wastewater network capacity and enable more efficient maintenance activities, reducing the need for disruptive future works.

Mitigation measures

With the implementation of the mitigation measures below, impacts to social and visual impacts can be adequately managed during construction and operation, and residual impacts are expected to be minor and temporary.

Table 6-25 Environmental mitigation measures — social and visual

Mitigation measures
Undertake works in accordance with Sydney Water Communications policies and requirements including: • Notify impacted residents and businesses. • Consult with affected sporting clubs (Willoughby United Netball Club and the North Sydney Junior Baseball Club) prior to site mobilisation and throughout construction to confirm the timing of key weekday and weekend activities. • Notify relevant cycling groups, including Bike NSW, of planned detours to ensure broader awareness beyond the immediate local area. • Notify adjacent councils – North Sydney Council, Lane Cove Council and Ku-ring-gai Council as requested by WCC. • Erect signs to inform the public on nature of work. • Treat community enquiries appropriately.
Access to the Flat Rock Baseball Field during the baseball season will be assessed on a shift-by-shift basis, in consultation with WCC. No intrusive excavation works are to be undertaken during the baseball season.
Restore work sites to pre-existing condition or better.
Minimise visual impacts (e.g. retain existing vegetation where possible).
Direct artificial light away from sensitive receivers where possible (ie residents, fauna or roadways).
Maintain work areas in a clean and tidy condition.
No laydown areas will be established within reserve areas during out-of-hours works or where works overlap with peak public usage periods.
Manage sites to allow people to move safely past the works, including alternative pedestrian, bicycle, pram and wheelchair access. Ensure site personnel are available to assist mobility-impaired users in safely navigating detours or passing through work areas.

6.1.10 Cumulative and future trends

Potential environmental impacts

Cumulative impacts

Other nearby works include Sydney Water's Willoughby Submain Amplification Project, within Artarmon Reserve (refer to Figure 6-13). The construction footprint of the amplification project has a minor overlap with the proposal footprint. The amplification project involves trenching works and a construction compound

in the southern portion of Artarmon Reserve. This area will also accommodate elements of the proposal, including sections of the bypass system, localised tree and vegetation clearing and trimming, access tracks and maintenance hole rehabilitation.

Despite the overlap between the two project footprints, long-term cumulative impacts are not expected. While there may be a temporary increase in construction noise generating activities and a temporary reduction to recreational spaces within Artarmon Reserve, Sydney Water and the respective contractors will coordinate construction activities to minimise potential impacts where practicable.



Figure 6-13 Willoughby Submain Amplification impact area

A review of the NSW Government Major Projects portal in December 2025 identified several major projects within the WCC LGA but none are close to the proposal.

A review of WCC ’s Development Application Tracker did not identify any developments close to the proposal or any that are expected to influence cumulative impacts.

Aside from the projects identified above, Sydney Water is not aware of any other current or planned works, including future Sydney Water or third-party projects, occurring in the surrounding area.

Future trends

The proposal is predominantly underground and no new above ground assets are proposed. Potential future trends that could affect the proposal during construction such as flooding and wet weather events associated with climate change have been considered.

The proposal is also unlikely to exacerbate future trends. Following construction, the site will be restored to pre-construction conditions, with no anticipated permanent changes to topography or drainage patterns. Air quality and ongoing energy use within the area are expected to remain consistent with existing conditions. While construction will involve some consumption of fossil fuels, this will be minimised where practicable and is not expected to represent a significant increase relative to existing regional energy use.

In the long term, the proposal will improve the operation and maintenance of the existing wastewater system.

Mitigation measures

With the implementation of the mitigation measures below, cumulative impacts are expected to be low. No impacts are anticipated during operation.

Table 6-26 Environmental mitigation measures — cumulative and future trends

Mitigation measures
Consult with key stakeholders and other project teams undertaking local development to coordinate works where practical.

6.1.11 General environmental management

Table 6-27 Environmental mitigation measures — general environmental management

Mitigation measures
Sydney Water’s Project Manager (after consultation with the environmental and community representatives and affected landowners) can approve temporary ancillary construction facilities (such as compounds and access tracks), without additional environmental assessment or approval if the facilities: • limit proximity to sensitive receivers • do not disrupt property access • have no impact to known items of non-Aboriginal and Aboriginal heritage • are outside high risk areas for Aboriginal heritage • use existing cleared areas and existing access tracks

Mitigation measures

- have no impacts to remnant native vegetation or key habitat features
- have no disturbance to waterways
- do not require additional safeguards beyond those included in the EIA
- do not disturb contaminated land or acid sulfate soils
- will be rehabilitated at the end of construction.

The Delivery Contractor must demonstrate in writing how the proposed ancillary facilities meet these principles. Any facilities that do not meet these principles will require additional environmental impact assessment.

The agreed location of these facilities must be shown on the CEMP site plan and appropriate environmental controls installed.

The Delivery Contractor must conduct pre-mobilisation and post-demobilisation soil sampling on compound sites to confirm no residual impacts.

Should the proposal change from the EIA, no further environmental assessment is required provided the change:

- remains within the assessment area for the REF has no net additional environmental impact or
- is outside the assessment area for the REF but:
    - reduces impacts to biodiversity, heritage or human amenity or
    - avoids engineering (for example, geological, topographical) constraints and
    - after consultation with any potentially affected landowners and relevant agencies.

The Contractor must demonstrate in writing how the changes meet these requirements, for approval by Sydney Water's Project Manager in consultation with the environmental and community representatives.

Prepare a Construction Environmental Management Plan (CEMP) addressing the requirements of this environmental 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 areas 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 or fauna, spill kits)
- location and full extent of any vegetation disturbance.

The CEMP will identify appropriate delineation with and approved disturbance boundary before construction.

Prepare an Incident Management Plan (IMP) as part of the CEMP 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.

Mitigation measures
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)*, Follow SWEMS0009 and attach SWEMS0009 to the CEMP.
Complaints to be managed in accordance with Sydney Water's Complaints Procedure and relevant Community Engagement Plan.
Assign single person with accountability for coordinating communication and information flow across contractors and consultants and provide the contact details of this person in the EWMS and/or CEMP.

7. Conclusion

Sydney Water has prepared this REF to assess the potential environmental impacts of the Willoughby Oviform Wastewater Pipeline rehabilitation. The proposal is required to provide reliable wastewater services to the Willoughby LGA.

The main potential construction environmental impacts of the proposal relate to soils, heritage, noise, vibration, traffic and access.

During operation, there will be negligible impacts as the proposal is below ground. 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, an environmental impact statement is not required under Division 5.1 of the EP&A Act.

The REF considers how the proposal aligns with the principles of ESD. The proposal would not result in the degradation of the quality of the environment and would not pose a risk to the safety of the environment or the community.

References

Cardno (2020) Traffic and Transport Plan – Willoughby Local Centres.

Confluence Water (2025) Construction Methodology.

Confluence Water (2023) Willoughby Oviform Submain Lining – MH3 - opposite 61A Station Street, Naremburn - Soil Characterisation Report.

Confluence Water (2025) Willoughby Oviform Submain Lining – MH17 & MH16D – Bicentennial Reserve at Small Street, Willoughby - Soil Characterisation Report.

Consulting Earth Scientists (2023) Environmental Management Plan.

Downer (n.d.) Construction Work Pack.

Golder Associates (2022) Willoughby Submain Sewer Rehabilitation Geotechnical Investigation.

Lyall & Associates (2018) Flood Study and Overland Flow Mapping Report.

McDonald, J. (2008) *Dreamtime Superhighway: Sydney Basin Rock Art and Prehistoric Information Exchange*. Canberra: Australian National University Press.

Sydney Water (2025) Preliminary Site Investigation.

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 related to construction traffic, access, noise and vibration, and visual amenity. There may also be cumulative impacts from other nearby works including trenching in the southern portion of Artarmon Reserve from Sydney Water's nearby Willoughby Submain Amplification Project. Despite the overlap between the two project footprints, long-term cumulative impacts are not expected. While there may be a temporary increase in construction noise generating activities, Sydney Water and the respective contractors will coordinate construction activities to minimise potential impacts where practicable. The proposal will be constructed progressively along the pipeline, and sensitive receivers would be temporarily impacted. Impacts will be mitigated by the mitigation measures in this REF. There will be environmental improvements by providing reliable wastewater services.
Any transformation of a locality	The proposal would not result in the transformation of a locality. Excavations will be backfilled and the site will be restored to its pre-construction conditions at the completion of the works. No new above-ground infrastructure is proposed.
Any environmental impact on the ecosystems of the locality	The proposal has been designed to minimise ecological impacts to the fullest extent possible. We will offset vegetation removal in line with Sydney Water's Biodiversity Offset Guide as outlined in the mitigation measures of this REF to minimise environmental impacts to ecosystems of the locality.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	The proposal is primarily in an urban locality and disturbed road corridors. During construction, there may be localised and temporary restricted use of access paths and recreation areas. The site will be restored to its pre-construction conditions at the completion of the works.
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	Implementation of the mitigation measures in Section 6.1.4 will ensure the proposal will not have any permanent effect on these matters and that items of heritage significance will be protected during construction. There will be temporary restricted use of recreation areas.
Any impact on the habitat of any protected animals (within the meaning of the *Biodiversity Conservation Act 2016*)	Vegetation impacts have been minimised. Potential significant impacts on fauna through habitat impacts are not likely. Vegetation clearing and trimming will be offset.
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 potential impacts on flora and fauna were assessed, and it was found that the proposal would not endanger any species.

Section 171 checklist	REF finding
Any long-term effects on the environment	The proposal would not have any long-term impacts on the environment, but would have a long-term benefit by continuing to provide a reliable wastewater service for the Willoughby LGA.
Any degradation of the quality of the environment	The proposal would not cause the degradation of the quality of the environment. Excavations will be backfilled and the site will be restored to its pre-construction conditions at the completion of the works. Mitigation measures will ensure the quality of the environment is not degraded.
Any risk to the safety of the environment	The proposal would not increase risk to the safety of the environment.
Any reduction in the range of beneficial uses of the environment	There will be temporary restricted use of recreation areas. The site will be restored to its pre-construction state after the works are finished.
Any pollution of the environment	Environmental mitigation measures would mitigate the potential for the proposal to pollute the environment, from noise, odour or water. No pollution of the environment is expected.
Any environmental problems associated with the disposal of waste	Waste disposal will be 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 would 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 may contribute to temporary cumulative noise impacts from concurrent and future infrastructure works in the area. Sydney Water would consult with project managers for nearby projects for which cumulative impacts are possible.
Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	Due to the distance of the proposal from the coast, the proposal would not have any impact on coastal processes or hazards, and coastal processes and coastal hazards would not have any impact on the proposed activity.
Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the EP&A Act, Division 3.1	Not applicable.
Any other relevant environmental factors.	The proposed work has been assessed against the factors listed above, and there are no other relevant environmental factors to consider.

Appendix B – Section 171A summary statement

Section 171A of the EP&A Regulation requires a determining authority to consider the matters that a consent authority must take into account under Part 6.2 of the Biodiversity and Conservation State Environmental Planning Policy (BCSEPP) for development within a regulated catchment. The proposal is located within the Sydney Harbour catchment, and therefore the requirements of Section 171A have been considered.

This REF has taken into account the potential impacts of the proposal on the following relevant BC SEPP aspects:

- water quality and quantity (including stormwater and groundwater)
- aquatic and terrestrial ecology, including migratory birds
- flood liable land
- recreational activities
- public and recreational access.

The proposal involves work on existing assets with no hard-stand or topography changes. The proposal does not require a controlled activity approval under the *Water Management Act 2000* or a permit under the *Fisheries Management Act 1994*. Potential construction impacts on water quality, water quantity, flow, aquatic ecology and flooding can be adequately managed by the proposed soil, ecology and water and drainage mitigation measures.

The proposal requires short term occupation of some recreational areas and public access paths. Mitigation measures, including those agreed during pre-construction community and stakeholder engagement, can adequately manage potential impacts.

The REF assessed the potential impacts of vegetation clearing on flora and fauna, and concluded potential impacts would be minor, and temporary.

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

TISEPP section	Yes	No
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 – Ecological Assessment

Appendix E – Aboriginal Due Diligence Assessment

Aboriginal heritage information must not be made publicly available or be published in any form or by any means by Sydney Water or our contractors / joint ventures, unless written approval has been provided to Sydney Water from DPE's AHIMS Registrar .

For publicly displayed REFs, all Aboriginal heritage information that identifies individual sites must be removed.

Appendix F – [redacted] Geotechnical Aboriginal Due Diligence Assessment Memorandum

Appendix G – Non-Aboriginal Heritage Statement of Advice

Appendix H – Flood Assessment

Appendix I – Noise and Vibration Impact Assessment