Transport for NSW

# Beaches Link and Gore Hill Freeway Connection

## Part D

Revised environmental management measures, conclusion and references

November 2021

# D Revised environmental management measures, conclusion and references

## Contents

Transport for NSW

# Beaches Link and Gore Hill Freeway Connection

## D1 – Construction environmental management framework

November 2021

# D1 Construction environmental management framework

## D1.1 Introduction

This section builds upon the environmental management plan framework discussed in Section 28.5 of the environmental impact statement, identifying the framework for the management of key issues.

A construction environmental management plan would be prepared for the project. The construction environmental management plan would provide the overarching framework for environmental management during construction, with sub-plans managing specific environmental issues. The following sub-plans were identified in Section 28.5.1 of the environmental impact statement as likely being required to manage specific environmental issues:

- Traffic management plan
- Marine works and marine traffic management plans
- Noise and vibration management plan
- Heritage management plan
- Air quality management plan
- Waste and resource use management plan
- Soil and water management plan
- Groundwater management plan
- Flora and fauna management plan
- Dredge management plan.

This sub-plan structure may be modified during detailed construction planning to respond more effectively to particular contractor or stakeholder requirements.

Key issues that each sub plan would address, along with the relevant guidelines or requirements that each plan would be prepared in accordance with, are provided in Table D1-1.

A number of other management plans are likely to be required separately to the construction environmental management plan. These may include, but are not limited to:

- Construction support site establishment management plan
- Sustainability management plan
- Community communication strategy.

The content and purpose of these plans will be developed in consultation with the relevant stakeholders.

**Table D1-1 Indicative construction environmental management plan sub plans**

| Sub plan | Key issues to be addressed | Relevant guidelines and requirements |
|---|---|---|
| Traffic management plan | • Construction traffic, transport and access management objectives<br>• Construction traffic, transport and access management documentation including:<br>- Traffic staging plans<br>- Traffic control plans and identification of truck marshalling areas<br>- Pedestrian management plans<br>- Parking management plans<br>- Heavy vehicle hauling routes<br>• Construction traffic, transport and access mitigation including:<br>- Monitoring and inspection requirements<br>- Compliance records<br>- Driver certification requirements. | • *Traffic Control at Worksites Technical Manual* (Transport for NSW, 2020g)<br>• Australian Standard *AS 1742.3-2019 Manual of uniform traffic control devices Part 3: Traffic control for works on roads* (Standards Australia, 2019b)<br>• *QA Specification G10: Traffic Management* (Transport for NSW, 2020l)<br>• *Truck and Plant Requirements: Specification* (Transport for NSW, 2020m)<br>• *Guide to Traffic Generating Developments Version 2.2* (NSW Roads and Traffic Authority (RTA), 2002) |
| Marine works and marine traffic management plans | • Marine works and marine traffic management objectives<br>• Marine works and marine traffic management documentation including:<br>- Works approval requirements<br>- Exclusion zones<br>- Temporary mooring locations<br>• Marine works and marine traffic mitigation including requirements for vessel movements and navigational restrictions. | • Ports and Maritime Administration Regulation 2012 |
| Noise and vibration management plan | • Hours of construction<br>• Construction noise and vibration management objectives<br>• Construction noise and vibration management documentation which includes the requirements of revised environmental | • *Interim Construction Noise Guideline* (Department of Environment and Climate Change (DECC), 2009)<br>• *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) |

| Sub plan | Key issues to be addressed | Relevant guidelines and requirements |
|---|---|---|
| | management measure CNV1 (refer to Table D2-1 of this submissions report)<br>• Construction noise and vibration impact statements for all construction support sites and major construction works required for the project as required by environmental management measure CNV2<br>• Out of hours works protocol as required by revised environmental management measure CNV3 including:<br>- Details of works required outside standard construction hours and justifications of why the works are required outside standard construction hours<br>- The noise and vibration impact assessment processes that will be followed to identify potentially affected receivers and clarify potential impacts<br>- Mitigation and management measures that are to be considered and implemented where appropriate to manage potential impacts associated with works outside standard construction hours<br>- Details of the approval processes (internal and external) for works proposed outside standard construction hours<br>• Construction noise and vibration mitigation including:<br>- Monitoring and inspection requirements<br>- Compliance records<br>• Management of unacceptable overpressure and vibration impacts from blasting through the identification of potentially affected sensitive receivers and features, appropriate tests to ensure compliance with relevant criteria and monitoring. | • *Assessing Vibration: a technical guideline* (DEC, 2006c)<br>• German Standard *DIN 4150-3:2016 Vibration in Buildings – Part 3: Effects on Structures* (Deutsches Institut für Normung (DIN), 2016)<br>• British Standard *BS 7385-2:1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration* (British Standards Institution, 1993)<br>• Australian Standard *AS 2187.2-2006 Explosives – Storage and use – Part 2 Use of explosive* (Standards Australia, 2006)<br>• *NSW Road Noise Policy* (Department of Environment, Climate Change and Water (DECCW), 2011b)<br>• *Noise Criteria Guideline* (Roads and Maritime Services, 2015a)<br>• *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b)<br>• *Noise Policy for Industry* (NSW Environment Protection Authority (EPA), 2017)<br>• *Noise Guide for Local Government* (NSW EPA, 2013a) |
| Heritage management plan | • Heritage management objectives<br>• Heritage management documentation including Aboriginal and non-Aboriginal heritage unexpected finds procedures | • *Standard Management Procedures: Unexpected Heritage Items* (Roads and Maritime Services, 2015c)<br>• NSW Heritage Manual, *Interpreting Heritage Places and Items: Guidelines* (NSW Heritage Office, 2005a) |

| Sub plan | Key issues to be addressed | Relevant guidelines and requirements |
|---|---|---|
| | • Maritime heritage management plan detailing the objectives and methodologies to conserve maritime heritage and mitigate impacts as required by environmental management measure NAH3 (refer to Table D2-1 of this submissions report)<br>• Heritage mitigation including:<br>- Monitoring and inspection requirements<br>- Compliance records. | • *Heritage Interpretation Policy* (NSW Heritage Council, 2005)<br>• *The Burra Charter – Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites (ICOMOS), 2013)<br>• *Cultural Heritage Guidelines* (Roads and Maritime Services, 2015f)<br>• *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime Services, 2011a)<br>• *Photographic Recording of Heritage Items Using Film or Digital Capture* (NSW Heritage Office, 2005b) |
| Air quality management plan | • Air quality management objectives<br>• Air quality mitigation including:<br>- Standard construction air quality mitigation and management measures required by revised environmental management measure AQ1 (refer to Table D2-1 of this submissions report<br>- Odour management measures for odour from contaminated soil, sediments and acid sulfate soils (if confirmed)<br>- Monitoring and inspection requirements<br>- Compliance records. | • *QA Specification G36: Environmental Protection* (Transport for NSW, 2020d)<br>• *Guidance on the Assessment of Dust from Demolition and Construction* (Institute of Air Quality Management (IAQM), 2014)<br>• *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (Department of Environment and Conservation (DEC), 2007a)<br>• *Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2006a) |
| Waste and resource management plan | • Waste and spoil management objectives<br>• Waste and spoil management documentation including procedures for handling and storing potentially contaminated substances<br>• Waste and spoil mitigation including:<br>- Monitoring and inspection requirements<br>- Compliance records. | • *Waste Avoidance and Resource Recovery Act 2001*<br>• *Waste Classification Guidelines* (NSW EPA, 2014b)<br>• *Work Health and Safety Procedure: Hazardous Chemicals* (Roads and Maritime Services, 2018c)<br>• *Technical Guide: Management of Road Construction and Maintenance Wastes* (Roads and Maritime Services, 2016d) |

| Sub plan | Key issues to be addressed | Relevant guidelines and requirements |
|---|---|---|
| | | • *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004) |
| Soil and water management plan | • Soil, surface water and contamination management objectives<br>• Soil, surface water and contamination management documentation including:<br>- Erosion and sediment control plans<br>- Emergency spill procedures<br>- Dewatering plans (including aquatic fauna relocation requirements)<br>• Soil, surface water and contamination mitigation including:<br>- Management responses to contaminated soils (if confirmed), including remediation action plans (in accordance with revised environmental management measure SG8). Management responses would provide a varied response based on identified risk to human or ecological receivers<br>- Management responses to acid sulfate soils<br>- Water quality monitoring and management<br>- Inspection requirements including building condition surveys<br>- Compliance records<br>• Construction flood emergency management measures including requirements for temporary construction support sites to manage risks to adjoining properties. | • National Water Quality Management Strategy<br>• *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ), 2000)<br>• *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Governments (ANZG), 2018)<br>• *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004)<br>• *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (DECC, 2008)<br>• *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee (ASSMAC), 1998)<br>• *Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2012a)<br>• *Guideline for Construction Water Quality Monitoring* (Roads and Traffic Authority (RTA), 2003a)<br>• *QA Specification G36: Environmental Protection* (Transport for NSW, 2020d)<br>• *QA Specification G38: Soil and Water Management* (Transport for NSW, 2020e)<br>• *Technical Guideline: Environmental Management of Construction Site Dewatering* (RTA, 2011b)<br>• *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013a) |

| Sub plan | Key issues to be addressed | Relevant guidelines and requirements |
|---|---|---|
| | | • *Work Health and Safety Procedure: Hazardous Chemicals* (Roads and Maritime Services, 2018c)<br>• *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)<br>• *Assessment and management of hazardous ground gases: Contaminated land guidelines* (NSW EPA, 2020b)<br>• *Water sensitive urban design guideline: Applying water sensitive urban design principles to NSW transport projects* (Roads and Maritime Services, 2017a) |
| Groundwater management plan | • Groundwater management objectives<br>• Groundwater management documentation including:<br>- Additional modelling requirements<br>- Acceptable groundwater inflow levels<br>- Ground movement management and minimisation requirements<br>• Groundwater mitigation including:<br>- Monitoring and inspection requirements<br>- Compliance records. | • *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)<br>• *Guidelines for Assessment and Management of Groundwater* (DEC, 2007b)<br>• *Australian groundwater modelling guidelines* (Barnett et al., 2012)<br>• *NSW Aquifer Interference Policy* (NSW Department of Primary Industries (DPI) (Office of Water), 2012a) |
| Flora and fauna management plan | • Flora and fauna management objectives<br>• Flora and fauna management documentation including:<br>- Unexpected flora and fauna finds procedure<br>- Stop works procedure<br>- Dewatering management<br>• Flora and fauna mitigation including:<br>- Seagrass monitoring and management measures | • *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RTA, 2011a)<br>• *QA Specification G40: Clearing and Grubbing* (Transport for NSW, 2020f)<br>• Australian Standard *AS 4282–2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019a) |

| Sub plan | Key issues to be addressed | Relevant guidelines and requirements |
|---|---|---|
| | - Intertidal and rocky reef management measures<br>- Marine mammals and reptile management measures<br>- Weed management measures<br>- Threatened species management measures<br>- Monitoring and inspection requirements<br>- Compliance records. | • *Technical Guideline: Environmental Management of Construction Site Dewatering* (RTA, 2011b)<br>• *Policy and guidelines for fish habitat conservation and management* (NSW DPI, 2013)<br>• *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003)<br>• *Waste Classification Guidelines* (NSW EPA, 2014b) |
| Dredge management plan | • Dredging management objectives<br>• Dredging mitigation including:<br>- Contamination management and contingency measures<br>- Backhoe dredging operations would be completed within a floating silt curtain, as described in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling)<br>- No overflow would be permitted from transport barges taking material not suitable for offshore disposal to the loadout facility, where it would be treated to be made spadable and then disposed of at a licensed land-based facility<br>- Additional silt curtains would be located around sensitive foreshore areas eg seagrass areas<br>- Works would be completed under a full time supervision and inspection regime<br>- Identification of relevant monitoring sites and inclusion of monitoring frequency and analytes. | • *National Assessment Guidelines for Dredging* (Department of the Environment, Water, Heritage and the Arts, 2009)<br>• *Waste Classification Guidelines* (NSW EPA, 2014b)<br>• National Water Quality Management Strategy<br>• *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000)<br>• *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) |

## D1.2 Construction environmental performance and compliance reports

The construction environmental management plan would include a range of construction performance and compliance reporting requirements to ensure the conditions of approval and performance outcomes in Section 28.6 of the environmental impact statement are met. A compliance monitoring and reporting program would be implemented to ensure non-compliances, corrective and preventative actions are properly identified, managed and documented.

Contractor performance and compliance reporting would be carried out in accordance with the *Compliance Reporting: Post Approval Requirements* (NSW Department of Planning, Industry and Environment (DPIE), 2020e). Potential environmental incidents during construction would be reported in accordance with the *Environmental Incident Classification and Reporting Guideline* (Transport for NSW, 2018c) and incorporated within relevant environmental management documentation.

## D1.3 Strategic urban design framework

A strategic urban design framework is referenced in Chapter 22 (Urban design and visual amenity) of the environmental impact statement and is described in Section 3 of Appendix V (Technical working paper: Urban design, landscape character and visual impact). The strategic urban design framework has been prepared to inform the urban design and establish benchmarks for achieving a well-planned and integrated road alignment through a high-quality urban design response. The framework would guide further design development and be refined as the design progresses. The framework includes the following:

- A high-level vision and principles to guide the future urban design of the project
- Urban design objectives identified for the project during the initial concept design stage
- Requirements for future design of infrastructure elements to ensure the project exhibits objectives of a quality and level of amenity that are consistent and readily associated with the project's transport functions
- Acknowledgement of the strategic directions and urban design strategies as directed by Centre for Urban Design (Infrastructure and Place, Transport for NSW) and NSW Government Architects.

The framework has been prepared with reference to the urban design principles in *Beyond the Pavement 2020* (Transport for NSW, 2020a) and *Better Placed* (Government Architect NSW, 2017a). Other Transport for NSW design and biodiversity guidelines and local government planning documents, such as local environmental plans and development control plans, have also been considered in the preparation of the urban design framework. The framework would inform the development of urban design and landscape plans as part of further design development.

Specific environmental management measures included in Section 6 of Appendix V (Technical working paper: Urban design, landscape character and visual impact) would be considered through the strategic urban design framework as the further design development occurs.

NSW GOVERNMENT

Transport for NSW

# Beaches Link and Gore Hill Freeway Connection

## D2 – Revised environmental management measures

November 2021

## D2 Revised environmental management measures

The environmental impact statement for the Beaches Link and Gore Hill Freeway Connection project identified the environmental management measures that would be adopted to avoid or reduce environmental impacts (refer to Appendix Y (Compilation of environmental management measures)). For each environmental management measure, Table D2-1 also includes the impact addressed by the measure, the location relevant to the measure and whether it will be implemented during the pre-construction, design, construction or operational phase. The phases have been developed by Transport for NSW to assist in the planning and implementation of the environmental management measures and the phases may occur concurrently as elements are planned, designed and constructed. In addition, an environmental management measure which addresses an impact during the construction phase of the project may be installed or constructed during the construction phase of a component.

After consideration of the issues raised in the public submissions, the environmental management measures for the project have been revised (refer to Table D2-1).

The adjustments to the measures were made to improve environmental outcomes by:

- Including additional commitments based on the response to submissions within this report
- Incorporating findings of further assessments provided within this report and the preferred infrastructure report for the project
- Making additional commitments based on the additional consultation carried out during the preparation of this report
- Modifying the wording so that the outcome of a commitment is clearer to implement.

Where new commitments have been added or new text has been added to an existing measure, it is in bold text. Where a commitment has been deleted or text from a commitment deleted, it appears as strikethrough text.

All revised environmental management measures would be incorporated into management plans where relevant.

**Table D2-1 Revised environmental management measures**

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| **Traffic and transport** | | | | |
| **Construction** | | | | |
| CTT1 | Pre-construction | Construction traffic | A **R**oad **C**ondition **R**eport will be prepared **before any local road is used by a heavy vehicle**, ~~in consultation with relevant councils and road owners, identifying existing conditions of local roads that will be used by heavy vehicles~~ associated with the project**.** ~~and mechanisms to repair~~ **Where** damage to the road network (beyond normal wear and tear) **is** caused by ~~these~~ **heavy vehicle** movements **the road will be restored to at least the condition it was pre-works or compensation will be offered to the road owner**. **A copy of the Road Condition Report must be provided to the relevant council within three weeks of completion of the survey and no later than one month prior to the road being used by heavy vehicles associated with the project**. | BL/GHF |
| CTT2 | Pre-construction | Maritime construction | Transport for NSW **(inclusive of NSW Maritime)** will consult with the owners and/or leaseholders and/or licence holders of jetties and moorings that require temporary relocation to determine alternative arrangements. Moorings impacted during construction will be temporarily relocated elsewhere in Middle Harbour in consultation with the lease holder(s) and coordination with the Port Authority of NSW. All efforts will be made to relocate facilities as close to their original locations as possible. Impacted mooring licence holders may be entitled to a fee waiver or fee reimbursement where appropriate. | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| CTT3 | Construction | Maritime construction traffic | Construction vessels will be required to operate in a manner that minimises wash ~~to areas of shoreline~~ **within Middle Harbour**. | BL |
| CTT4 | Construction | Maritime construction traffic | Construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic, **including near the Spit Bridge,** where **possible.** ~~feasible and reasonable.~~ | BL |
| CTT5 | Construction | Maritime construction traffic | Harbour closures scheduling will be carried out in consultation with Port Authority of NSW, other divisions of Transport for NSW and other relevant stakeholders. | BL |
| CTT6 | Construction | Construction traffic | Ongoing consultation, as relevant to the location, will be carried out with Greater Sydney Operations, the Port Authority of NSW, local councils, emergency services and bus operators to minimise traffic and transport impacts. | BL/GHF |
| CTT7 | Construction | Construction traffic | The community will be notified in advance of proposed transport network changes, and maritime restrictions through appropriate media and other appropriate forms of community liaison. | BL/GHF |
| CTT8 | Construction | Construction traffic | Construction road traffic will be managed to minimise impacts of movements during peak periods where feasible and reasonable. | BL/GHF |
| CTT9 | Construction | Construction traffic | Vehicle movements to and from construction sites will be managed to ensure pedestrian, cyclist and road user safety. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasion, police presence. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| CTT10 | Construction | Construction traffic | Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by Variable Message Signs to advise all road users of potential delays, traffic diversions, speed restrictions or alternative routes. | BL/GHF |
| CTT11 | Construction | Construction traffic | **Impacts resulting from on- and off-street parking changes during construction will be minimised where reasonable and feasible. Depending on the location, options to manage construction staff and worker parking and manage impacts to stakeholders may include:**<br>**a) Proactively encouraging usage of public transport for workers through site induction information sessions**<br>**b) Provision of shuttle buses from public transport hubs where appropriate**<br>**c) Staged removal and replacement of parking**<br>**d) Provision of alternative parking arrangements such as off-site contractor managed parking lots**<br>**e) Managed staff parking arrangements**<br>**f) Working with relevant council(s) to introduce appropriate parking restrictions adjacent to construction sites and support sites or appropriate residential parking schemes.**<br>~~Where provision of construction on-site parking cannot accommodate the full construction workforce, construction worker parking will be actively managed to minimise impacts on parking on local roads. Depending on the location, this will include encouraging the use of public transport and may include provision of shuttle buses for workforce transport where appropriate.~~ | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| CTT12 | Construction | Construction traffic | Any adjustments to existing bus stops will be determined in consultation with relevant stakeholders including other divisions of Transport for NSW and advanced notification ~~would~~ **will** be provided to affected bus customers. Relocations will be as close **as reasonably practicable** to their existing position**.** ~~where feasible and reasonable.~~ | BL/GHF |
| CTT13 | Construction | Construction traffic | Truck marshalling areas will be identified and used where **required** ~~feasible and reasonable~~, to minimise potential queueing**, to ensure associated road user safety** and **minimise** traffic and access disruptions in the vicinity of construction support sites **and access points to construction sites**. | BL/GHF |
| CTT14 | Construction | Construction traffic | Activities requiring temporary partial road closures will be carried out outside of peak periods and/or during night time to minimise the impact of these activities on the road network where feasible and reasonable. | BL/GHF |
| CTT15 | Construction | Construction traffic | Direct impacts to existing pedestrian and cycling facilities will be minimised **to the extent reasonably practicable.** ~~where reasonable and feasible.~~ Any detours and adjustments will be designed with consideration of user safety and convenience. | BL/GHF |
| CTT16 | Construction | Maritime construction impacts | Consultation will be carried out with surrounding water based users of Middle Harbour including Mosman Rowing Club**, 1st Northbridge Sea Scout Group, 1st Sailors Bay Sea Scouts** and Northbridge Sailing Club to **develop reasonable and feasible management measures to** minimise construction impacts. | BL |
| **CTT17** | **Construction** | **Maritime construction impacts** | **All construction vessels including stationary barges and transport vessels will be fitted with and use automatic identification systems.** | **BL** |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| **CTT18** | **Construction** | **Maritime construction impacts** | **All structures occupying part of the waterway or any exclusion marker placed in the water will be adequately lit. This includes temporary wharves, jetties, cofferdams, dredgers, and the temporary mooring facility. Lighting shall minimise light pollution and include low glare fixtures.** | **BL** |
| **CTT19** | **Construction** | **Maritime construction impacts** | **A navigation channel delineated with marker buoys will be formed on the approach to d'Albora Marina at The Spit adjacent to the Spit West Reserve construction support site (BL9).** | **BL** |
| **CTT20** | **Construction** | **Maritime construction impacts** | **A speed limit of four knots for all marine traffic will be implemented between the Spit Bridge and 100 metres upstream of the Middle Harbour crossing to minimise the impact of vessel wash and reduce vessel speed to ensure the safety of mariners.** | **BL** |
| **CTT21** | **Construction** | **Maritime construction impacts** | **The Spit West Reserve construction support site (BL9) will not impact the land based approach or water based approach to the Mosman Rowing Club. The channel on approach to Mosman Rowing Club will be 30 metres (100 feet) wide and will be delineated with marker buoys.** | **BL** |
| **Operation** | | | | |
| OT1 | Operation | Operational traffic | A review of operational network performance will be carried out 12 months and five years from the opening of the project to confirm the operational impacts of the project on surrounding arterial roads and major intersections. The assessment will be based on updated traffic data at the time and the methodology used will be comparable with that used in Appendix F (Technical working paper: Traffic and transport) of the environmental impact statement. Where required, additional feasible and reasonable mitigation | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | measures will be identified in consultation with Department of Planning, Industry and Environment and the relevant council to manage any additional traffic performance impacts identified during the review of operational network performance. | |
| OT2 | Operation | Impacts on local roads | Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project on the surrounding local road network. Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable. | BL/GHF |
| **OT3** | **Design** | **Impacts on local roads** | **Opportunities to reduce and/or offset the permanent loss of parking spaces in Artarmon due to the project will be investigated during further design development.** | **BL/GHF** |
| **Noise and vibration** | | | | |
| **Construction** | | | | |
| CNV1 | Pre-construction and construction | Construction noise and vibration impacts | A **c**~~C~~onstruction **n**~~N~~oise and **v**~~V~~ibration **management p**~~P~~lan will be developed for the project. This plan will:<br>a) Identify relevant criteria and management levels in relation to noise and vibration<br>b) Identify noise and vibration sensitive receivers and features in the vicinity of the project<br>c) Include standard and additional mitigation from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) and detail how and when these will be applied in the project<br>d) Describe the approach that will be adopted for carrying out location and activity specific construction noise and vibration impact assessments to assist with designing and | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | selecting of the appropriate mitigation and management measures<br>e) Include protocols that will be adopted to manage works required outside standard construction hours<br>f) Detail the methodology and approach for managing construction noise impacts<br>g) Detail the process for managing construction vibration, including for heritage structures, considering all types of vibration generating works, including blasting<br>h) Outline the approach for identifying and managing potential cumulative impacts, including ensuring appropriate respite for works outside standard construction hours<br>i) Outline the procedures and approach for noise and vibration monitoring to be carried out to confirm construction noise and vibration levels in relation to noise and vibration management levels<br>j) Detail how construction noise impacts from concurrent or consecutive nearby construction works associated with the project will be managed where feasible and reasonable.<br>The **c~~C~~**onstruction **n~~N~~**oise and **v~~V~~**ibration **m~~M~~**anagement Plan will be implemented for the duration of construction of the project. | |
| CNV2 | Pre-construction | Construction noise and vibration impacts | Detailed location and activity specific construction noise and vibration impact statements will be prepared and implemented to cover:<br>a) Construction support sites<br>b) Works outside standard construction hours | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | c) Works with the potential to result in highly noise affected residential receivers (ie exposed to noise levels that exceed 75 dB(A))<br>d) Works with the potential to exceed relevant human response and cosmetic damage criteria for vibration<br>e) Subsurface tunnelling activities.<br>The statements will consider the proposed site layouts and noise generating activities that will occur, identify potentially impacted sensitive receivers and assess predicted noise and vibration levels against the relevant criteria and management levels, and specify the feasible and reasonable mitigation and management measures that will be implemented in accordance with the requirements of the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). | |
| CNV3 | Construction | Construction noise and vibration impacts during out of hours work | An out of hours works protocol will be developed for the construction of the project. The protocol will include:<br>a) Details of works required outside standard construction hours **and** justifications of why the works are required outside standard construction hours<br>b) The noise and vibration impact assessment processes that will be followed to identify potentially affected receivers and clarify potential impacts<br>c) Mitigation and management measures that are to be considered and implemented where appropriate to manage potential impacts associated with works outside standard construction hours<br>d) Details of the approval process (internal and external) for works proposed outside standard construction hours.<br>The protocol will be prepared in consultation with Department of Planning, Industry and Environment and the NSW | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | Environment Protection Authority. The project protocol will be implemented during the duration of the construction of the project. | |
| CNV4 | Construction | Construction noise and vibration impacts during out of hours work | For works outside standard construction hours on and adjacent to major roadways, the elevated existing ambient and background noise levels during the following shoulder periods will be investigated and confirmed:<br>a) Shoulder period (night-day) – between 5.00am and 7.00am<br>b) Shoulder period (evening-night) – between 10.00pm and 12.00am.<br>Where appropriate **and where a road occupancy licence is approved by Greater Sydney Operations for the works (if required)**, these shoulder periods will be utilised ~~where feasible and reasonable~~ to minimise potential amenity impacts associated with project activities outside standard construction hours. | BL/GHF |
| CNV5 | Construction | Construction noise and vibration impacts | Construction noise and vibration impacts will be monitored periodically throughout all stages of ~~the~~ construction ~~support site~~ to ensure that:<br>a) Noise and vibration levels are consistent with the predictions detailed in the relevant construction noise and vibration impact statements<br>b) Noise and vibration impacts are being appropriately managed<br>c) Mitigation measures are effective. | BL/GHF |
| CNV6 | Construction | Construction noise impacts | Where feasible and reasonable, unless compliance with the relevant traffic noise criteria can be achieved~~,~~ or alternative arrangements have been agreed with affected receivers, construction vehicle movements will not occur on local roads beyond those required for direct access to construction sites. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| CNV7 | Construction | Construction vibration impacts | Vibration generating activities will be managed through the establishment of minimum working distances to achieve vibration screening levels.<br><br>Where vibration levels are predicted to exceed the screening levels, a more detailed assessment of the impacted structure will be carried out to assess the susceptibility of the structure to damage from vibration due to the project. Appropriate mitigation and management measures, such as equipment substitution and alternative methods, will be identified and implemented to avoid damage. Attended vibration monitoring will be carried out during vibration intensive activities in the vicinity to ensure vibration levels remain below appropriate limits for that structure.<br><br>For heritage items, the more detailed assessment will specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.<br><br>Pre-construction building structure condition surveys will be carried out in accordance with environmental management measure SG7. Any building and/or structure damage from vibration caused by the project would be repaired at no cost to the owner. | BL/GHF |
| CNV8 | Construction | Construction ground-borne noise impacts | Where ground-borne levels are predicted to exceed the relevant noise management levels, alternative construction techniques and equipment that are likely to generate less ground-borne noise will be investigated and used where feasible and reasonable. | BL/GHF |
| CNV9 | Construction | Construction impacts from surface road works | Mitigation measures will be implemented for surface road works, local area and utility works, where construction activities are predicted to exceed noise management levels at | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | receivers. Where feasible and reasonable the approaches that will be used include:<br>a) Carrying out works during the daytime period when near residential receivers<br>b) Selection of plant and equipment to minimise noise and vibration impacts<br>c) Management of plant and equipment to minimise the generation of noise and vibration impacts<br>d) Community consultation, engagement and notification<br>e) Detailed programming and respite protocols<br>f) Where out of hours works are required, programming the noisiest activities to occur during the less sensitive time periods<br>g) Out of hours works protocols<br>h) Limiting timing of noise intensive work<br>i) Use of portable noise barriers around particularly noisy equipment such as concrete saws and rock hammers in cases where it will effectively reduce noise levels at nearby receivers<br>**j) At property mitigation, as required by the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) where long-term, continuous out of hours works are required**<br>k) Management of construction traffic to minimise movements during the night periods along local roads<br>l) Establishing minimum vibration working distances for vibration intensive works<br>m) Vibration and blasting trials and/or monitoring along with building condition surveys.<br>Construction support sites that support surface road works will be designed to ensure that primary noise sources are | |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | located as far as possible from the nearby noise sensitive receivers, with solid structures (shed, containers, barriers, etc) placed between the noise sensitive receiver where feasible and reasonable to maximise acoustic shielding and block the line of **sight** ~~site~~ between the source and the receiver. | |
| CNV10 | Construction | Construction noise impacts | Where feasible and reasonable, noise barriers **and at-property treatment** proposed as part of the project to address road traffic noise will be implemented as early as possible to attenuate construction noise. | BL/GHF |
| CNV11 | Construction | Construction noise impacts | Where it is necessary to relocate or remove existing noise barriers to facilitate construction of new road infrastructure, the new noise barriers will be installed before removing the existing barriers where feasible and reasonable. Where it is not possible to install the new barriers before removing the existing barriers, the duration between removing the existing and installing the new barriers will be minimised. Temporary noise barriers will be installed to ensure that road traffic noise levels do not increase by more than 2 dB(A) at the affected residential receiver buildings, where feasible and reasonable. | BL/GHF |
| CNV12 | Construction | Construction blasting impacts | Any blasting and associated activities will be carried out in a manner that does not generate unacceptable overpressure and vibration impacts or pose a significant risk of impact to structures and sensitive receivers (including threatened fauna and fauna habitat adjacent the Wakehurst Parkway). Prior to any blasting all potentially affected sensitive receivers and features in the vicinity **will** ~~would~~ be identified. Appropriate tests will be carried out at each proposed blasting location to develop site-specific laws that take into account relevant factors such as underlying geology and separation distance to sensitive receivers and features to determine appropriate charge sizes and blasting design to ensure compliance with | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | relevant vibration and overpressure criteria. All blasting will be carried out in accordance with the specific-laws. Monitoring will occur to determine compliance with the relevant criteria, and the site-specific laws will be adjusted as required based on the monitoring results to ensure ongoing compliance. The potentially affected community will be kept informed about proposed blasting activities. | |
| CNV13 | Construction | Cumulative construction noise impacts and construction fatigue | Construction noise from concurrent and consecutive major projects in the vicinity of work locations associated with the project will be managed to minimise cumulative construction noise impacts. Where feasible and reasonable the approaches that will be used include:<br>a) Considering the potential for cumulative impacts due to other major projects in the locality during development of the detailed construction methodology. The construction methodology will be developed to minimise overall noise impacts and the need for respite for receivers potentially affected by cumulative impacts ~~wherever feasible and reasonable~~<br>b) Consulting with other major projects in the vicinity with the aim of coordinating work between the different projects that will affect the same area to ensure that affected receivers get appropriate respite from high noise impact activities and works outside standard construction hours<br>c) Implementing additional ~~feasible and reasonable~~ source mitigation for cumulative construction activities, where programming is not practical to avoid cumulative noise impacts<br>d) Community consultation to seek feedback on and identify key noise and vibration issues relevant to the local community so that current and future works can be managed to limit cumulative impacts. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| CNV14 | Construction | Impact piling | In any given week, impact piling will be carried out over no more than either:<br>a) a two hour period each work day or<br>b) a six hour period on a single work day. | BL |
| **CNV15** | **Construction** | **Impact piling** | **Less noise and vibration intensive piling methods, and the need to minimise potential noise and vibration impacts to adjacent sensitive receivers, will be considered during the development of the detailed piling methodology for the Middle Harbour crossing. Less noise and vibration intensive methods will be adopted where feasible and reasonable and subject to addressing potential constructability and engineering constraints.** | **BL** |
| **Operation** | | | | |
| ONV1 | Operation | Operational road traffic noise | The operational noise performance of the project will be reviewed during further design development and functionally appropriate operational noise mitigation (quieter pavements eg open grade asphalt, noise barriers, at-property treatments or a combination of treatments) will be confirmed in accordance with *NSW Road Noise Policy* (DECCW, 2011), *Noise Criteria Guideline* (Roads and Maritime Services, 2015) and *Noise Mitigation Guideline* (Roads and Maritime Services, 2015). | BL/GHF |
| ONV2 | Operation | Operational road traffic noise | Within 12 months of the commencement of the operation of the project, actual operational noise performance will be compared to predicted operational noise performance (as reviewed during further design development) to analyse the effectiveness of the operational road traffic noise mitigation measures. Additional ~~reasonable and~~ feasible **and reasonable** mitigation will be considered where any additional receivers are identified as qualifying for | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | consideration of noise mitigation in accordance with the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015). | |
| ONV3 | Design and construction | Operational road traffic noise | For local roads **within the project area** in Balgowlah, North Balgowlah and Seaforth where predicted increases in traffic are likely to result in exceedances of the relevant road traffic noise criteria, traffic calming measures with the aim of limiting potential road traffic noise increases to no more than 2 dB(A) will be investigated in consultation with Northern Beaches Council and implemented. As a minimum, traffic calming measures will be investigated for Wanganella Street at Balgowlah, Woodbine Street at Balgowlah and Judith Street at Seaforth. The need for at-property treatments will be confirmed during further design development and will consider the potential impact of the proposed traffic calming measures on traffic volumes and speeds. | BL |
| ONV4 | Operation | Operational facilities noise | Operational fixed facilities will be designed to meet project specific noise criteria derived in accordance with the *Noise Policy for Industry* (NSW EPA, 2017). | BL/GHF |
| ONV5 | Operation | Sporting and recreation noise impacts | Open space and recreation facilities at Balgowlah will be designed to meet intrusive noise criteria derived in accordance with the *Noise Guide for Local Government* (NSW EPA, 2013) where ~~reasonable and~~ feasible **and reasonable**. The final layout will be subject to further noise assessment to confirm the need for and details of any additional noise attenuation required. | BL |
| **ONV6** | **Operation** | **Operational road traffic noise** | **The owners of properties that are eligible for at-property treatments will be provided with a copy of all guidelines and procedures that will be used to determine at-property treatment for their property.** | **BL** |

| Ref | Phase | Impact | Environmental management measure | Location |
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| **Air quality** | | | | |
| AQ1 | Pre-construction and construction | General | Standard construction air quality mitigation and management measures will be detailed in construction management documentation and implemented during construction, such as:<br>a) ~~Reasonable and feasible d~~**D**ust suppression and/or management measures, including the use of water tanks and/ or carts, sprinklers, site exit controls (eg wheel washing systems and rumble grids), stabilisation of exposed areas or stockpiles, and surface treatments **where appropriate**<br>b) Selection of construction equipment and/or materials handling techniques that minimise the potential for dust generation<br>c) Management measures to minimise dust generation during the transfer, handling and on site storage of spoil and construction materials (such as sand, aggregates or fine materials) (eg the covering of vehicle loads)<br>d) Adjustment or management of dust generating activities during unfavourable weather conditions, where **appropriate** ~~reasonable and feasible~~<br>e) Minimisation of exposed areas during construction<br>f) Measures for managing odour generation likely to result in odour impacts at sensitive receivers in the vicinity during the disturbance, handling and storage of potentially odorous materials, including any contingency measures<br>g) Internal project communication protocols to ensure dust-generating activities in the same area are coordinated and mitigated to manage cumulative dust impacts of the project | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | h) Site inspections will be carried out to monitor the effectiveness of implemented measures and identify any additional measures to be implemented<br>i) **Regular maintenance of construction vehicles and plant to ensure compliance with relevant emissions standards.** | |
| AQ2 | Pre-construction and construction | Odour | Further site investigations will be carried **out** during the detailed design and construction planning phase to determine the potential to encounter odorous gases or materials during the proposed excavations at the Flat Rock Drive construction support site (BL2). If the investigations indicate that there is potential for odorous materials to be uncovered or odorous gases to be released, the potential for off-site impacts (informed by meteorological studies and modelling as required) will be investigated. If unacceptable off-site impacts are predicted, appropriate mitigation and management measures will be identified to minimise potential impacts, with consideration of the investigation results, proposed site activities and meteorological conditions, and the identified measures will be implemented during relevant site activities. Odour monitoring will be carried out during relevant site activities and mitigation and management measures adjusted as required to minimise potential off-site impacts. | BL |
| AQ3 | Construction | General | Dust and air quality complaints will be managed in accordance with the overarching complaints handling process for the project. Appropriate corrective actions, if required, will be taken to reduce emissions in a timely manner. | BL/GHF |
| AQ4 | Construction | Odour | Any areas of exposed material at the Flat Rock Drive construction support site **(BL2)** that have the potential to generate odour will be kept to a minimum during site establishment works and while the area is uncovered. If odorous areas are to remain uncovered at the end of the | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | work shift, temporary cover or other suitable measures to minimise odour emissions will be implemented. | |
| AQ5 | Construction | Odour | If the dredged materials require some form of land-based processing prior to disposal, an assessment of potential odour impacts will be carried out for the proposed processing site in accordance with the *Technical framework: ~~for the a~~**A**ssessment and management of odour from stationary sources in NSW* (DEC, 2006). This will include modelling to assess whether the use of the site and the proposed processing and treatment activities for the dredged material can comply with a criterion of 2 odour units at all sensitive receivers in the vicinity. | BL |
| AQ6 | Construction | Odour | Where the assessment carried out in environmental management measure AQ5 indicates that compliance is not likely, an odour management strategy will be developed. The strategy will describe appropriate mitigation and management measures to ensure that the 2 odour units criterion is met, odour survey requirements and contingency actions that will be implemented if significant odour issues are observed in the vicinity of sensitive receivers. The strategy will be developed prior to accepting dredged material at the site and implemented for the duration of the processing of dredged material at the site. | BL |
| **Human health** | | | | |
| HH1 | Construction | Underwater noise impacts | Monitoring during ~~the early~~ **key** stages of impact piling activities**, including an initial piling trial, will be carried out** at each location ~~will be carried out~~ to measure underwater noise levels and compare against acoustic thresholds to confirm the extent of areas that need to be managed with respect to underwater noise, and to confirm appropriate management measures (as required). Appropriate | BL (Middle Harbour) |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | management measures will be implemented during impact piling.<br><br>The monitoring results, management areas and proposed management measures will be peer-reviewed to ensure they adequately address potential health impacts.<br><br>Monitoring will be carried out following implementation of management measures (as required) to confirm they are appropriate and to identify any additional management measures required. | |
| HH2 | Construction | Underwater noise impacts | Communication and management measures will be implemented during construction to manage potential underwater noise impacts to water-based recreational users during dredging and piling activities in Middle Harbour. The communication tools and management measures that **will** ~~would~~ be contemplated within the management zone include:<br><br>a) Coordination of piling programs with the planned activities of key recreational stakeholders to minimise interaction with planned or peak activity periods of these stakeholders, where feasible and reasonable<br>b) Communication of the piling program and management area so recreational users know when the piling, dredging and other noise generating activities will be taking place, what they can expect, and the zones to minimise the possibility of being startled from a sudden increase in sound pressure underwater<br>c) Direct communication with key local recreational stakeholders during the piling and dredging program to provide up-to-date scheduling<br>d) Use of advertisements, signage, letter box drops and project updates to communicate the implementation of a management area during the works. This could include | BL (Middle Harbour) |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | floating markers or signage on approach to the construction work<br>e) Surveillance within the areas in which **the** precautionary guideline level is exceeded to proactively monitor users ~~in the~~ prior to and during relevant activities that could pose a risk to recreational users. | |
| **Non-Aboriginal heritage** | | | | |
| NAH1 | Design | Ongoing Non-Aboriginal heritage impacts | Appropriate heritage interpretation will be incorporated into the urban design for the project in accordance with the *NSW Heritage Manual* (NSW Heritage Office and Department of Urban Affairs and Planning, 1996), *Interpreting Heritage Places and Items: Guidelines* (NSW Heritage Office, 2005), and the *Heritage Interpretation Policy* (NSW Heritage Council, 2005). | BL/GHF |
| NAH2 | Pre-construction | Impacts on specific non-Aboriginal heritage items | Archival recording will be carried out in accordance with the *Photographic Recording of Heritage Items Using Film or Digital Capture* guideline for areas/items subject to change within the following items, in accordance with Appendix J (Technical working paper: Non-Aboriginal heritage):<br>a) Item 10: Balgowlah Golf Course, Balgowlah<br>b) Item 11: Frenchs Bullock Track, Killarney Heights (pending further detailed survey and detailed design development confirming direct impact)~~.~~<br>**c) Item 15: Canberra Concrete Bus Shelter, Frenchs Forest**<br>**d) Item 16: Wakehurst Parkway Memorial, Killarney Heights.**<br>Archival recording will be completed prior to any works that have the potential to impact upon the items and deposited | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | with appropriate stakeholders as determined during further design development (eg local councils). | |
| NAH3 | Pre-construction | Maritime non-Aboriginal heritage impacts | A Maritime Heritage Management Plan that details the objectives and methodologies to conserve maritime heritage and mitigate impacts will be prepared in consultation with a qualified and experienced maritime archaeologist. The Maritime Heritage Management Plan will specify:<br>a) Unexpected finds protocols relevant to each type of activity such as dredging or piling<br>b) Artefact management procedures, including identification of approved submerged reburial locations<br>c) Relevant work method requirements and maritime heritage inductions tailored for each type of work activity such as dredging or piling<br>d) Restricted zone, archival, baseline and periodic monitoring protocols including before and during construction, and final site inspections within three months of completion of works for the following maritime heritage sites:<br>i) Clive Park Tidal Pool<br>ii) Clive Park Unidentified No. 1<br>iii)Pearl Bay Unidentified No. 1.<br>e) An archaeological research design to guide the investigation of Clive Park Unidentified No 1. | BL |
| NAH4 | Pre-construction | Maritime non-Aboriginal heritage impacts | Any pre-dredge bed of the harbour clearance by divers in Middle Harbour will be carried out in the presence of a maritime archaeologist, who will identify any additional inspection or documentation that should be carried out during the clearance dive. This may include inspecting the locations | Middle Harbour |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | of known or potential submerged maritime heritage sites and items, either recording in situ or recovery and/or relocation. | |
| NAH5 | Pre-construction | Maritime archival recording | An archival recording of Clive Park Unidentified No. 1 will be carried out to mitigate the likely loss of information resulting from a breakdown of site integrity. The archival recording will have the following objectives or research questions:<br>a) Identifying and recording the extent of the site<br>b) Identifying the type and function of the vessel (which would mean determining its construction)<br>c) Identifying what the vessel was carrying at the time of loss<br>d) Re-assessing the cultural heritage significance of the site.<br>The archival recording of the wreck would require limited excavation of the site to recover and examine its contents. This excavation will be carried out in accordance with the research design (refer to NAH3) and any artefacts recovered from the site will be buried, after analysis, in an approved location nearby. | Clive Park Unidentified No. 1 |
| NAH6 | Pre-construction | Maritime archival recording | A detailed archival recording of the following maritime heritage items will be prepared, consistent with relevant NSW Heritage Council approved standards and guidelines:<br>a) Clive Park Tidal Pool<br>b) Pearl Bay Unidentified No. 1.<br>The archival records will also capture any relevant information needed to serve as a baseline for monitoring during the project, as identified in the Maritime Heritage Management Plan (see NAH3). The final archival record will be updated with any changes identified during monitoring or investigation prior to lodgement. | Clive Park Tidal Pool, Pearl Bay Unidentified No.1 |

| Ref | Phase | Impact | Environmental management measure | Location |
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| NAH7 | Pre-construction | Maritime non-Aboriginal heritage impacts | A side scan sonar survey will be carried out for the following areas, where they are not already covered by existing surveys:<br>a) Project construction footprint between Northbridge and Seaforth in the vicinity of the immersed tube tunnels and the Middle Harbour cofferdams (BL7 and BL8)<br>b) Project construction footprint in the vicinity of the Spit West Reserve construction support site (BL9).<br>A qualified maritime archaeologist will assess the results of the side scan survey to identify any additional potential heritage items requiring investigation and assessment. | Middle Harbour south cofferdam (BL7), Middle Harbour north cofferdam (BL8), Spit West Reserve construction support site (BL9) |
| NAH8 | Pre-construction | Maritime non-Aboriginal heritage impacts | **A side scan sonar survey will be carried out of the project construction footprint of the temporary mooring facility and a qualified maritime archaeologist will assess the results of the side scan survey to identify any potential heritage items. If required, a**~~A~~ dive team under the supervision of a maritime archaeologist will ~~inspect the location of each proposed piled mooring to~~ assess the maritime heritage **significance** ~~value~~ of any cultural **item** ~~object~~ present and either relocate the object or, if significant, relocate the proposed mooring. | Temporary mooring facility east of Clive Park in Middle Harbour |
| NAH9 | Pre-construction | Non-Aboriginal heritage impacts to Frenchs Bullock Track | The northern section of the Frenchs Bullock Track potentially impacted directly by construction works will be reformed if impacted, as close as possible to the existing alignment.<br>Further detailed survey will be completed to confirm the heritage curtilage of the southern section of Frenchs Bullock Track prior to construction to determine if this section will be directly impacted.<br>Where the heritage curtilage of the Frenchs Bullock Track is within the construction footprint or boundary of proposed | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | permanent infrastructure, impacts to the track will be avoided where possible through further design development. | |
| NAH10 | Pre-construction and construction | Vibration impacts to non-Aboriginal heritage | A structural survey will be prepared for all maritime infrastructure within the Seaforth 'Harbour Foreshores' that could be subject to vibrational impact to determine minimum working distances and vibration limits to be observed to prevent cosmetic damage. Vibration monitoring will be carried out during works to ensure vibration levels do not exceed appropriate limits. The recommended actions in Appendix G (Technical working paper: Noise and vibration) will be followed. | Harbour foreshores (Seaforth) |
| NAH11 | Construction | Non-Aboriginal heritage impacts during construction | Delineation of restricted zones will be implemented to avoid inadvertent works occurring within the curtilage of heritage items. | BL/GHF |
| NAH12 | Construction | Unexpected discovery of historical heritage materials, features or deposits | If at any time during construction of the project, historical materials, features and/or deposits are encountered, the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services, 2015) will be followed. | BL/GHF |
| NAH13 | Construction | Unexpected discovery of human remains | In the event that construction of the project reveals possible human skeletal material (remains), *Standard Management Procedures – Unexpected Heritage Items* (Roads and Maritime Services, 2015) will be implemented. | BL/GHF |
| NAH14 | Construction | Non-Aboriginal heritage impacts during construction | Non-Aboriginal heritage awareness training will be provided for contractors prior to commencement of construction works to ensure understanding of potential heritage items that may be impacted during the project, and the procedure required to be carried out in the event of discovery of non-Aboriginal heritage materials, features or deposits, or the discovery of human remains. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | This includes relevant work method requirements and maritime heritage inductions tailored for each type of work activity such as dredging or piling. | |
| NAH15 | Construction | Non-Aboriginal heritage impacts | Should at-property noise treatment be required at a premise that is heritage listed, this will be carried out in a manner to minimise heritage impact, and advice of a heritage conservation architect will be sought prior to carrying out the works. Any treatments will be sympathetic to the heritage values of the item, designed with heritage architect input and be reversible where feasible. | BL/GHF |
| **NAH16** | **Construction** | **Maritime heritage impacts** | **During dredging works at the Middle Harbour crossing, side scan and/or multibeam information will be reviewed on a monthly basis by a suitably qualified maritime archaeologist in order to identify any newly exposed anomalies of potential cultural heritage significance. If any anomalies are identified, divers under the supervision of a maritime archaeologist will assess the cultural significance of the anomaly. Heritage mitigation response/s proportionate to the assessed level of the cultural heritage significance will then be determined and implemented.** | **BL (Middle Harbour)** |
| **NAH17** | **Pre-construction and construction** | **Impact on Canberra Concrete Bus Shelter, Frenchs Forest** | **Consultation with Northern Beaches Council will be carried out regarding options for an appropriate new location for the Canberra Concrete Bus Shelter located on Wakehurst Parkway. Where practicable, the Canberra Concrete Bus Shelter will be relocated to a suitable location on Wakehurst Parkway or otherwise within the Northern Beaches local government area, and ideally continue to be used as a bus shelter. Repurposing of the shelter to a use other than a bus stop shelter could be considered, with an appropriate use which retains its aesthetic significance.** | **BL** |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | **Where relocation of the Canberra Concrete Bus Shelter to a new location and/or repurposing of the Canberra Concrete Bus Shelter is deemed practicable, this will be carried out under the supervision of an appropriately qualified heritage consultant and with appropriate engineering advice.** | |
| **NAH18** | **Pre-construction and construction** | **Impact on Wakehurst Parkway Memorial, Killarney Heights** | **Consultation with Northern Beaches Council will be carried out regarding options for an appropriate new location for the Wakehurst Parkway Memorial along Wakehurst Parkway. Where practicable, a location alongside the Wakehurst Parkway at the southern end of the roadway in a publicly accessible area will be investigated, so as not to intrude on the existing North Narrabeen Wakehurst Parkway Memorial at the northern end of the roadway.**<br>**Where relocation of the Wakehurst Parkway Memorial to the new location is deemed practicable, this will be carried out under the supervision of an appropriately qualified heritage consultant and an appropriately qualified and experienced stonemason.** | **BL** |
| **NAH19** | **Construction** | **Impact on Wakehurst Parkway Memorial, Killarney Heights** | **The entry for the two Wakehurst Parkway Memorials on the Monument Australia website (https://monumentaustralia.org.au/) will be updated to reflect the heritage assessment and the changed location of the Wakehurst Parkway Memorial at Killarney Heights.** | **BL** |
| **Aboriginal heritage** | | | | |
| AH1 | Pre-construction and construction | Aboriginal heritage – vibration, and settlement impacts | Before the start of construction~~, further consultation with Heritage NSW, the Metropolitan Local Aboriginal Land Council, the Aboriginal Heritage Office and the Registered Aboriginal Parties will be carried out to decide an appropriate course of action for the Aboriginal site 45-6-0662 on~~ | Frenchs Forest; Bantry Bay; Wakehurst Parkway (45-6-0662) |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | ~~Wakehurst Parkway, as the location of this site could not be confirmed during field inspection (site is likely covered by gravel/vegetation).~~<br><br>~~If considered appropriate~~, an archaeological investigation ~~may~~ **will** be carried out at the possible **Aboriginal heritage** site **45-6-0662** location to carefully remove the gravel/vegetation, to **try and locate and** confirm its presence and record the underlying site condition. **This will occur in the presence of a representative from Metropolitan Local Aboriginal Land Council.**<br><br>If new information regarding site condition is identified during consultation suggesting the site may be subject to impacts due to vibration and settlement, environmental management measures AH2, AH3 and AH4 will apply.<br><br>In the absence of confirming the site, if during construction works a site is located, the unexpected finds protocol prescribed in AH5 would apply. Further, Heritage NSW, an appropriately qualified archaeologist and the Metropolitan Local Aboriginal Land Council will be contacted and the site will be re-recorded in situ. | |
| AH2 | Pre-construction and construction | Aboriginal heritage – vibration impacts | The following process will be carried out to confirm where vibration monitoring at those terrestrial sites within 50 metres of the project corridor will be required:<br><br>a) Terrestrial Aboriginal site condition surveys of sites will be completed by an appropriately qualified person using those techniques appropriate in determining which sites are considered to be structurally unsound<br>b) Where this determination cannot be made, as a precaution the site will be considered to be structurally unsound | All registered AHIMS sites subject to vibration intensive activities determined to be structurally unsound (see AH2). |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | c) A screening of vibration intensive activities within 50 metres of structurally unsound sites will be carried out to identify activities that have the potential to exceed vibration levels of 2.5 millimetres per second<br>d) Sites identified as being both structurally unsound and having potential for exceedance in vibration levels of 2.5 millimetres per second will be identified as requiring vibration monitoring where this cannot be reduced at the source. | |
| AH3 | Construction | Aboriginal heritage – vibration impacts | Vibration monitoring will be carried out at sites that have been identified as requiring monitoring in accordance with the process outline in environmental management measure AH2. The monitoring process will:<br>a) Be developed by a suitably qualified person<br>b) Be risk-based<br>c) Include appropriate frequency and duration of monitoring including adequate benchmark recording before works commence<br>d) Include appropriate management protocols for any exceedances.<br>Where possible, project works will be conducted in a manner to minimise vibration levels, to less than 2.5 millimetres per second at all structurally unsound AHIMS sites. | All registered AHIMS sites located subject to vibration intensive activities determined to be structurally unsound (see AH2). |
| AH4 | Construction | Aboriginal heritage – vibration impacts | Where monitoring identifies that vibration levels exceed 2.5 millimetres per second or following vibration intensive activities, subsequent condition survey of sites that are subject to monitoring in AH3 will be carried out.<br>The subsequent condition surveys will record any changes to the integrity of the site that may have resulted from construction vibration. Additional surveys must be carried out by a suitably qualified person and include a Metropolitan | All registered AHIMS sites subject to vibration monitoring (see AH3). |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | Local Aboriginal Land Council representative. AHIMS site cards will be updated accordingly where any changes are observed. Condition surveys may include further photogrammetry and 3D-capture techniques, in which case comparison against the baseline will be carried out. | |
| AH5 | Construction | Unexpected discovery of historical heritage materials, features, or deposits | If at any time during the construction of the project, any items of potential Aboriginal archaeological or cultural heritage conservation significance or Ancestral remains are discovered, they will be managed in accordance with the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services, 2015). | BL/GHF |
| AH6 | Construction | Aboriginal heritage - impacts | Cultural and historic heritage awareness training will be carried out for personnel engaged in work that may impact heritage items before commencing works for the project. | BL/GHF |
| AH7 | Pre-construction and construction | Aboriginal heritage - impacts | As part of the project urban design and landscape plan, an Aboriginal heritage interpretation strategy will be developed for the project in consultation with Registered Aboriginal Parties and other relevant Stakeholders. Appropriate Aboriginal heritage interpretation will be incorporated into the project urban design and landscape plan in accordance with the interpretation strategy. | BL/GHF |
| AH8 | Pre-construction | Potential Aboriginal submerged sites heritage impacts | The effectiveness of using high resolution geophysical survey to identify rock overhangs concealed by marine sediments will be assessed. If it is determined that a high resolution geophysical survey could produce the desired results, then the survey will be carried out.<br><br>If the geophysical survey conclusively shows that there are no rock overhangs measuring at least 1.5 metres in height (from the rock base to the rock ceiling), there would be no further archaeological work carried out and any residual risk will be managed through an unexpected finds procedure. | Potential rock shelter(s) at Seaforth located outside of Middle Harbour north construction support site (BL8) cofferdam footprint but within the dredge footprint |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | However, if the geophysical survey is inconclusive or distinct rock overhangs are identified, then an archaeological dive investigation will be implemented. Much of the diving will be done in near zero visibility and will therefore be limited to what a diver can feasibly and safely do. | |
| AH9 | Pre-construction and construction | Potential Aboriginal submerged sites heritage impacts | The effectiveness of using high resolution geophysical survey to identify rock overhangs concealed by marine sediments will be assessed. If it is determined that a high resolution geophysical survey could produce the desired results, then the survey will be carried out.<br><br>If the geophysical survey conclusively shows that there are no rock overhangs measuring at least 1.5 metres in height (from the rock base to the rock ceiling), there would be no further archaeological work carried out and any residual risk will be managed through an unexpected finds procedure. However, if the geophysical survey is inconclusive or distinct rock overhangs are identified, then onsite visual monitoring within the cofferdam will be carried out during the construction period, after the cofferdam has been de-watered. The aim of the monitoring will be to identify voids within the bedrock close to the interface with marine sediments.<br><br>In the event that a void in the bedrock appears that displays the characteristics of a potential rock shelter, then the marine sediments will be removed by pump. Should the marine sediments bottom out onto the rock no further action would be taken. If the characteristics of the marine sediments change or if fissures are evident, then samples of the sediments will be taken, preferably as an intact core sample.<br><br>In consultation with a suitably experienced geomorphologist a set of criteria will be established for the identification of pre-inundation soil deposits (peat, charcoal, roots, etc). If pre-inundation soil deposits are evident within samples, a | Within the footprint of Middle Harbour south and north cofferdams construction support sites (BL7 and BL8) |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | controlled archaeological investigation to recover any artefacts will take place. However, the extent of the archaeological investigation and method of recovery will be determined by the constraints of the bed rock conditions and workplace health and safety protocols and constraints within the cofferdams, including safety protocols for handling of potentially contaminated sediment. Environmental, engineering and workplace health and safety factors such as operating space within an overhang, viscosity of the pre-inundation soil and elevated contamination levels will have an influence on the method of archaeological investigation, which will nonetheless aim to retain spatial and stratigraphic control if at all feasible. | |
| **Geology, soils and groundwater** | | | | |
| SG1 | All phases | Groundwater drawdown and quality | The existing groundwater monitoring program for both groundwater levels and quality will be continued through construction. Outcomes of updated groundwater modelling (environmental management measure SG2) will identify any requirements for further groundwater monitoring during the operational phase. | BL/GHF |
| SG2 | All phases | Groundwater drawdown | As more information becomes available on groundwater levels **and contamination** through ongoing groundwater monitoring, groundwater modelling will be updated to refine the predictions. Inflow predictions will be updated prior to finalising detailed design and will include designed tunnel linings, and the detailed design will be updated based on the updated operational inflow and impact predictions.<br><br>If refined predictions of groundwater levels and drawdown indicate that impacts would be greater than the impacts presented in the environmental impact statement, feasible | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | and reasonable mitigation measures will be incorporated into the detailed design and implemented.<br>Groundwater modelling will be conducted considering *Australian ~~G~~**g**roundwater ~~M~~**m**odelling ~~G~~**g**uidelines* (Barnett et al., 2012), including sensitivity analysis and consideration of future climate change, as required. | |
| SG3 | All phases | Impact to registered groundwater bores | The viability of the following domestic bores will be confirmed prior to construction:<br>a) GW023150<br>b) GW026513<br>c) GW072478<br>d) GW107970<br>e) GW108224<br>f) GW108991.<br>If drawdown at the bore exceeds two metres (in accordance with the *NSW Aquifer Interference Policy* (NSW DPI **(Office of Water)**, 2012)) and impacts to the ongoing use of the bores are unacceptable, measures will be taken to 'make good' the impact by restoring the water supply to pre-development levels. The measures taken will be dependent upon the impacts to the bore and will be determined in consultation with the affected licence holder but could include deepening the bore, providing a new bore or providing an alternative water supply. | BL/GHF |
| SG4 | Design | Ground movement impacts | Detailed predictive settlement models will be developed for areas of concern to guide tunnel design and construction methodology, including the selection of options to minimise settlement where required. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| SG5 | Pre-construction | Ground movement impacts | An Independent Property Impact Assessment Panel, comprising geotechnical and engineering experts, will be established prior to the commencement of works to independently verify building condition survey reports, resolve any property damage disputes and establish ongoing settlement monitoring requirements. | BL/GHF |
| SG6 | ~~Pre-construction~~ **All phases** | Water table drawdown impact on baseflow and groundwater dependent ecosystems | **Following completion of environmental management measure SG2, a** focussed study will be carried out **in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science Group)** to confirm potential groundwater drawdown and associated baseflow reductions at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek due to tunnelling, and confirm potential impacts on freshwater ecology in the affected watercourses and nearby groundwater dependent ecosystems. The study will consider how existing site features affect the interaction between surface water and groundwater along the affected reaches of these watercourses, and the hydraulic connectivity in the underlying geology. Where ~~unacceptable~~ ecological impacts are predicted **to be worse than that presented as part of the environmental impact statement/submissions report**, feasible and reasonable mitigation measures to address the impacts will be identified **in consultation with a suitably qualified and experienced specialist**, incorporated into the detailed design, and implemented during construction. The mitigation measures considered will include tunnel linings. | BL |
| SG7 | Pre-construction, construction | Ground movement impacts | Pre-construction building structure condition surveys will be offered and prepared (where the offer is accepted by the owner) for properties (and heritage assets) within the zone of influence of tunnel settlement where the degree of severity has been assessed as 'slight' **(**or above**)** ~~and~~ **or** within the minimum working distances for cosmetic and structural | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | damage due to vibration. The surveys will be carried out by a suitably qualified person prior to the commencement of the tunnelling and vibration intensive activities in the vicinity with the potential to affect the building/structure.<br><br>Within three (3) months of the completion of construction activities that have the potential to cause settlement or vibration-related damage to the subject surface/subsurface structure, all property owners of buildings for which a pre-construction building condition survey was carried out will be offered a second building condition survey. Where an offer is accepted, a post-construction building condition survey will be carried out by a suitably qualified person. The results of the survey will be documented in a post-construction building condition survey report for each building surveyed.<br><br>Copies of building condition survey reports will be provided to the owners of the buildings surveyed within one (1) month of the survey being completed.<br><br>Any building and/or property damage from settlement caused by the project will be repaired at no cost to the owner. Any repairs to listed heritage items required as a result of the settlement damage, will be carried out under the guidance of a suitably qualified and experienced heritage professional. | |
| SG8 | Pre-construction and construction | Impacts on site workers and/or local community through disturbance and mobilisation of **terrestrial** contaminated material | Potentially contaminated areas directly affected by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act* ***1997*** ~~*2008*~~**.**<br><br>This includes, but is not limited to, further investigations in potential areas of environmental interest in the project footprint, including:<br><br>~~Warringah Freeway (from North Sydney to Cammeray)~~ | BL/GHF **(terrestrial sites; marine works will be managed in accordance with environmental management measures SG17 and WM3)** |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | a) Punch Street, Artarmon<br>b) Willoughby Leisure Centre and Bicentennial Reserve, Willoughby<br>c) Flat Rock Reserve, Northbridge<br>d) Spit West Reserve, Mosman<br>e) Balgowlah Golf Course, Balgowlah<br>f) Wakehurst Parkway (from Seaforth to Frenchs Forest).<br>Subject to the outcomes of the investigations, a Remediation Action Plan will be implemented in the event that site remediation is warranted.<br>The Remediation Action Plan will be prepared in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998). If Remediation Action Plan(s) are required for works at Flat Rock Drive (BL2), Balgowlah Golf Course (BL10) construction support sites and surface works and construction support site locations along the Wakehurst Parkway (BL12, BL13 and BL14) these will be developed with consideration of environmental management measure **WM9** ~~WM6~~.<br>An independent NSW EPA Accredited Site Auditor will be engaged where contamination is complex to review applicable contamination reports and evaluate the suitability of sites for a specified use as part of the project. | |
| SG9 | Construction | Erosion and sedimentation | Erosion and sediment control measures will be implemented at all **construction support** ~~work~~ sites and surface road upgrades in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004), *Managing Urban Stormwater:* ***Soils and Construction -*** *Volume 2D Main Road Construction* (~~NSW Department of Environment and Climate~~ | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | ~~Change~~ **DECC**, 2008) and relevant guidelines, procedures and specifications of Transport for NSW.<br><br>A soil conservation specialist will be engaged for the duration of construction of the project to provide advice regarding erosion and sediment control including review of Erosion and Sediment Control Plans. | |
| SG10 | Construction | Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material | Asbestos handling, management and disposal will be carried out in accordance with relevant legislation, codes of practice and Australian standards. | BL/GHF |
| SG11 | Construction | Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material | A hazardous materials assessment will be carried out prior to and during the demolition of structures. Demolition works will be carried out in accordance with the relevant Australian Standards and relevant **SafeWork** NSW **Work, Health and Safety** Codes of Practice, including the Work Health and Safety Regulation 2011 (NSW) to minimise potential exposure of construction personnel and the public to hazardous materials. | BL/GHF |
| SG12 | Construction | Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material | A Construction Waste Management Plan will be prepared and implemented during construction. The plan will include but not be limited to procedures for handling and storing potentially contaminated substances. | BL/GHF |
| SG13 | Construction | Impacts on site workers and/or local community through | The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contamination discovery procedure, as outlined in the | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | disturbance and mobilisation of contaminated material | *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013). | |
| SG14 | Construction | Impacts from disturbance of acid sulfate soils | Prior to ground disturbance in high risk acid sulfate areas at Spit West Reserve and Middle Harbour testing will be carried out to determine the presence of acid sulfate soils. If acid sulfate soils are encountered, they will be managed in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee, 1998). | BL |
| SG15 | Construction | Ground gas impacts | Ground gas investigations will be carried out in Flat Rock Reserve to further assess the potential presence of landfill generated gas which could impact on the construction and/or operation of the project.<br><br>Ground gas investigations will be carried out in accordance (where applicable) with the ~~*Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*~~ ***Assessment and management of hazardous ground gases: Contaminated land guidelines*** (NSW EPA, ~~2012~~ **2020**). **If ground gas risks are established, appropriate design and/or management measures will be developed and implemented to remove or reduce the associated risk.** | BL |
| SG16 | Construction | Groundwater drawdown during operation | Measures will be implemented during tunnel construction to ensure that groundwater inflows **into each tunnel** during the operation phase do not exceed 1L/s/km ~~on average over the entire tunnel length~~ **across any given kilometre.** | BL |
| SG17 | Construction | Marine contamination impacts | The appropriateness of offshore disposal will be assessed in accordance with the Australian Government Department of Agriculture, Water and the Environment's *National Assessment Guidelines for Dredging* (Department of | BL **(marine sites)** |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | Environment, Water, Heritage and the Arts, 2009). Offshore disposal will only occur for material that meets the criteria provided in these guidelines. | |
| SG18 | Construction and operation | Groundwater drawdown | The groundwater monitoring program will consider additional locations for monitoring that are subject to medium and high risk of groundwater contamination during construction and operation.<br><br>Where relevant, modelling/mass balance analysis will be carried out to assess potential impacts on beneficial aquifer use**,** the likely quality of groundwater inflows **and migration of potential contaminant hazards**. | BL/GHF |
| SG19 | Construction and operation | Groundwater quality impacts | If the groundwater quality monitoring and associated analysis identifies potential impacts to beneficial aquifer use from the migration of contaminated groundwater, ~~or~~ the quality of groundwater tunnel inflows, **or migration of potential contaminant hazards,** feasible and reasonable management measures will be identified and implemented. | BL/GHF |
| SG20 | Construction and operation | Contamination due to leakage or spills | Emergency procedures, including material **and washdown area** bunding and appropriately sized spill containment kits, will be developed to avoid and manage accidental spillages of fuels, chemicals, and fluids to minimise the risk of human health impacts**, water quality impacts** and contamination of groundwater. | |
| **SG21** | **Pre-construction** | **Impacts on utility and infrastructure owners** | **Utility and infrastructure owners will be consulted prior to the commencement of excavation or tunnelling works which may potentially affect the asset to identify settlement criteria and appropriate mitigation measures to ensure, where possible, that the asset will not experience exceedances of the relevant criteria.** | **BL/GHF** |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| **Hydrodynamics and water quality** | | | | |
| WQ1 | Design | Stormwater harvesting | The ~~need~~ **final design** for a stormwater harvesting water quality basin at Balgowlah **to replace the existing Balgowlah Golf Course stormwater dam will be developed** ~~will be assessed and determined~~ during further design development **in consultation with Northern Beaches Council**. ~~If the stormwater harvesting water quality basin is considered to be required, a~~ **A** suitable alternate location **and size for the basin** ~~and future use~~ will be determined as part of the dedicated consultation **and follow on design** process **associated with** ~~regarding~~ the final layout of the new and improved public open space and recreation facilities at Balgowlah. **The new stormwater basin at Balgowlah will be constructed and operational prior to the decommissioning of the existing Balgowlah Golf Course stormwater dam.** | BL (Balgowlah) |
| WQ2 | Design | Spill containment | Spill containment controls along surface roads will be confirmed during further design development and determined with consideration of:<br>a) The environmental sensitivity of the receiving waterways<br>b) The likelihood of vehicle accidents, informed by the annual average daily traffic (AADT) loading along the surface road<br>c) Where implementation of controls measures may have a negative impact on other areas of environmental importance, such as biodiversity and heritage. | BL/GHF |
| WQ3 | Design and operation | Local stormwater system capacity | The capacity for the local stormwater system to receive operational wastewater treatment plant discharge will be confirmed during further design development. If there is a stormwater infrastructure capacity issue with existing infrastructure, mitigation measures such as storage detention | GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | to control water outflow during wet weather events will be implemented within the motorway facility site. | |
| WQ4 | Design and operation | Burnt Bridge Creek geomorphology | The localised adjustment of Burnt Bridge Creek will be designed with consideration of existing channel conditions and an understanding of existing hydrology to minimise alterations to, and erosion of, the bed and banks. The gradient, sinuosity and channel capacity will be consistent with upstream and downstream sections.<br>The extension to the existing culvert will be designed with a low gradient and scour protection to minimise impacts to geomorphology. Where required, the adjustment will include grade controls and bank stabilisation works to manage anticipated high velocity conditions. | BL |
| WQ5 | Design and operation | Water sensitive urban design | Opportunities for water sensitive urban design will be considered during the development of the design for the stormwater management system for the new and upgraded road infrastructure and during development of the urban design and landscape plans. Identified water sensitive urban design features will be implemented where practical and with consideration to best management practice guidelines including Transport for NSW's *Water sensitive urban design guideline**: Applying water sensitive urban design principles to NSW transport projects*** (Roads and Maritime Services, 2017). | BL/GHF |
| WQ6 | Design and operation | Surface water discharge | Water quality treatment controls for stormwater will meet the design targets, where possible. Where the design targets cannot be met due to site constraints, water quality treatment controls will be provided to meet or improve existing surface water quality. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| WQ7 | Design and operation | Connection to Sydney Water stormwater assets | The need for direct connection to Sydney Water stormwater assets will be reviewed during further design development and in consultation with Sydney Water. Where direct connection to a Sydney Water stormwater asset is required, the project will install and operate water treatment devices during operation to achieve the Sydney Water pollutant load reduction targets where feasible and reasonable. | BL/GHF |
| WQ8 | ~~Design and construction~~ **All phases** | Watercourse geomorphology | The potential for scour and erosion of watercourse bed and banks will be considered during the design of new discharge outlets.<br>Construction work activities within or next to the watercourses and drainage lines will be minimised as much as reasonably practical to minimise disturbance of sediments in or near the waterway. | BL/GHF |
| WQ9 | ~~Design and construction~~ **All phases** | Local stormwater system **and/or receiving waterway** capacity | Further design development will confirm the local stormwater system **and/or receiving waterway** capacity to receive construction **and operational** wastewater treatment plant inflows. If there is a stormwater infrastructure capacity issue with existing infrastructure, mitigation measures such as storage detention to control water outflow during wet weather events will be considered and implemented within the construction **footprint** ~~support site~~ where feasible and reasonable. | BL/GHF |
| WQ10 | Pre-construction and construction | Freshwater quality monitoring | A freshwater quality monitoring program for the construction of the project will be developed and implemented, with consideration of the freshwater monitoring being carried out for the Western Harbour Tunnel and Warringah Freeway Upgrade project and the completed Northern Beaches Hospital road upgrade project.<br>The program will be developed in consultation with the Environment Protection Authority, Department of Planning, | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | Industry and Environment (Natural Resources Access Regulator), Department of Planning, Industry and Environment (Water), and relevant councils.<br><br>Sampling locations and monitoring methodology including frequency and indicators will be in accordance with the *Guideline for Construction Water Quality Monitoring* (RTA 2003) and ANZG (2018).<br><br>If exceedances of the criteria established under the freshwater monitoring program are detected, a management response will be triggered and appropriate mitigation measures to address the exceedance will be identified and implemented. | |
| WQ11 | Construction | Wastewater discharge | Discharges from wastewater treatment plants during the construction phase will be required to meet the following discharge criteria:<br><br>a) The relevant physical and chemical stressors**, the guideline values** set out in **Table 3.3.2 and 3.3.3 of** the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000)<br><br>b) The ANZG (2018) 90 per cent species protection levels for toxicants generally, with the exception of those toxicants known to bioaccumulate, which will be treated to meet the ANZG (2018) 95 per cent species protection levels<br><br>c) The draft ANZG default guideline values for iron (in fresh and marine water) and zinc (in marine water).<br><br>**Where the ANZG (2018) does not provide a default guideline value for a particular pollutant, the approaches set out in the ANZG (2018) for deriving guideline values, using interim guideline values and/or using other lines of evidence such as international** | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | **scientific literature or water quality guidelines from other countries, will be used.** | |
| WQ12 | Construction | Dredge plumes | **Monitoring during dredging activities will be carried out to validate the effectiveness of mitigation measures implemented to manage potential impacts on the water quality and sensitive marine vegetation and habitats of Middle Harbour. The use of real-time turbidity monitoring at both potential impact and background locations, as well as adoption of a tiered (trigger level) management approach for sensitive sites to manage any potential impacts, will be included in a dredge monitoring program. The dredge monitoring program will be developed in consultation with an appropriately qualified and experienced specialist, DPI Fisheries and the NSW EPA prior to its implementation.**<br>~~Monitoring of dredge plumes will be carried out during dredging activities to validate the dredge plume dispersion predictions. Exceedances of the predicted dredge plume extents and intensities will trigger subsequent management responses that will include a range of strategies including, assessing whether secondary impacts are occurring (eg seagrass stress) and if so then further levels of management actions will be implemented, such as adjustments to the dredging process.~~ | BL |
| WQ13 | Construction | Watercourse geomorphology | During construction, the drainage and adjustment works associated with Burnt Bridge Creek and an existing aboveground constructed **open channel** ~~drainage line~~ within Flat Rock Reserve will be staged to ensure creek flows and velocities are not substantially changed and to avoid downstream erosion and bed and bank stability impacts. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| WQ14 | Construction | Sediment basin discharge | Sediment basin discharge impact assessments, commensurate with the potential risk and consistent with the **Australian Government National Water Quality Management Strategy guidelines** ~~*National Water Quality Guidelines* (ANZG (2018))~~ and *Managing Urban Stormwater – Soils and Construction*, *Volume 1* (Landcom, 2004) will be prepared to inform the criteria for discharge from sediment basins. | BL/GHF |
| WQ15 | Construction | Erosion and sedimentation | Disturbed floodplain environments next to the watercourses and/or along overland drainage lines ~~should~~ **will** be stabilised as soon as practical following disturbance. | BL/GHF |
| WQ16 | Construction | Marine water quality | Management measures that will be implemented during dredging activities to minimise impacts on marine water quality, vegetation and habitats will include:<br>a) Use of a backhoe dredge with a closed environmental clamshell bucket operated within a localised floating silt curtain enclosure to a depth of two to three metres to dredge the top layer of marine sediments<br>b) Implementation of 10 to 12 metre deep-draft silt curtains around the dredge works<br>c) Implementation of silt curtains in accordance with environmental management measures B31 to B33. | BL |
| WQ17 | Operation | Wastewater discharge | The Gore Hill Freeway wastewater treatment plant will be designed to treat wastewater generated from tunnel groundwater ingress and rainfall runoff in tunnel portals **to** ~~and~~ the following discharge criteria:<br>a) The relevant physical and chemical stressors**, the guideline values** set out in **Tables 3.3.2 and 3.3.3 of** the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | b) The ANZG (2018) 95 per cent species protection levels for toxicants generally, with the exception of those toxicants known to bioaccumulate, which would be treated to meet the ANZG (2018) 99 per cent species protection levels<br>c) The draft ANZG default guideline values for iron (in fresh and marine water) and zinc (in marine water).<br>**Where the ANZG (2018) does not provide a default guideline value for a particular pollutant, the approaches set out in the ANZG (2018) for deriving guideline values, using interim guideline values and/or using other lines of evidence such as international scientific literature or water quality guidelines from other countries, will be used.** | |
| WQ18 | Operation | Operational monitoring | Operational phase monitoring of surface water quality of sensitive receiving environments will be described in the operational surface water quality monitoring program and carried out in line with the post construction phase requirements of the Roads and Maritime *Guideline for Construction Water Quality Monitoring* (RTA, 2003).<br>As a minimum, monthly monitoring will be carried out for the first year of operation or until a suitably qualified and experienced independent expert determines that a site has adequately stabilised and stormwater basin discharge criteria are achieved.<br>Should discharge criteria from operational stormwater basins be exceeded, a management response will be triggered and appropriate mitigation measures to address the exceedance will be identified and implemented. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| **WQ19** | **Design** | **Stormwater discharge / flooding impacts** | **The condition and capacity of local stormwater infrastructure to receive operational flows from the motorway component of the project will be reviewed during detailed design and as necessary, adjustments made to ensure sufficient capacity is provided. Any potential downstream stormwater / flooding impacts associated with the new and improved open space and recreation facilities at Balgowlah will be reviewed when the facilities to be constructed are agreed through the dedicated consultation process. Reasonable and feasible mitigation measures will be applied to ensure downstream impacts are minimised.** | **BL/GHF** |
| **WQ20** | **Construction** | **Water quality monitoring** | **Monitoring of dissolved oxygen, temperature, salinity, turbidity and sediment oxygen demand will be carried out for a period of 12 months prior to construction in Middle Harbour. The monitoring will include:**<br>**a) Vertical profile monitoring of dissolved oxygen, temperature, salinity and turbidity at one location within the deep basin upstream of the immersed tube tunnel location where the changes to dissolved oxygen are predicted to occur**<br>**b) Monthly vertical profiling of dissolved oxygen, temperature, turbidity and salinity upstream and downstream of the immersed tube tunnel location at up to six locations within Middle Harbour**<br>**c) Monthly sampling of sediment oxygen demand at the location in a) above and every three months at each upstream vertical profile site in b) above.**<br>**The need for further modelling or post-construction monitoring of potential dissolved oxygen changes will be** | **BL, Middle Harbour** |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | **determined following the completion of the pre-construction monitoring.** | |
| **WQ21** | **Construction** | **Marine water quality** | **Barges located at Port of Newcastle construction support site (BL15) will be enclosed within a localised floating silt curtain enclosure to a depth of two to three metres.** | **Port of Newcastle construction support site (BL15)** |
| **Flooding** | | | | |
| F1 | Design | Impact of the project on flood behaviour | Where flood levels in the 1% AEP event are predicted to increase at any residential, commercial and/or industrial buildings as a result of operation of the project, a floor level survey will be carried out.<br>If the survey indicates existing buildings would experience above floor inundation during a 1% AEP event as a result of the project, further refinements will be made (as required) to the design of permanent project components to minimise the potential for impacts. | BL/GHF |
| F2 | Design | Operational flooding impacts | Impact of the project on flood behaviour during operation will be confirmed during further project development. This will include the consideration of future climate change and a partial blockage of the local stormwater drainage system. **The project will be designed such that the flood hazard in existing residential development during floods larger than 1% AEP would not be significantly increased such that there would be an increased risk to life.** | BL/GHF |
| F3 | Design | Impact of flooding on the project | Flood emergency management measures for construction and operation of the project will be prepared in consultation with State Emergency Services and relevant councils and incorporated into relevant environmental and/or safety management documentation. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| F4 | Design | Impact of the project on scour potential | Measures will be assessed during further design development which are aimed at reducing as far as is practical the risk of increased scour in the receiving drainage lines that are located along the Wakehurst Parkway. **Further design development will include consideration of the resistance of the soil materials to the hydraulic forces likely to be imposed.** Scour countermeasures will also be provided at the outlet of new or upgraded transverse and longitudinal drainage lines**, as well as in other areas where the project would otherwise result in unacceptable increases in scour potential**. | BL/GHF |
| F5 | Design and construction | Impacts of construction sites on flood behaviour | Detailed construction planning will consider flood risk at construction sites and construction support sites. This will include:<br>a) A review of site layout and staging of construction activities to avoid or minimise obstruction of overland flow paths and limit the extent of flow diversion required<br>b) Identification of measures to not worsen flood impacts on the community and on other property and infrastructure during construction up to and including the 1% AEP flood event where reasonable and feasible<br>c) Measures to mitigate alterations to local runoff conditions due to construction activities. | BL/GHF |
| F6 | Construction | Flooding impacts to tunnel excavation | Entries to tunnel excavations, including cut and cover sections of tunnel, will be protected against frequent flooding by locating openings outside flood prone areas, and/or the provision of local bunding and flood protection barriers. | BL/GHF |
| F7 | Construction | Flooding impacts to tunnel excavation | The flood standard adopted at each tunnel entry during construction will be developed taking into consideration the | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | duration of construction, the magnitude of inflows and the potential risks to personal safety and the project works. | |
| F8 | Construction | Flood impacts to construction sites | Spoil stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside the 10% AEP flood extent. The exact level of flood risk accepted at stockpile sites will depend on the duration of stockpiling operations, the type of material stored, the nature of the receiving drainage lines and also the extent to which it would impact flooding conditions in adjacent development. | BL/GHF |
| F9 | **Construction** ~~Operation~~ | Flood impacts to construction sites | Site facilities will be located outside high flood hazard areas based on a 1% AEP flood. | BL/GHF |
| **F10** | **Design** | **Flood impacts in the PMF event** | **Opportunities to minimise and/or eliminate adverse impacts in residential development that is located upstream of the Burnt Bridge Creek Deviation for events greater than the 1% AEP event will be investigated during further design development. This would include refinement of road levels at the existing creek crossing of Burnt Bridge Creek, and detailed design of the new stormwater basin at Balgowlah.** | **BL** |
| **Biodiversity** | | | | |
| B1 | Design | Removal of native vegetation and threatened species habitat | The area required and layout of Flat Rock Drive construction support site (BL2) will be refined during further design development and construction planning to avoid direct impacts on PCT 1841, where feasible and reasonable. | BL |
| B2 | Design | Injury and mortality of fauna | Connectivity measures will be designed during further design development in accordance with the *Wildlife Connectivity Guidelines: Managing wildlife connectivity of road projects* (Draft) (Roads and Maritime Services, 2011)**, taking into account best available knowledge** and consider measures to facilitate the crossing of native fauna species including the | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | Eastern Pygmy-possum, Red-crowned Toadlet, Southern Brown Bandicoot and Rosenberg's Goanna.<br>Maintenance requirements for ~~underpasses and rope~~ **fauna** crossings **and fauna exclusion fencing** will be developed during further design development and incorporated into an Operational Environmental Management Plan or existing Environmental Management System as relevant. | |
| B3 | Design | Injury and mortality of fauna | Fauna exclusion fencing ~~would~~ **will** be designed to exclude small fauna species from the road corridor**,** such as Eastern Pygmy-possum**,** and will be installed for the full extent of the Wakehurst Parkway within the construction footprint. **In addition, frog fencing will be added to the fauna exclusion fencing within identified Red-crowned Toadlet habitat.** The design specifications of the fauna exclusion fence will be developed during further design development including the need for access gates to manage any fauna on the ~~roadside~~ **road side** of the fauna exclusion fence based on best available knowledge from other Transport for NSW projects**, and in consultation with NSW National Parks and Wildlife Service and Northern Beaches Council**. | BL |
| B4 | Design and operation | Noise, vibration and light impacts | Artificial light impacts on native fauna in the operational phase of the project will be minimised **to the extent reasonably practicable** ~~where feasible and reasonable~~ through further design development, where the project adjoins tracts of fauna habitat (eg along the Wakehurst Parkway) consistent with the requirements of Australian Standard~~s *and Guidelines*~~ ***AS*** *4282 – 2019 Control of the obtrusive effects of outdoor lighting* **(Standards Australia, 2019)**. | BL/GHF |
| B5 | Pre-construction **and** | Impacts to marine species | Pre-construction surveys of potentially affected marine habitat areas will be carried out ~~as close as practicable to 24 hours~~ **in the 24 hour period** prior to commencement of works **that** | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | **construction** | | **may impact potential habitat** by suitably qualified and experienced marine ecologists to search for White's Seahorses (and other Syngnathids) and relocate them to nearby habitat. **Prior to the pre-construction survey, consultation with DPI Fisheries will be carried out to obtain a permit under Section 37 of the *Fisheries Management Act 1994* to authorise potential relocations.** | |
| B6 | Pre-construction **and construction** | Removal of native vegetation and threatened species habitat | Vegetation removal including the clearing of native vegetation and fauna habitat will be further minimised during further design development and construction planning **to the extent reasonably practicable.**~~, where feasible and reasonable.~~ | BL/GHF |
| B7 | Pre-construction and construction | Impacts on the Large-eared Pied Bat | Activity-specific controls will be developed to manage impacts from high noise and vibration generating activities (eg controlled blasting and rock hammering) on Large-eared Pied Bat along the Wakehurst Parkway. The controls will be prepared **in consultation with** ~~by~~ a suitably qualified and experienced microbat specialist and implemented during surface road works as required. | BL |
| B8 | Pre-construction | Impact to aquatic environments | Any dewatering activities will be undertaken in accordance with the *Technical Guideline: Environmental Management of Construction Site Dewatering* (RTA, 2011), in a manner that prevents pollution of waters.<br><br>Dewatering of the stormwater harvesting dam at Balgowlah Golf Course will be carried out with consideration of native fauna and appropriate measures will be implemented to relocate native aquatic fauna as required. | BL/GHF |
| B9 | Pre-construction and construction | Underwater noise impacts to marine species | Prior to commencement of impact piling appropriate management measures to minimise noise impacts on fish and aquatic organisms will be developed **in consultation with** ~~by~~ a suitably qualified and experienced marine ecologist and implemented during impact piling works. The measures | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | will include investigation and contingency actions should distressed or dead fish be observed within or adjacent to the construction footprint during piling works. | |
| B10 | Construction | Removal of native vegetation and threatened species habitat | Vegetation removal along the Wakehurst Parkway will be timed to avoid the winter breeding period for the Eastern Pygmy-possum (May to July), where feasible and reasonable. | BL |
| B11 | Construction | Removal of native vegetation and threatened species habitat | Vegetation removal will be carried out in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). | BL/GHF |
| B12 | Construction | Removal of native vegetation and threatened species habitat | The unexpected species find procedure included in *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011) will be followed if threatened ecological communities, flora or fauna species, not assessed in the biodiversity development assessment report, are identified in the construction footprint. | BL/GHF |
| B13 | Construction | Removal of native vegetation and threatened species habitat | Vegetation will be re-established within the construction footprint, where feasible, in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). | BL/GHF |
| B14 | Construction | Removal of native vegetation and threatened species habitat | Pre-clearing surveys for threatened fauna species will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). This will include inspections of hollows and dead timber for Eastern Pygmy-possum. **Surveys will also include human made structure that have been identified as potentially providing habitat** | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | **for microbats and are subject to demolition or modification.** | |
| B15 | Construction | Removal of threatened flora species | Prior to clearing, the location of the individual of *Syzygium paniculatum* next to the Wakehurst Parkway will be confirmed. If the individual is outside the construction footprint, but in close proximity to the boundary, the need for a site-specific exclusion zone will be investigated to minimise potential indirect impacts. Should the individual be within the construction footprint, further design investigation will be carried out to determine if impacts can be avoided where reasonable and feasible. | BL |
| B16 | Construction | Removal of threatened flora species | Pre-clearing surveys for threatened flora species will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). | BL/GHF |
| B17 | Construction | Noise, vibration and light impacts | Mitigation measures such as quieter construction methods or the use of temporary noise barriers in close proximity to the construction activities will be used wherever feasible and reasonable to minimise noise impacts to the Grey-headed Flying-fox camp. For the Kitchener Street construction support site (BL11), the arrangement of the site layout ~~should~~ **will** maximise acoustic shielding (ie locations of site sheds, offices and fixed structures) to minimise noise impacts from within the site to the direction of the Grey-headed Flying-fox camp. | BL |
| B18 | Construction | Noise, vibration and light impacts | Where feasible and reasonable, noise intensive works with the potential of impacting the Grey-headed Flying-fox camp (ie demolition involving rock hammering or resurfacing works) **will** ~~should~~ be programmed to avoid September to February. | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
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| B19 | Construction | Noise, vibration and light impacts | A person experienced in flying-fox behaviour, (ie able to identify each stage of the reproductive cycle, ABLV-vaccinated and trained to rescue flying-foxes if required) will monitor disturbance levels within the Grey-headed Flying-fox camp at Balgowlah during construction activities that result in noise levels at the camp that exceed the pre-construction ambient noise levels. Monitoring would occur at representative periods (eg fortnightly) while pups are being carried (August-February). | BL |
| B20 | Construction | Noise, vibration and light impacts | Adaptive management measures to minimise impacts on Grey-headed Flying-foxes will be developed in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science) and an appropriately qualified expert in Grey-headed Flying-fox biology and behaviour, if Grey-headed Flying-fox behaviour during monitoring suggests that disturbance levels are high. | BL |
| B21 | Construction | Noise, vibration and light impacts on fauna | Controlled blasting, rock hammering and other potential high noise generating activities along the Wakehurst Parkway will be managed to minimise noise and vibration levels to adjacent fauna habitat where practicable, including but not limited to:<br>a) Use of noise suppression devices on plant and equipment in accordance with the manufacturer's specifications<br>b) Regularly maintain plant and equipment to minimise noise levels when in use<br>c) Substituting plant or processes to reduce noise. | BL |
| B22 | Construction | Injury and mortality of fauna | Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| B23 | Construction | Injury and mortality of fauna | Pre-clearing surveys for non-threatened fauna species will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). Surveys will also include human made structures that have been identified as potentially providing habitat for microbats and are subject to demolition or modification. | BL/GHF |
| B24 | Construction | Injury and mortality of fauna | An observer **appropriately trained** ~~qualified~~ to spot Little Penguins will be used during marine construction activities. A stop-work procedure will be developed **in consultation with** ~~by~~ a suitably qualified and experienced ecologist and implemented upon evidence of the species in the proximity of the works area. | BL |
| B25 | Construction | Invasion and spread of weeds, pests, pathogens and disease | Weed species will be managed in accordance with *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). | BL/GHF |
| B26 | Construction | Invasion and spread of weeds, pests, pathogens and disease | Pathogens will be managed in accordance with ***Guide 7: Pathogen management*** ~~*Guide 2: Exclusion zones*~~ of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). | BL/GHF |
| B27 | Construction | Removal of aquatic habitat | Aquatic habitats will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011) and the *Policy and guidelines for fish habitat conservation and management* (NSW DPI, 2013). This will include flow and sufficient fish passage to be maintained similar to current conditions during instream works where reasonable and feasible. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| B28 | Construction | Impacts to marine vegetation and sensitive habitat | Transit routes for vessels entering and departing from construction support sites will be marked out with consideration for propeller wash and distances to sensitive marine habitats. | BL |
| B29 | Construction | Impacts to marine vegetation and sensitive habitat | Exclusion zones will be implemented to avoid disturbance to sensitive marine habitats not proposed to be directly impacted by the project. These include any intertidal sand and mudflats, intertidal rocky shore, subtidal rocky reef and seagrass habitats with potential to occur within or next to transit routes and vessel movements.<br>Routine inspections and maintenance of exclusion measures will be carried out. | BL |
| B30 | Construction | Impacts to marine vegetation and sensitive habitat | Scour protection measures including possible velocity reduction from wastewater treatment plant discharge will be implemented where reasonable and feasible to avoid scour impacts on the marine environment. | BL |
| B31 | Construction | Impacts to marine vegetation and sensitive habitat | To minimise the potential impact of turbidity (suspended sediment) on sensitive marine vegetation and habitats, silt curtains will be installed around seagrass patches and subtidal rocky reef ~~contained within the Zone of Influence as described in the Appendix T (Technical working paper: Marine ecology)~~ **within 25 metres of the Middle Harbour cofferdam construction support sites (BL7 and BL8)**. | BL |
| B32 | Construction | Impacts to marine vegetation and sensitive habitat | Silt curtains will be monitored for effectiveness particularly following inclement weather and maintenance carried out when required. Records of monitoring and maintenance will be kept. | BL |
| B33 | Construction | Impacts to marine vegetation and sensitive habitat | To avoid direct damage to seagrass and subtidal rocky reef from silt curtain movement, there will be a suitable buffer distance between marine habitat and the silt curtain to | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | account for curtain movement due to tides and currents and to prevent shading of the marine vegetation from the silt curtain. The silt curtain will be anchored to bare sediment where practicable to avoid movement. | |
| B34 | Construction | Impacts to marine vegetation and sensitive habitat | Subtidal rocky reef habitat removed along the shoreline at the Middle Harbour north cofferdam (BL8) and intertidal rocky shore, sand and mudflat habitats removed at the Spit West Reserve construction support site (BL9) will be rehabilitated and restored as close as possible to pre-construction conditions **to the extent reasonably practicable** ~~where feasible and reasonable~~ **and in consultation with Department of Primary Industries (Fisheries)**. | BL |
| B35 | Construction | Invasion and spread of marine pests, pathogens and disease | **Where available and appropriate for the construction activity, l**~~L~~ocally sourced vessels and equipment will be used ~~where feasible and reasonable~~. Any vessels sourced internationally will be inspected for potential marine pests prior to departing from their previous port. Construction contractors will need to demonstrate that due diligence has been taken to avoid introducing marine pests, pathogens or disease from internationally sourced vessels and/or construction equipment prior to departure. | BL |
| B36 | Construction | Invasion and spread of marine pests, pathogens and disease | A targeted survey will be conducted of the dredge footprint to locate any areas of the marine algal pest *Caulerpa taxifolia*. If *Caulerpa taxifolia* is identified within the dredging footprint, surface sediments from these areas will be disposed of onshore rather than in the marine environment. | BL |
| B37 | Construction | Impacts to marine species | A stop work procedure will be developed in accordance with the recommendations in Appendix T (Technical working paper: Marine ecology) to mitigate potential impacts to marine mammals and reptiles within the vicinity of impact piling works. | BL |

| Ref | Phase | Impact | Environmental management measure | Location |
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| B38 | Construction | Impacts to marine species | Salvage of live fish and other native marine organisms (eg large, mobile macroinvertebrates) will occur during cofferdam dewatering and will be carried out by suitably qualified and experienced marine ecologists. All salvaged organisms will be immediately relocated to similar habitat nearby. | BL |
| **B39** | **Construction** | **Injury and mortality of fauna** | **Removal of the existing fauna fencing installed as part of the Northern Beaches Hospital road upgrade project will be avoided where possible in overlapping construction areas. Where this is not possible, temporary fauna fencing will be installed during construction to ensure fauna are guided to existing underpasses and away from construction areas and/or live traffic.** | **BL** |
| **B40** | **Design and construction** | **Removal of aquatic habitat** | **Temporary and permanent waterway crossings and instream drainage infrastructure will be designed in accordance with *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003) to ensure fish passage is maintained along the waterway during low flows, where reasonable and feasible. Instream habitat landscaping will favour habitat requirements of native species.** | **BL** |
| **B41** | **Construction and operation** | **Injury and mortality of fauna** | **During site establishment of the Wakehurst Parkway north construction support site (BL14), the project will ensure that the revegetated area within the eastern section of the site (planted as part of the Northern Beaches Hospital road upgrade project with species consistent with Duffys Forest endangered ecological community) is fenced adequately so that it is avoided and protected from disturbance during construction. During operation, this revegetation area will continue to be protected and managed.** | **BL** |

| Ref | Phase | Impact | Environmental management measure | Location |
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| **B42** | **Construction** | **Removal of aquatic habitat** | **Any exotic fauna encountered during instream works and dewatering activities will be captured, humanely euthanised and disposed of in accordance with *Waste Classification Guidelines* (NSW EPA, 2014).** | **BL** |
| **B43** | **Construction** | **Impacts on flora and fauna** | **Biodiversity awareness training will be provided for contractors prior to commencement of construction works to ensure an understanding of potential threatened species, populations and ecological communities that may be impacted during the project, and the environmental management measures proposed to minimise and/or manage potential impacts including the contractor's responsibilities under the unexpected species finds procedures included in *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011).** | **BL/GHF** |
| **B44** | **All phases** | **Injury and mortality of fauna** | **Monitoring will occur during pre-construction, construction and post-construction phases of the project to determine the effectiveness of the proposed fauna connectivity measures and exclusion fencing to be provided as part of the project.**<br>**Pre-construction baseline monitoring will commence prior to project construction works impacting fauna habitat adjacent to the Wakehurst Parkway and include adequate sampling of threatened and protected targeted fauna species in line with relevant guidelines.**<br>**A construction/post-construction ecological monitoring program will be developed prior to construction in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science Group) and Northern Beaches Council. The program will include monitoring of targeted fauna species, threatened or protected species, and pest species, in addition to key** | **BL/GHF** |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | **performance criteria that trigger the need for and feasibility of potential corrective actions. The program will consider the pre-construction baseline monitoring results and ecological monitoring data collected for the Northern Beaches Hospital road upgrade project where relevant.**<br>**Post-construction monitoring will extend for 10 years after the opening of the project.** | |
| **B45** | **Construction** | **Impact on flora and fauna** | **Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011).** | **BL/GHF** |
| **Land use and property** | | | | |
| LP1 | All phases | Changes to lease arrangements | Transport for NSW will consult with existing lease holders of properties that will be directly affected by the project regarding any changes to lease arrangements. | BL/GHF |
| LP2 | All phases | Residual land | Identification of residual land of the project will be confirmed during further design development and construction planning. Appropriate strategies for the ongoing management and/or divestment of the residual land will consider the location, land use characteristics, area and adjacent land uses. | BL/GHF |
| LP3 | Pre-construction and construction | Property acquisition | Land acquisition for the project will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, the *Roads and Maritime Services Land Acquisition Information Guide* (Roads and Maritime Services, 2014) and *Fact sheet: Property acquisition of subsurface lands* (Roads and Maritime Services, 2015) and in accordance with the land acquisition reforms announced by the NSW Government in 2016. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | Transport for NSW will appoint a Personal Manager - Acquisition to help landowners and residents who may be affected by acquisition for the project. The Personal Manager - Acquisition will be in regular contact with these individuals to provide updates on the project and respond to questions and queries. Should acquisition for the project be confirmed for a particular property, the Personal Manager - Acquisition will work with the affected landowners and residents to offer assistance and support throughout the acquisition and relocation process. | |
| LP4 | Pre-construction and construction | Residual land at Balgowlah | A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities at Balgowlah. This process will start ~~after the environmental impact statement public exhibition period and well~~ in advance of construction commencing. As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space. | BL (Balgowlah) |
| LP5 | Construction | Temporary use of land | Land subject to temporary use, including areas of public open space, will be rehabilitated as soon as practicable to an appropriate condition, taking into consideration the location, land use characteristics, area and adjacent land uses or in accordance with the urban design and landscape plan where applicable (environmental management measure V1).<br>Rehabilitation will be carried out in consultation with the relevant landowner, the local council and community (where appropriate). | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| LP6 | Construction | Access impediments to private property | Where impacts to private property access **are**~~is~~ unavoidable during construction, landowners or lease holders/tenants where appropriate will be consulted in advance to develop appropriate alternative access arrangements. | BL/GHF |
| LP7 | Operation | Air quality impacts for elevated receivers located around ventilation outlets and motorway facilities | **Transport for NSW will provide data to Northern Beaches Council, North Sydney Council, Willoughby City Council and the Department of Planning, Industry and Environment (as appropriate), detailing pollution concentrations at various heights and distances from the ventilation outlets to facilitate the planning of and assessment of new development in areas within a distance of 300 metres around the ventilation outlets which would be within a potential three-dimensional zone of affectation (buffer volume).**<br>~~Transport for NSW will assist Northern Beaches Council, North Sydney Council, Willoughby City Council and the Department of Planning, Industry and Environment (as appropriate) in determining relevant land use considerations applicable to future development in the immediate vicinity of ventilation outlets for inclusion in local environmental plans or development control plans, where required, to manage interactions between the project and future development. This may include procedures for identifying the requirement for consultation with Transport for NSW.~~ | BL~~/GHF~~ |
| **LP8** | **Design** | **Vegetation/ landscaping** | **Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community. The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.** | **BL** |

| Ref | Phase | Impact | Environmental management measure | Location |
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| **LP9** | **Pre-operation** | **Facilities management** | **Prior to operations, Transport for NSW will assist Northern Beaches Council to prepare a Plan of Management for the new and improved open space and recreation facilities at Balgowlah. Transport for NSW will assist Northern Beaches Council to update and amend the *Manly Warringah War Memorial Park Plan of Management* (Warringah Council, 2014) to reflect the changes to the park as a result of the project.** | **BL** |
| **LP10** | **Construction** | **Impacts on survey infrastructure** | **Consultation will be carried out with NSW Spatial Services to carry out work in the vicinity of survey marks to be removed as part of the project, and to establish new survey marks as necessary.** | **BL/GHF** |
| **Socio-economics** | | | | |
| SE1 | Design | Social infrastructure | Where feasible and reasonable, the extent of permanent impact on public open space areas (for example, Artarmon Park) will be minimised in further design development. | BL/GHF |
| SE2 | Construction | Social infrastructure | Ongoing engagement will be carried out with representatives of user groups and managers of social infrastructure located near surface construction works/construction support sites and sensitive social infrastructure above the tunnel alignment (for example, schools, places of worship, aged care, child care, health and medical facilities) about the timing and duration of construction works and management of potential impacts. | BL/GHF |
| SE3 | Pre-construction and construction | Stakeholders, community and business | Consultation for the project will be carried out in accordance with the Community Consultation Framework provided as Appendix E of the environmental impact statement. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| SE4 | Pre-construction and construction | Employment benefits | A workforce strategy for the project that includes strategies to increase employment and training opportunities for groups such as Aboriginal people, women, young people and the unemployed will be developed and implemented to help maximise employment benefits of the project. | BL/GHF |
| **SE5** | **Construction** | **Stakeholders and community** | **Consultation and notification will be carried out with Mosman Council, sporting groups and clubs, and Beauty Point Public School to facilitate the ongoing use of Spit West Reserve during construction to minimise potential amenity and access impacts** | **BL** |
| **SE6** | **Construction** | **Social value** | **Transport for NSW will develop a Flat Rock Drive Social Value Strategy within one year of commencement of construction at the Flat Rock Drive construction support site (BL2). The strategy will be developed in consultation with Willoughby City Council and relevant community groups and include initiatives which enhance the social value of the Flat Rock Reserve. These initiatives, which will be implemented during construction and for three years post the completion of construction, will seek to:**<br>**a) Enhance the Flat Rock Reserve, including in the areas of access, amenity and facilities**<br>**b) Support existing community outcomes, initiatives and programs**<br>**c) Partner with educational facilities and other stakeholders in research.** | **BL** |
| BU1 | Pre-construction and construction | Businesses | Where businesses are affected by property acquisition, or lease cessation, the acquisition and compensation process will be implemented in line with the *Determination of compensation following the acquisition of a business guideline* **(Valuer General, 2021)**. Compensation for a | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | business conducted on land that is acquired ~~should~~ **will** be determined in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* as relevant. | |
| BU2 | Construction | Businesses | Specific consultation will be carried out with businesses potentially impacted during construction. Consultation will aim to identify specific potential construction impacts for individual businesses. | BL/GHF |
| BU3 | Construction | Businesses | Based on consultation with businesses, specific feasible and reasonable measures to maintain business access, visibility, parking and address other potential impacts as they arise through the construction phase will be identified and implemented. A phone hotline that enables businesses to find out about the project or register any issues will be maintained. | BL/GHF |
| **Landscape character and visual amenity** | | | | |
| V1 | Design | Vegetation/ landscaping | The urban design and landscape plan will be further developed during further design development and implemented in line with the strategic urban design framework for the project and appropriate operational mitigation measures (Appendix V (Technical working paper: Urban design, landscape character and visual impact)). The urban design and landscape plan will detail built and landscape features to be implemented during construction and rehabilitation of disturbed areas during construction of the project. The urban design and landscape plan will be made available to the public for feedback. | BL/GHF |
| V2 | Construction | Built form | Construction support sites will be developed to minimise visual impacts for adjacent receivers **to the extent reasonably practicable** ~~where feasible and reasonable~~. | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| V3 | Construction | Built form | Storage areas and associated works will be located in cleared or otherwise disturbed areas away from residential areas **to the extent reasonably practicable** ~~where feasible and reasonable~~. | BL/GHF |
| V4 | Construction | Built form | Site hoardings will be in neutral colours and designs, in proximity to open space, to help them blend into surrounding environment. | BL/GHF |
| V5 | Construction | Built form | Site hoarding and perimeter site areas will be maintained regularly to include the prompt removal of graffiti. | BL/GHF |
| V6 | Construction | Built form | Site lighting will be designed to minimise glare issues and light spillage into adjoining properties and be generally consistent with the requirements of Australian Standard ***AS*** *4282-2019 Control of the obtrusive effects of outdoor lighting* **(Standards Australia, 2019)**. | BL/GHF |
| V7 | Construction | Built form | Hoardings and temporary noise walls will be erected as early as possible within the site establishment phase to provide visual screening. | BL/GHF |
| V8 | Construction | Built form | High quality fencing suitable for parks and public spaces will be used where construction support sites are located in close proximity to sensitive residential receivers and users of recreational space. | BL/GHF |
| V9 | Construction | Vegetation/ landscaping | Existing trees adjacent to the works will be retained and protected where possible to screen construction works. | BL/GHF |
| V10 | Construction | Vegetation/ landscaping | Where possible, trees will be **protected or pruned** ~~trimmed~~ rather than removed. **Trees will be protected in accordance with Australian Standard *AS 4970-2009 Protection of trees on development sites* (Standards Australia, 2009). Pruning w**~~W~~orks will be supervised by a qualified arborist **and in accordance with Australian** | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | **Standard *AS 4373-2007 Pruning of amenity trees* (Standards Australia, 2007)**. | |
| V11 | Construction | Vegetation/ landscaping | All areas disturbed by construction and not required for operation of the project will be restored as soon as practicable to their existing condition or in accordance with the urban design and landscape plan where applicable (environmental management measure V1). | BL/GHF |
| V12 | Construction | Vegetation/ landscaping | Early planting works will be considered to provide a screening buffer that has time to mature before the project is fully operational. | BL/GHF |
| V13 | Construction | Vegetation/ landscaping | Where **mature** amenity trees **(other than trees offset under the NSW Biodiversity Offsets Scheme, established under Part 6 of the *Biodiversity Conservation Act 2016*)** are removed as a result of ~~the establishment of~~ construction ~~support sites~~, they will be replaced at a ratio ~~equal to or greater than 1~~**of 2**:1. The replacement trees will consist of local native provenance species from the vegetation community that once occurred in the locality (rather than plant exotic or non-local native trees) where available and subject to the urban design and landscape plan. Where replacement trees cannot be accommodated within the operational footprint of the project, consultation will be carried out with ~~the~~ adjacent **government** land owner**s** and **the** relevant local council (where appropriate) to determine if they can accommodate the replacement tree(s). | BL/GHF |
| **Hazards and risks** | | | | |
| HR1 | Construction and operation | Transportation of dangerous goods and hazardous substances | Dangerous goods and hazardous materials will be stored in accordance with supplier's instructions and relevant legislation. Australian Standards, and applicable guidelines | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
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| | | | and may include bulk storage tanks, chemical storage cabinets/containers or impervious bunds. | |
| HR2 | Construction | Transportation of dangerous goods and hazardous substances | Dangerous goods and hazardous substances will be transported in accordance with relevant legislation and codes, including the *Dangerous Goods (Road and Rail Transport) Act 2008*, Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, ~~2007~~ **2020**). | BL/GHF |
| HR3 | Construction | Bushfire | Adequate access and egress for fire fighting vehicles and staff will be provided at the Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites. Access roads will have a minimum width of four metres to allow passage of fire fighting vehicles. | Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites |
| HR4 | Construction | Bushfire | Adequate setbacks from bushfire prone vegetation to allow for fire fighting vehicle access will be provided for the Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites. | Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites. |
| HR5 | Construction | Bushfire | An emergency response plan will be prepared for the construction of the project at the Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites, including a bushfire risk matrix. | Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | | construction support sites. |
| HR6 | Construction | Bushfire | First response capabilities, including fire extinguishers, water carts and hoses will be assessed and provided at the Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites, where needed. | Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites. |
| HR7 | Operation | Bushfire | Adequate access and egress for fire fighting vehicles and operation vehicles will be provided at the Beaches Link tunnel support facilities at the Wakehurst Parkway at Frenchs Forest. | Beaches Link tunnel support facilities at Wakehurst Parkway at Frenchs Forest |
| HR8 | Operation | Bushfire | Adequate setbacks from bushfire prone vegetation will be provided for the Beaches Link tunnel support facilities at the Wakehurst Parkway at Frenchs Forrest and ventilation outlet at the Wakehurst Parkway, Killarney Heights. | Beaches Link tunnel support facilities at the Wakehurst Parkway at Frenchs Forest and, ventilation outlet at Wakehurst Parkway at Killarney Heights. |
| HR9 | Operation | Fire and life safety | The fire and safety systems and measures adopted for the project will be equivalent to or exceed the fire safety measures recommended by NFPA 502 ~~(American) –~~ ***Standard for Road Tunnels, Bridges, and Other Limited Access Highways*** (National Fire Protection Association (NFPA), 2020) **(American)**, Permanent International Association of Road Congresses (PIARC) (European), *AS 4825-2011* ***Tunnel Fire Safety*** (Standards Australia, 2011) and *AS 3959-2018* ***Construction of a Building in*** | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | ***Bushfire-prone Areas*** (Standards Australia, 2018), and Transport for NSW standards. | |
| HR10 | Operation | Transportation of dangerous goods and hazardous substances | The transport of dangerous goods and hazardous substances will be prohibited through the mainline and ramp tunnels. | BL/GHF |
| HR11 | Operation | Incident response | The response to incidents within the motorway will be managed in accordance with the memorandum of understanding between Transport for NSW and the NSW Police Service, NSW Rural Fire Service, **Fire and Rescue** NSW ~~Fire Brigade~~ and other emergency services. | BL/GHF |
| HR12 | Operation | Aviation risks | The ventilation outlet and motorway facilities at the Warringah Freeway will be operated in accordance with any conditions of approval from the Secretary of Department of Infrastructure, Transport, Regional Development and Communications to manage penetration of the OLS layers. | BL |
| **Resource use and waste management** | | | | |
| WM1 | Construction | Resource use | Construction materials will be sourced in accordance with the project's Sustainability Framework and with a preference for Australian materials and prefabricated products with low embodied energy, **to the extent reasonably practicable** ~~where feasible and reasonable~~. | BL/GHF |
| WM2 | Construction | Resource management | The resource management hierarchy principles established under the *Waste Avoidance and Recovery Act 2001* of avoid/reduce/reuse/recycle/dispose will be applied. | BL/GHF |
| WM3 | Construction | Waste generation and disposal | Any surplus material requiring offsite disposal to land, including marine sediments unsuitable for offshore disposal, will be classified in accordance with *Waste Classification Guidelines* (NSW EPA, 2014). | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| WM4 | Construction | Storage and transport of waste | Wastes will be appropriately transported, stored and handled according to their waste classification and in a manner ~~than~~**that** prevents pollution of the surrounding environment. | BL/GHF |
| WM5 | Construction | Waste generation and disposal | Opportunities for terrestrial spoil reuse within the project corridor, so as to minimise the quantity of material disposed to land will be investigated and implemented where feasible and reasonable. | BL/GHF |
| WM6 | Construction | Wastewater generation and disposal | Opportunities for wastewater reuse and recycling, including use of stormwater from sediment basins and recirculating water during tunnel excavation to use for dust suppression or off-site reuse, will be investigated and implemented where feasible and reasonable. | BL/GHF |
| WM7 | Construction | Management of mulch | Mulch stockpiles and the potential generation of tannin leachates will be managed through the implementation of *Environmental Direction for the Management of Tannins from Vegetation Mulch* (Roads and Maritime Services, 2012). | BL/GHF |
| WM8 | Construction | Reuse of vegetation waste | Where reasonable and feasible, salvaged logs from the clearing process will be reused on site and/or reused as part of the fauna connectivity structures with consideration of the *Guide 5: Re-use of woody debris and bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011). **Prior to clearing, local community restoration/rehabilitation groups, Landcare groups, relevant councils and National Parks and Wildlife Service will be consulted with to determine if there is an interest in the reuse of suitable timber and root balls not used by the project for habitat enhancement and rehabilitation work. If there is an interest, Transport for NSW will facilitate collection of native trees (greater than 25-30 centimetres in diameter and three metres in length) and root balls where reasonable and feasible.** | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| WM9 | Construction | Waste disposal | Further investigations will be carried out at the Flat Rock Drive (BL2), Balgowlah Golf Course (BL10) construction support sites and surface works and construction support site locations along the Wakehurst Parkway (BL12, BL13 and BL14) to determine the feasibility of encapsulation of contaminated materials on site.<br>Where contaminated soils and other materials are to be encapsulated on-site, encapsulation will be designed in accordance with the requirements detailed in the *Guidelines for the Assessment of On-site Containment of Contaminated Soil* (ANZECC, 1999). | Flat Rock Drive (BL2), Balgowlah Golf Course (BL10), Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites |
| WM10 | Operation | Resource use and waste generation | The project will be operated in accordance with the relevant aims of the project's Sustainability Framework to optimise resource efficiency and waste management. | BL/GHF |
| WM11 | Operation | Waste generation and disposal | Waste will be managed and disposed of in accordance with relevant applicable legislation, policies and guidelines, including the *Waste Avoidance and Resource Recovery Act 2001* and the *NSW Waste Avoidance and Resource Recovery Strategy 2014–21* (NSW EPA, 2014). | BL/GHF |
| WM12 | Operation | Water use and discharge | Opportunities to reuse treated groundwater during project operation will be considered where feasible and reasonable. | BL/GHF |
| **Sustainability** | | | | |
| SU1 | Design | Project sustainability outcomes | Project sustainability objectives and targets will be finalised during further design development, informed by the requirements of the project planning approval. | BL/GHF |
| SU2 | Construction | Project sustainability outcomes | Activities to implement the sustainability framework, including requirements from the Infrastructure Sustainability rating scheme, will be implemented through a Sustainability Management Plan. The management plan will detail | BL/GHF |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| | | | measures to meet the sustainability objectives and targets as well as achieving 'Design' and 'As Built' ratings of Excellent under the Infrastructure Sustainability Council ~~of Australia~~ rating scheme. | |
| **Climate change risks** | | | | |
| CC1 | Design | **Changes to flooding impacts from climate change** ~~Climate change risks and flood modelling projections~~ | The following actions will be carried out during further design development to ensure climate change is adequately addressed:<br>a) Flood modelling **(required by environmental management measure F2)** will continue to use sea level rise projections and future climate change rainfall projections<br>b) The extent of scour protection will be refined<br>c) Sensitivity testing for future climate change will be carried out in the detailed design of drainage channels and culverts. Increased capacity will be provided where feasible and reasonable. | BL/GHF |
| **Greenhouse gas emissions** | | | | |
| GHG1 | Design | Energy efficiency | Energy efficiency will be considered during further design development with energy efficient systems installed where reasonable and practicable. | BL/GHF |
| GHG2 | Construction | Emission of greenhouse gases during construction | Greenhouse gas emissions will be managed and minimised as part of the Sustainability Management Plan and will be implemented to assist in achieving 'Design' and 'As Built' ratings of Excellent under the Infrastructure Sustainability Council ~~of Australia~~ rating scheme (Version 1.2). | BL/GHF |
| **Cumulative impacts** | | | | |

| Ref | Phase | Impact | Environmental management measure | Location |
|---|---|---|---|---|
| CI1 | Pre-construction | Cumulative impacts | Considered and tailored multi-party engagement and cooperation will be established prior to construction to ensure all contributors to impacts are working together to minimise adverse impacts or enhance benefits of multiple projects occurring concurrently or consecutively. Haulage routes and road occupancy will be coordinated with other major transport projects via Greater Sydney Operations. | BL/GHF |
| CI2 | Pre-construction | Construction fatigue | Multi-party engagement and cooperation will be established prior to construction to coordinate with the following projects to manage construction fatigue impacts where possible:<br>a) Western Harbour Tunnel and Warringah Freeway Upgrade<br>b) Sydney Metro City & Southwest<br>c) Channel 9 site staged residential redevelopment.<br>**d) Willoughby Leisure Centre pool area upgrades.** | BL/GHF |
| CI3 | Construction | Cumulative impacts | Communication strategies for the project will be managed consistently across the NSW Government transport portfolio and in accordance with the Community consultation framework for the project. | BL/GHF |
| CI4 | Construction | Complaints fatigue | Complaint fatigue will be managed as outlined in Chapter 7 (Stakeholder and community engagement) of the environmental impact statement. Complaint management tools for the project are outlined in Appendix E (Community consultation framework). | BL/GHF |
| CI5 | Construction | Spoil management | Co-ordination and engagement with proponents of other major projects, including external to Transport for NSW, will be undertaken prior to construction to identify the opportunity for beneficial reuse of construction spoil where it cannot be reused on site and prior to consideration of disposal options. | BL/GHF |

BL = Beaches Link, GHF = Gore Hill Freeway Connection

Transport for NSW

# Beaches Link and Gore Hill Freeway Connection

## D3 – Conclusion and next steps

November 2021

# D3 Conclusion and next steps

The Department of Planning, Industry and Environment will, on behalf of the NSW Minister for Planning and Public Spaces, review the environmental impact statement, this submissions report and the preferred infrastructure report for the project. Once the Department of Planning, Industry and Environment has completed its assessment, a draft Environmental Assessment Report will be prepared for the Secretary of the Department of Planning, Industry and Environment, which may include recommended conditions of approval.

The assessment report will be provided to the NSW Minister for Planning and Public Spaces, who will then make a determination on the project. If the determination is to approve the project, the determination is anticipated to include conditions of approval considered appropriate.

A copy of this submissions report has been made publicly available on the Department of Planning, Industry and Environment Major Projects website and the project interactive online portal (*nswroads.work/blportal*). The NSW Minister for Planning and Public Spaces determination, including any conditions of approval and the Secretary's Environmental Assessment Report, will be published on the Department of Planning, Industry and Environment Major Projects website following determination.

Transport for NSW

# Beaches Link and Gore Hill Freeway Connection

## D4 – References

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