Chapter 24

Resource use and waste management

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24 Resource use and waste management

This chapter describes the resources and materials, including potential sources and the expected quantities that would be used to construct and operate the project.

Construction and operation of the project would also generate waste streams which would require management and disposal in accordance with relevant state policies and guidelines. This chapter provides a description of likely waste streams, expected quantities, and waste management strategies.

The Secretary's environmental assessment requirements as they relate to resource use and waste management, and where in the environmental impact statement these have been addressed, are detailed in Table 24-1 (Secretary's environmental assessment requirements checklist).

The proposed environmental management measures relevant to resource use and waste management are discussed in Section 24.6.

Table 24-1 Secretary's environmental assessment requirements – resource use and waste management

Secretary's requirement	Where addressed in EIS
Waste	
1. The Proponent must assess predicted waste generated from the project during construction and operation, including: a. classification of the waste in accordance with the current guidelines;	Waste streams are classified in **Section 24.3.2** and **Section 24.4.2**.
b. estimates/details of the quantity of each classification of waste to be generated during the construction of the project, including bulk earthworks and spoil balance;	Estimates of the quantities of waste are provided in **Sections 24.3.1** and **24.4.1**. Spoil balance and management is also outlined in **Section 24.3.3**.
c. handling of waste including measures to facilitate segregation and prevent cross contamination;	Construction waste management measures are provided in **Section 24.6**.
d. management of waste including estimated location and volume of stockpiles;	Indicative stockpile locations and volumes is provided in **Section 24.3**.
e. waste minimisation and reuse;	The reuse of construction and operational waste is discussed in **Section 24.3.1** and **Section 24.4.1** respectively.
f. lawful disposal or recycling locations for each type of waste; and	Disposal and recycling options are outlined in **Section 24.3.2** and **Section 24.5**.
g. contingencies for the above, including managing unexpected waste volumes.	Contingencies for managing unexpected waste is discussed in **Section 24.6**.

Secretary's requirement	Where addressed in EIS
2. The Proponent must assess potential environmental impacts from the excavation, handling, storage on site and transport of the waste particularly with relation to sediment/leachate control, noise and dust.	Potential environmental impacts associated with the handling, storage and transport of waste are discussed in **Section 24.3.1** and **Section 24.4.1**. Dust impacts and management are discussed in **Chapter 12** (Air quality). Noise impacts and management are discussed in **Chapter 10** (Construction noise and vibration). Sediment control and potential environmental impacts associated with the excavation of waste are described in **Chapter 16** (Geology, soils and groundwater) and **Chapter 17** (Hydrodynamics and water quality).

24.1 Legislative and policy framework

Waste management and recycling is regulated in NSW through the *Protection of the Environment Operations Act 1997*, the Protection of the Environment Operations (Waste) Regulation 2014 (including the requirement to track certain types of waste) and the *Waste Avoidance and Resource Recovery Act 2001*.

The *Waste Avoidance and Resource Recovery Act 2001* aims to promote efficient use of resources, and avoidance and minimisation of waste through the following resource management hierarchy:

- Avoidance of unnecessary resource consumption
- Resource recovery, including reuse, reprocessing, recycling and energy recovery
- Disposal.

By minimising consumption and encouraging the efficient use of resources, the *Waste Avoidance and Resource Recovery Act 2001* aims to reduce the generation and impacts of waste.

The following guidelines inform or respond to the regulatory framework and have been applied to the assessment of the project:

- *Waste Classification Guidelines* (NSW EPA, 2014a)
- *Technical Guide: Management of Road Construction and Maintenance Wastes* (Roads and Maritime, 2016c)
- *NSW Sustainable Design Guidelines*, Version 4.0 (Transport for NSW, 2017e)
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Volume 2* (DECC, 2008).

A number of policies and strategic documents are relevant to the project's resource use and waste management. The *NSW Government Resource Efficiency Policy* (Office of Environment and Heritage, 2014b) aims to drive resource efficiency by NSW Government agencies and reduce harmful air emissions from government operations. As a government agency, Transport for NSW has a responsibility under this policy to incorporate resource-efficiency considerations in all major decisions to address rising costs for energy, water, clean air and waste management.

The *NSW Waste Avoidance and Resource Recovery Strategy 2014–21* (NSW EPA, 2014b) supports the avoidance and minimisation of waste and provides a framework and targets for waste management and recycling in NSW until 2021–2022.

Transport for NSW, as a NSW Government agency, supports these targets by:

- Implementing complementary policies and programs, including sustainable procurement policies
- Incorporating resource recovery and waste reduction objectives into its operations
- Complying with relevant regulations.

The aims of these policies are incorporated into the *Environmental Sustainability Strategy 2015–2019* (Roads and Maritime, 2016d), which outlines specific focus areas for integrating sustainability into Transport for NSW projects and services. Under the Sustainability Strategy, resource use and waste reduction initiatives include:

- Consideration of earthworks in project design and construction, including the recovery of materials for reuse
- Recycling materials
- Reducing resource use through appropriate project design and operation.

24.2 Assessment methodology

The assessment of resource use and waste management comprised:

- Review of the likely resources required for the construction and operation of the project, including construction materials, water and power
- Review of the likely waste streams, volumes and classifications
- Identification of opportunities for the avoidance, minimisation and reuse of wastes, including targets for the beneficial reuse of solid wastes, wastewater and other wastes consistent with the project's sustainability framework (refer to Chapter 25 (Sustainability))
- Identification of the environmental impacts associated with resource use and the generation (and subsequent disposal) of residual waste materials
- Management strategies for waste during construction and operation, including:
  - Managing construction waste through the resource management hierarchy established under the *Waste Avoidance and Recovery Act 2001*
  - Developing procedures for the assessment, handling, stockpiling and disposal of potentially contaminated materials and wastewater, in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014a).

24.3 Assessment of potential construction impacts

Potential impacts during construction of the project relate to:

- Construction resource use, including construction materials, water and electricity
- Generation and management of wastes (non-spoil)
- Generation and management of spoil, including dredged material from Sydney Harbour.

24.3.1 Construction resource use

Construction materials

Given the scale of the project, substantial quantities of materials would be used for construction. Indicative quantities and the potential sources of construction materials are provided in Table 24-2. Other items such as timber, electrical materials and landscaping materials would also be required.

Table 24-2 Indicative quantities of resources required for construction

Material	Estimated quantity required	Anticipated source/origin
Asphalt	371,400 tonnes	Sydney suppliers
Sprayed bitumen	1000 tonnes	Sydney suppliers
Ready mixed concrete	378,600 cubic metres	Sydney suppliers located close to the project and on-site batch plant
Precast concrete	33,600 cubic metres	Sydney, central and mid north coast of NSW
Aggregates – gravel/sand	54,800 cubic metres	NSW South Coast and Central Coast
Aggregates – general fill	162,900 cubic metres	Re-use spoil from tunnelling works if timing permits, or imported fill from the Greater Sydney region
Steel	80,600 tonnes	Australia and/or overseas
Aluminium	80 tonnes	Overseas
Glass	<1 tonne	Australia and/or overseas
PVC piping	2200 tonnes	Australia and/or overseas
Concrete piping	4700 tonnes	Australia
Plastic sheeting	520 cubic metres	Australia and/or overseas
Composites – cement fibreboard	800 tonnes	Australia
Coatings and finishes	1 tonne	Australia and/or overseas
Water treatment chemicals	50 tonnes	Australia and/or overseas

Construction material requirements for the project are typical for a motorway project of this scale. While the resource requirements of the project do have the potential to impact resource availability within the Sydney metropolitan region over the construction period, the concurrent construction of NorthConnex, M4-M5 Link and Sydney Metro Northwest demonstrates that the market is able to manage the concurrent construction of major infrastructure projects given sufficient opportunity to forward plan. The period between the approval of the project and the start of major construction

would be sufficient to allow the market to prepare for the needs of the project in conjunction with the concurrent infrastructure projects listed in Chapter 27 (Cumulative impacts).

The design of the project has included careful consideration of the construction methodology and selection of materials and resources to ensure fitness for purpose, and minimise resource consumption. Consistent with the resource management hierarchy of the *Waste Avoidance and Resource Recovery Act 2001*, resource consumption would be further minimised during construction through reuse, where possible. For example, temporary work structures such as road plates and tunnel formwork would be reused, and asphalt from decommissioned paving would be reused in new paving where possible.

Water

Water would be required during construction activities including:

- Tunnelling activities such as dust suppression
- Surface works such as during compaction of pavement materials and for dust suppression
- Concrete batching
- Site offices and ablutions.

Measures to avoid and minimise water consumption, particularly of potable water, have been included in the design and construction planning for the project. Examples of these measures include:

- Use of dust extraction and ventilation systems to control dust in tunnels during construction to minimise the use of water as a dust suppressant
- Capture, treatment and use of wastewater and rain water at construction sites to minimise the use of potable water during construction.

Water for construction of the project would be sourced according to the following hierarchy, where feasible and reasonable, and where water quality and volume requirements are met:

- Stormwater harvesting (non-potable water)
- On-site construction water treatment and reuse, including groundwater (non-potable water)
- Mains supply (potable water).

The average total water demand during construction is estimated to be 1327 kilolitres per day. About 837 kilolitres per day would be sourced from mains supply (potable water) with the remainder coming from treated groundwater or harvested rainwater (non-potable water).

A summary of the indicative construction water balance is presented in Chapter 17 (Hydrodynamics and water quality). Connection to and supply of mains water would be confirmed during further design development, in consultation with Sydney Water.

Electricity

Electricity supply would be required at all construction support sites, including high voltage supply for tunnelling support sites. Table 24-3 summarises the indicative electricity demand at construction support sites where tunnelling is proposed.

Infrastructure required to connect each construction support site with the electricity supply network outside the project corridor would be subject to separate design, assessment and approval. Further information on the coordination and management of electricity infrastructure delivery is provided in Appendix D (Utilities management strategy).

Measures to avoid and minimise electricity consumption have been included in the design and construction planning for the project. Examples of these measures include:

- Use of guidance systems for tunnel excavation and rock bolting to ensure efficient use of tunnelling equipment to minimise excessive electricity consumption
- Use of energy efficient site buildings and equipment on construction support sites, including use of solar powered lights and signage where feasible and reasonable
- Efficient design of electricity transmission systems to supply power as efficiently as possible.

Table 24-3 Construction electricity demand for tunnelling construction support sites

Construction support site	Indicative temporary power requirement (megavolt ampere (MVA))
Rozelle Rail Yards (WHT1)	5.5
Victoria Road (WHT2)	8.5
Yurulbin Point (WHT4)	4
Berrys Bay (WHT7)	5
Cammeray Golf Course (WHT10)	5

24.3.2 Construction waste generation and management (non-spoil)

This section details the solid and liquid wastes, and the wastewater expected to be generated during construction of the project. Generation and management of spoil, including dredged material, is considered in Section 24.3.3.

Solid and liquid wastes

Measures to minimise the generation of waste and to maximise resource recovery have been included in the design and construction planning for the project. Examples of these measures include:

- Prioritisation of pre-cast concrete structural elements to improve efficiency and minimise waste
- On-site sorting of materials like timber, steel and concrete to maximise resource reuse on-site or nearby to the site where possible.

Table 24-4 summarises indicative solid and liquid waste streams that would be generated during construction, including examples of these waste streams, indicative waste stream quantities and anticipated waste classifications.

These waste streams are typical of construction and demolition activities and can be adequately managed with the implementation of common environmental management measures (refer to Section 24.6). Consistent with the resource management hierarchy under the *Waste Avoidance and Resource Recovery Act 2001*, solid wastes would be reused and recycled where feasible and reasonable. Construction waste would be disposed of at appropriate licenced facilities.

Table 24-4 Indicative solid and liquid waste streams generated during construction

Waste stream	Examples of wastes	Indicative quantity	Likely waste classification
Demolition wastes	Concrete, bricks, tiles, timber, metals, plasterboard, carpets,	61,980 cubic metres	General solid waste (non-putrescible)

Waste stream	Examples of wastes	Indicative quantity	Likely waste classification
	electrical and plumbing fittings, furnishings		
Aggregates – crushed rock/concrete	Concrete	2,318,340 cubic metres	General solid waste (non-putrescible)
Hazardous wastes	Asbestos, heavy metals	1850 tonnes	Hazardous waste and/or special waste
Vegetation wastes	Trees, shrubs, ground cover	5.5 hectares	General solid waste (putrescible)
General construction wastes	Timber formwork, scrap metal, steel, concrete, plasterboards, packaging materials	23,000 tonnes	General solid waste (non-putrescible)
Wastes from the operation and maintenance of construction vehicles and equipment	Adhesives, lubricants, waste fuels, oils, engine coolant, batteries, hoses, tyres	8 tonnes	Hazardous waste
General wastes from site offices	Putrescibles (food waste), paper, cardboard, plastics, glass, printer cartridges	860 tonnes	General solid waste (putrescible and non-putrescible)

Wastewater

Wastewater volumes generated during construction would vary depending on the types of construction activities being carried out and the stage of construction. The majority of wastewater generated during construction would be through groundwater infiltration in the tunnels.

The average infiltration rate across the project tunnels is expected to be less than the design standard of an average one litre per second per kilometre applied to other recent motorway tunnel projects, including NorthConnex and M4-M5 Link. Further information on groundwater infiltration and groundwater effects is provided in Chapter 16 (Geology, soils and groundwater).

Smaller volumes of wastewater would be generated by other construction activities, such as dust suppression and equipment washdown.

Opportunities for wastewater reuse would be investigated and pursued where feasible and reasonable, and subject to meeting water reuse quality requirements. Options for wastewater reuse may include on-site reuse for construction purposes, such as dust suppression.

The anticipated generation of wastewater from tunnel construction would be greater than the potential for reuse. Therefore, treatment of surplus wastewater and off-site discharge would be required. Chapter 2 (Assessment process) outlines the requirement for an environment protection licence for road construction under Chapter 3 of the *Protection of the Environment Operations Act 1997*. The wastewater collected from tunnelling activities would be tested and treated at construction wastewater treatment plants prior to reuse or discharge.

Site-specific trigger values would be used during construction planning when setting the wastewater treatment plant discharge criteria to ensure wastewater would be treated to a level that is representative of background concentrations at the receiving environment.

Indicative wastewater treatment plant discharge volumes at the construction support sites used to support tunnelling are summarised in Table 24-5. These volumes conservatively assume that all wastewater would be treated and discharged, and do not take into account the opportunities for wastewater reuse identified above. The generation of wastewater at the Berry Street north (WHT8) and Ridge Street north (WHT9) construction support sites and those for the Warringah Freeway Upgrade would be minimal and are therefore not included in the table. Further information on water treatment and discharge water quality, as well as the complete water balance for the project, is provided in Chapter 17 (Hydrodynamics and water quality).

Table 24-5 Indicative average wastewater treatment plant discharge volumes

Construction support site	Estimated daily discharge (kilolitres)	Treated wastewater available for reuse daily (kilolitres)	Discharge point
Rozelle Rail Yards (WHT1)	214	30	Rozelle Bay
Victoria Road (WHT2)	413	177	Iron Cove
Yurulbin Point (WHT4)	214	92	Snails Bay
Berrys Bay (WHT7)	249	107	Berrys Bay
Cammeray Golf Course (WHT10)	196	84	Willoughby Creek
Total	**1286**	**490**	

Note: The generation of wastewater at the Berry Street north (WHT8) and Ridge Street north (WHT9) construction support sites and those for the Warringah Freeway Upgrade would be minimal and are therefore not included in the Table 24-5.

24.3.3 Spoil generation and management

About 2.1 million cubic metres of spoil would be produced from land-based construction activities (terrestrial spoil) during construction, made up of:

- Soil and rock from construction of the project tunnels underground
- Soil and rock from bulk excavation works on the surface.

The majority of land-based spoil generated by the project would be crushed sandstone from tunnelling. This material is generally considered as a desirable engineering fill, and is typically reused in development sites and major earthworks projects across Greater Sydney.

In addition, marine construction works for the project within Sydney Harbour would produce around 900,000 cubic metres of dredged material, made up of:

- Rock excavated from temporary cofferdams in Sydney Harbour
- Soil and rock from the installation of the immersed tube tunnel.

The management of spoil and dredged material during construction of the project would depend on its composition, the location from which it was removed (ie land-based or marine-based construction), and whether it is considered to be suitable or unsuitable for reuse. The approach to management of land-based spoil and dredged materials is shown in Figure 24-1.

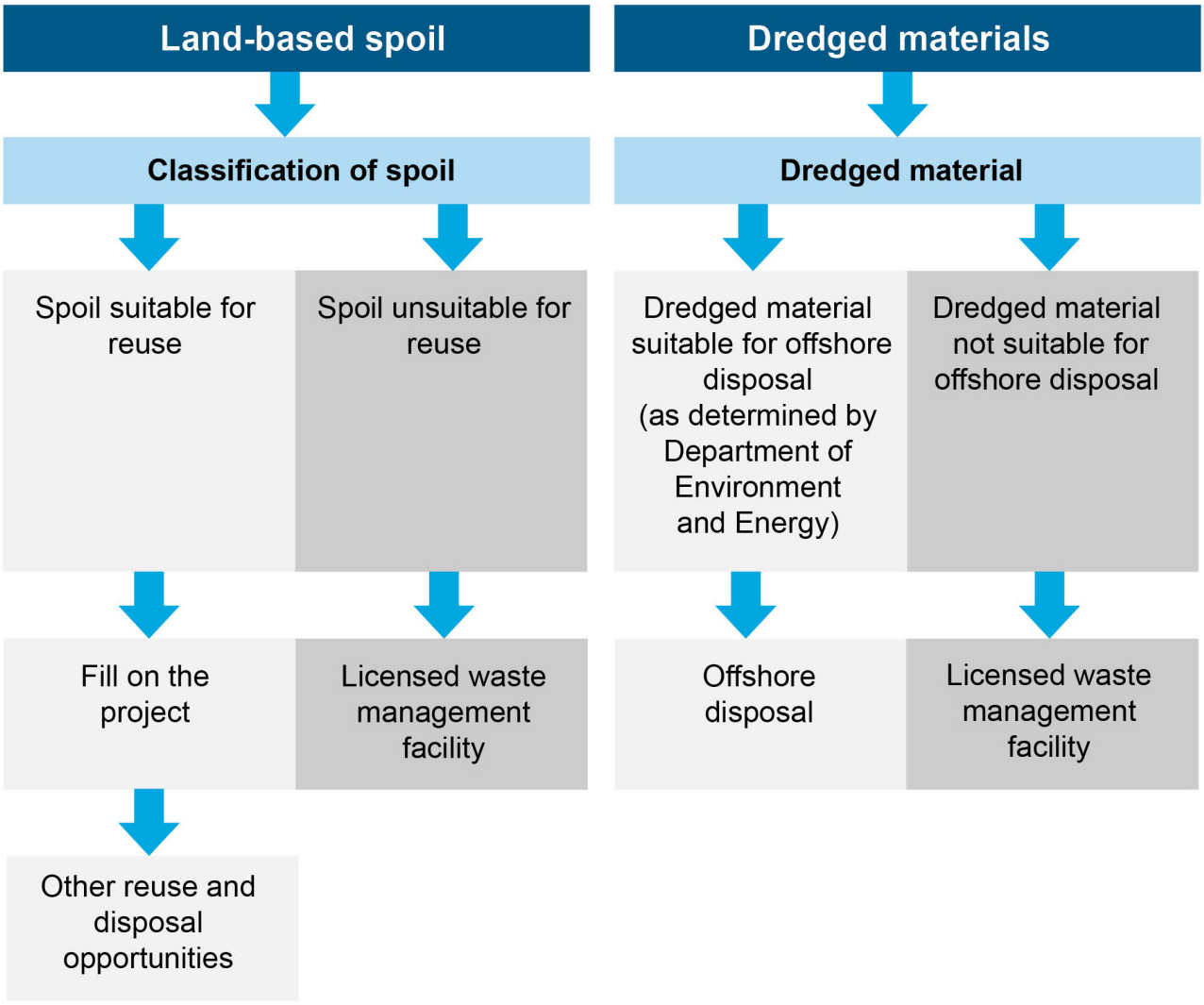

Figure 24-1 Spoil management approach

Spoil from land-based construction activities

Land-based spoil generation

The project's land-based construction activities would generate about 2.1 million cubic metres of spoil as part of project construction.

The construction support sites supporting tunnelling would be the main generators of spoil during construction. Additional, smaller quantities of spoil would be generated at other construction areas along the project alignment, associated with surface road works at Rozelle Interchange and the Warringah Freeway Upgrade. The indicative volume of surplus land-based spoil to be extracted and managed through each of the construction sites is summarised in Table 24-6.

Table 24-6 Indicative land-based spoil generation

Construction site	Spoil volume (cubic metres)	Spoil composition
Spoil generation – Western Harbour Tunnel		
Rozelle Rail Yards (WHT1)	34,650	Sandstone
Victoria Road (WHT2)	565,740	Sandstone

Construction site	Spoil volume (cubic metres)	Spoil composition
Yurulbin Point (WHT4)	339,280	Sandstone
Berrys Bay (WHT7)	260,940	Sandstone
Cammeray Golf Course (WHT10)	410,510	Sandstone
Warringah Freeway	164,240	Sandstone
Waltham Street (WHT11)	500	Clay, shale and sandstone
Total – Western Harbour Tunnel	**1,775,860**	
Spoil generation – Warringah Freeway Upgrade		
Berry Street east (WFU5)	12,290	Sandstone
Multiple sites within Warringah Freeway	224,280	Sandstone, general fill
Falcon Street surface works	28,270	Sandstone
Alfred Street, Mount Street and High Street surface works	27,770	Sandstone, general fill, construction rubble
Ernest Street surface works	3600	Sandstone, general fill
Miller Street surface works	7800	Sandstone, general fill
Brooks Street surface works	14,360	Sandstone, general fill
Willoughby Road surface works	2190	Sandstone, general fill
Total – Warringah Freeway Upgrade	**320,560**	
Total land-based spoil generation	**2,096,410**	

Spoil from tunnelling works would be transported from the tunnel face to the surface using dump trucks. Where required, tunnel spoil stockpiles would be largely contained within acoustic sheds. This would also minimise the potential for impacts from runoff and sedimentation associated with stockpiling.

Spoil would be classified prior to leaving the site in accordance with NSW and Australian standards and guidelines. It is anticipated that the majority of this material would be used at development, construction or remediation sites across Greater Sydney.

Other earthworks such as those required for surface road works, cut-and-cover tunnels and trough structures may require the stockpiling of material on site if the material cannot be loaded directly into trucks. These stockpiles would be located outside of acoustic sheds; however, appropriate measures, including bunding, would be in place to avoid potential impacts associated with runoff, sedimentation and leachate. The indicative location and volume of spoil stockpiles located outside of acoustic sheds is provided in Table 24-7.

Potential impacts from runoff and sedimentation would be further minimised through the implementation of the environmental management measures described in Chapter 17 (Hydrodynamics and water quality).

Potential impacts related to leachate (ie contaminated liquid that drains from a landfill or stockpile) are considered to be unlikely during construction as the project does not involve the excavation or disturbance of landfill areas. Stockpiles would be managed appropriately to avoid potential impacts associated with runoff, sedimentation and leachate.

Table 24-7 Indicative stockpile locations and volumes – outside of acoustic sheds

Location	Indicative stockpile volume
Western Harbour Tunnel	
Victoria Road (WHT2)	500 cubic metres
White Bay (WHT3)	10,000 cubic metres
Berry Street North (WHT8)	750 cubic metres
Cammeray Golf Course (WHT10)	4500 cubic metres
Waltham Street (WHT11)	250 cubic metres
Warringah Freeway Upgrade	
Warringah Freeway	750 cubic metres
Falcon Street	500 cubic metres

The design of the project and preferred construction methodology has taken into consideration the waste hierarchy by aiming to reduce the volume of excess spoil generated, as far as practical. Where possible, the project would maximise reuse of spoil generated during construction before alternative off-site spoil disposal options are pursued.

The geochemistry of the spoil material as well as its consistency and quality would determine the reuse options. The spoil produced by the project would have the following potential reuse opportunities:

- Granular sandstone fill is likely to be suitable for use as structural fill
- Excavated clay and clayey sand material is likely to be suitable for use as general fill following moisture conditioning
- Excavated weathered shale and sandstone could be suitable for use as structural fill following moisture conditioning to reduce reactivity
- Medium strength or better quality shale is likely to be suitable for use as non-reactive fill
- Medium to high strength sandstone may be suitable for use as structural fill
- Wet clay and wet shale spoil is unlikely to be suitable for reuse on site without substantial moisture conditioning.

Where spoil cannot be reused for the project, opportunities to reuse this material on other projects (preferably within the Sydney region to reduce transport distances) would be identified.

The following sites are potential options for spoil reuse/disposal:

- Western Sydney Airport (about 50 kilometres from the project)

- Moorebank Intermodal Terminal Precinct (about 30 kilometres from the project)
- Kurnell Landfill (about 30 kilometres from the project)
- Penrith Lakes Scheme (about 60 kilometres from the project).

These sites have a need for spoil or fill material and represent viable reuse locations. Other re-use or disposal sites may be used depending on need at the time the spoil is generated.

Disposal of contaminated material

There is potential to discover contaminated material during excavation works for the project. A Stage 1 contamination assessment has been carried out to determine the potential for encountering contaminated material during construction (refer to Chapter 16 (Geology, soils and groundwater)).

The contamination assessment identified nine locations within or adjacent to the construction footprint of the project that are considered to be potential areas of environmental interest. These locations, and types of potential contaminated material, are provided in Chapter 16 (Geology, soils and groundwater). Further investigations of these sites are required to quantify the exposure risk. These investigations would be carried out prior to construction activities so that contamination (if present) can be adequately planned for and appropriately managed.

Management of contaminated spoil would be in accordance with the mitigation measures outlined in Chapter 16 (Geology, groundwater and soils). Any contaminated material disturbed during construction would be separated from uncontaminated material on site to prevent cross contamination. This spoil would be loaded into sealed and covered trucks for disposal at a suitably licenced landfill.

Dredged material from harbour construction activities

About 900,000 cubic metres of soft soil, sediments and rock would need to be removed from Sydney Harbour for the construction of the immersed tube tunnels and associated transition structures. The indicative volume and composition of dredged material to be removed as part of marine construction activities is included in Table 24-8.

Table 24-8 Indicative dredged material volumes

Construction area	Dredged material volume (cubic metres)	Indicative composition of dredged material
White Bay (WHT3) construction support site	142,500	Dredged sediment not suitable for offshore disposal
Sydney Harbour south cofferdam (WHT5) and Sydney Harbour north cofferdam (WHT6) construction support sites	44,000	Sandstone suitable for offshore disposal under Commonwealth permit
Sydney Harbour immersed tube tunnel construction	610,000	Sediment suitable for offshore disposal under Commonwealth permit
	108,000	Sandstone suitable for offshore disposal under Commonwealth permit
Total dredged material	**904,500**	

Dredged material suitable for potential offshore disposal

An application for offshore disposal of suitable dredged material has been submitted to the Commonwealth Department of the Environment and Energy. Dredged material suitable for offshore disposal would be transported from Sydney Harbour on split hopper barges and disposed within the existing designated offshore disposal site, which is located about 10 to 15 kilometres east of Sydney Heads and regulated by the Commonwealth. Offshore disposal would reduce the number of heavy vehicle movements required to transport dredged material. As detailed in Chapter 2 (Assessment process), assessment for offshore disposal dredged material is subject to a separate assessment process by the Commonwealth Department of the Environment and Energy.

The potential impacts to marine water quality from the transport, treatment and/or temporary storage of dredged material is assessed in Chapter 17 (Hydrodynamics and water quality). The potential impacts of shipping movements is discussed further in Chapter 8 (Construction traffic and transport).

Dredged material unsuitable for potential offshore disposal

Some sediments in Sydney Harbour contain high concentrations of metallic and non-metallic contaminants (refer to Chapter 16 (Geology, soils and groundwater)). Most of the harbour's contamination results from a combination of historical inputs that remain in the sediments and some current sources of input such as stormwater.

Of the 904,500 cubic metres of material to be removed from Sydney Harbour, it is expected that about 142,500 cubic metres from the top 1.5 metres of the harbour bed would not be suitable for potential offshore disposal. The nature of existing contamination within Sydney Harbour is described in more detail in Chapter 16 (Geology, soils and groundwater).

Dredged material not suitable for potential offshore disposal would be loaded onto hopper barges and transferred to the White Bay construction support site (WHT3).

Dredged material would be subject to waste classification under the *Waste Classification Guidelines 2014* (NSW EPA, 2014a) and would be treated to make the material spadable (a consistency which allows the material to be spaded or shovelled). During this process, additives such as lime or absorbent polymers would be mixed into the dredged material to assist in mitigating potential odour and to neutralise any potential acid sulfate soils. This process is widely understood and has been applied on recent projects in Sydney Harbour, including Garden Island dredging works completed in 2010 and 2019.

Once treated, materials would be loaded into covered trucks for transport to a suitably licensed waste disposal facility.

24.4 Assessment of potential operational impacts

Potential impacts during operation of the project relate to:

- Operational resource use, including operational materials, water and electricity
- Generation and management of wastes.

24.4.1 Operational resource use

Operational materials

Materials used for the operation of the project would be limited to those required for ongoing maintenance activities, and for the operation of the motorway control centre and tunnel support facilities. As outlined in Chapter 5 (Project description), ongoing maintenance activities are not

included as part of the project and would be considered separately at the relevant time in the future.

Water

During operation of the project, water would be required for:

- Testing and operation of the tunnel deluge system, which forms part of the fire and life safety system
- Tunnel cleaning systems
- Motorway control centre ablutions
- Landscape irrigation.

Measures to avoid and minimise water use, particularly of potable water, have been included in the project design. An example of these measures includes the reuse of groundwater entering the project tunnels where possible to satisfy the project's operational water requirements and reduce the demand for potable water.

Water for operation of the project would be sourced according to the following hierarchy, where feasible and reasonable and where water quality and volume requirements are met:

- Treated groundwater (non-potable water)
- Rainwater harvesting (non-potable water)
- Mains supply (potable water).

Indicative volumes and potential sources of water for each operational activity are provided in Table 24-9. Connection to and supply of mains water would be confirmed during further design development, in consultation with Sydney Water.

Table 24-9 Indicative operational water requirements

Project component	Total water demand (kilolitres/year)	
	Washdown	Deluge testing
Western Harbour Tunnel	365	1825
Warringah Freeway Upgrade	0	0

Electricity

An operational electricity supply would be required for the mainline tunnels (including associated mechanical and electrical equipment), traffic control facilities (including the motorway control centre and electronic signage) and surface street lighting. As described in Chapter 5 (Project description), the project includes a series of five underground substations at regular intervals within the tunnel, and aboveground substations at the Western Harbour Tunnel motorway facilities.

The project would likely be connected to the Rozelle sub-transmission substations due to its proximity to the tunnel portals. Initial discussions with Ausgrid indicate that these substations would have sufficient capacity to supply the project without negative impacts on the local power supply.

Measures to minimise energy consumption and maximise energy efficiency have been included in the project design. Examples of these measures include:

- Use of low heat emission LED lighting to reduce operational energy requirements
- Efficient and effective longitudinal ventilation system design with outlets located in close proximity to tunnel portals, taking advantage of the movement of vehicles within tunnels to reduce fan usage and reducing energy needed to move exhaust to outlet locations

- Opportunities to install solar panels at the tunnel portals and on tunnel support and traffic control facility buildings to supplement non-renewable power sources where feasible and reasonable.

Opportunities to further minimise energy consumption and maximise energy efficiency would be considered during further design development, where feasible and reasonable.

The anticipated operational electricity consumption of the project would be about 32 MVA.

24.4.2 Operational waste generation

This section details the solid and liquid wastes and the wastewater expected to be generated during operation of the project.

Solid and liquid wastes

The type and volume of wastes generated from operation of the motorway would depend on the nature of the activity but would predominantly consist of minor volumes of general office waste (such as paper, plastics and food waste).

The volumes and types of waste would be typical of motorway operations and could be accommodated by existing metropolitan waste management facilities. With the implementation of standard waste management practices, the overall impact of operational waste streams would be minimal.

Maintenance and repair activities would be subject to separate assessment processes, which would include the assessment of waste impacts associated with these activities.

Wastewater

The project tunnels would include drainage infrastructure to capture groundwater and stormwater, spills, maintenance wastewater, fire deluge and other potential water sources. The tunnel drainage streams would receive water containing a variety of potential pollutants (such as fuel, oil grease, and fire suppressants) requiring different treatment before discharge.

Tunnel wastewater (including collected groundwater) would be pumped to an operational wastewater treatment facility at the Rozelle Interchange (refer to Chapter 5 (Project description)). On average, the project tunnels would generate about 184 megalitres per year of treated groundwater.

Following treatment, discharges would enter into the local stormwater network. Further information is provided in Chapter 17 (Hydrodynamics and water quality) including potential impacts associated with operational stormwater runoff and water discharge.

24.5 Waste disposal locations

There are a number of options for recycling and disposal of construction and operational waste generated by the project. A large number of waste facilities in Sydney are licensed to accept general solid waste (putrescible) and general solid waste (non-putrescible). Specific facilities and collection contractors for the disposal of putrescible and non-putrescible general solid waste would be selected during the later stages of the project and documented in the construction waste management plan.

Recyclables generated during construction and operation of the project would be collected by an authorised contractor for off-site recycling. There are a number of resource recovery facilities in Sydney. Recycling facilities for the project would be determined by the contractor engaged to collect the material.

Special and hazardous wastes would be disposed of at appropriately licensed waste management facilities to be selected during the later stages of the project and documented in the construction waste management plan.

24.6 Environmental management measures

24.6.1 Contingency management of waste

Contingency measures would be implemented to manage unexpected waste volumes and types of waste materials generated from the construction of the project. Suitable areas would be identified, where feasible, to allow for contingency management of unexpected waste materials, including contaminated materials. These areas would be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage and segregation.

As detailed in Chapter 16 (Geology, soils and groundwater), in the event of discovery of previously unidentified contaminated material, all relevant work would cease in the vicinity of the discovery and the unidentified contaminated material would be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the Guideline for the Management of Contamination (Roads and Maritime, 2013a).

The environmental management measures outlined in Table 24-10 would be consistently implemented in the event of unexpected waste volumes and materials generated from the construction of the project, along with adherence to all waste principles and relevant legislation and regulations.

24.6.2 Management of waste

The project design has taken into account the principles of the resource management hierarchy as defined in the *Waste Avoidance and Resource Recovery Act 2001* and as described in Section 24.1. Where feasible and reasonable, resources would be managed according to the following hierarchy:

- Avoidance of unnecessary resource consumption through design, efficient construction methodologies and management
- Resource recovery, including reuse, reprocessing, recycling and energy recovery within the project
- Resource recovery, including reuse, reprocessing, recycling and energy recovery outside the project
- Where resource recovery is not feasible or reasonable, disposal would be the last resort.

Measures to avoid, minimise or manage resource consumption and waste generation as a result of the project are detailed in Table 24-10. Environmental management measures relating to contamination, including acid sulfate soils, are provided in Chapter 16 (Geology, soils and groundwater).

Table 24-10 Environmental management measures for resource use and waste management

Ref	Phase	Impact	Environmental management measure	Location
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, where feasible and reasonable.	WHT/WFU
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.	WHT/WFU
WM3	Construction	Waste generation and disposal	Wastes will be classified in accordance with the NSW Environment Protection Authority *Waste Classification Guidelines: Part 1 Classifying Waste*.	WHT/WFU
WM4	Construction	Storage and transport of wastes	Wastes will be appropriately transported, stored and handled according to their waste classification and in a manner than prevents pollution of the surrounding environment.	WHT/WFU
WM5	Construction	Wastewater generation and disposal	Opportunities for wastewater reuse and recycling will be pursued, including recirculating water during tunnel excavation to use for dust suppression. Wastewater not used onsite will be appropriately treated to a level that is representative of background concentrations at the receiving environment prior to discharge into the local stormwater system.	WHT/WFU
WM6	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.	WHT/WFU
WM7	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, 2014b).	WHT/WFU
WM8	Operation	Water use and discharge	Opportunities to reuse treated groundwater during project operation will be considered where feasible and reasonable.	WHT

Western Harbour Tunnel = WHT, Warringah Freeway Upgrade = WFU

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