24 Resource use and waste minimisation

This chapter describes the construction resources and materials, including potential sources and expected quantities that would be used for the project.

In addition, construction and operation of the project would generate waste streams that would require management and disposal in accordance with relevant NSW policies and guidelines. This chapter also provides a description of each waste stream, expected quantities of waste materials where known, and applicable waste management strategies.

Resource consumption and waste generated by the project would also contribute to the emission of greenhouse gases during construction and operation. The consideration of this impact and potential emission reduction opportunities are discussed in **Chapter 22** (Greenhouse gas).

Table 24-1 sets out the Secretary's Environmental Assessment Requirements (SEARs) as they relate to resource management and waste minimisation, and notes where in the environmental impact statement (EIS) they have been addressed.

Table 24-1 SEARs – resource and waste

SEARs	Where addressed
A Spoil Management Strategy detailing how spoil will be managed during construction, including likely volumes, likely nature and classification of excavated material, opportunities for recycling, potential disposal sites (including description of sites), stockpile management, and method(s) and route of transportation.	Spoil management during construction is detailed in **Section 24.1**. Spoil transportation method and routes are detailed in **Chapter 9** (Traffic and transport).

24.1 Assessment of potential impacts

The *Waste Avoidance and Resource Recovery Act 2001* is the primary legislation for managing waste. The key objectives of the Act in respect to this project are:

- To encourage the most efficient use of resources and to reduce environmental harm
- To ensure that resource management options are considered against a hierarchy of the following order: avoidance, resource recovery and disposal
- To assist in the achievement of the objectives of the *Protection of the Environment Operations Act 1997* (POEO Act*)*. The POEO Act establishes management and licensing requirements for the transport, storage, disposal and re-use of waste.

This section outlines the impacts that the project would have on resource consumption and waste generation during construction and operation, in the context of the objectives of the *Waste Avoidance and Resource Recovery Act 2001* and the SEARs.

24.1.1 Construction

Construction resource consumption

Indicative quantities of materials required for construction of the project are detailed in **Table 24-2**. Where feasible and reasonable, construction material would be sourced from within the Sydney region. Select materials such as steel, copper and polypropylene are likely to be required from quarries, manufacturers and suppliers outside the Sydney region. Construction resource requirements for the project are typical for a tunnelling project of this scale. Resource requirements may have a temporary impact on resource availability within the local area during construction.

Additional specific details for subcontractor management would be included in the Construction Environmental Management Plan, and the Workplace Health and Safety Plan for the project. Further procurement strategies would be identified during detailed design to manage the competition for the selection of suitably qualified and capable subcontractors, suppliers and providers of other resources.

The earthworks required as part of the closure of the Alexandria Landfill is anticipated to require about 620,000 cubic metres of cut and around 556,000 cubic metres of fill material. Due to compaction and importation of materials from tunnel spoil, this is expected to result in a cut / fill balance. Any excess cut material is expected to minimal, and would be classified as waste and therefore managed, treated and transported accordingly.

Table 24-2 outlines the materials required for construction of the project.

Table 24-2 Materials required for construction

Material	Estimated quantity required
Concrete – plain shotcrete (cast *in situ*)	2000 cubic metres
Concrete – reinforced shotcrete (cast *in situ*)	130,000 cubic metres
Concrete – no-fines (cast *in situ*)	80,000 cubic metres
Concrete – piles (cast *in situ*)	12,000 cubic metres
Concrete – New Jersey kerbs slipformed	13,000 cubic metres
Concrete – retaining walls (precast)	1000 cubic metres
Concrete – base paving	80,000 cubic metres
Concrete – drainage pipes (precast)	40,000 metres
Concrete – Other	200,000 cubic metres
Steel – steel fibre reinforcement for shotcrete	4,300 tonnes
Steel – rock bolts	5100 tonnes
Steel – rebar	40,000 tonnes
Asphalt	135,000 tonnes
Aggregate	350,000 tonnes
Copper wire cable	200 tonnes
Plastic – PVC (conduit)	402 tonnes
Plastic – polypropylene	180 tonnes
Pre-fabricated noise walls	13,446 metres squared
Noise wall – plexiglass	128 cubic metres
Noise wall – polyethylene	900 cubic metres

A procedure for the procurement and management of subconractors would be implemented to ensure that only those subcontractors which are capable of fulfilling the project's requirements would be given the opportunity to tender for the appropriate trade and supply packages. Procurement procedures would detail:

- How the procurement of subcontractors / products and services would be sourced and managed. This would include provisions for local content in accordance with the requirements of the Australian Industry Participation Plan, along with local training and development opportunities
- Prior to engagement, suppliers and subcontractors would be required to demonstrate acceptable health, safety and environmental practices which comply with design and construction best practices, along with capability of key personnel. Compliance with the project health and safety and environmental requirements would be mandatory
- Performance of subcontractors / suppliers would be monitored against requirements and poor workmanship and / or poor site behaviour would not be tolerated.

Water resources

The use of water during construction would be required for:

- Tunnelling activities such as cooling water and dust suppression
- Surface works, including compaction of pavement materials and dust suppression
- Site office and ablutions
- Commissioning of the fire and life safety deluge systems within the tunnels.

The total volume of water required for construction of the project would be around 2,500 mega litres. Water would primarily be sourced from the Sydney water mains (potable water). Non potable water sources include collected rainwater and treated groundwater would also be used. Estimated volumes and potential supplies of water for each site, based on the construction program and the anticipated demand and supply sources at varying times throughout construction are shown in **Table 24-3.**

Table 24-3 Water requirements (total construction period)

Compound	Potable water supply from Sydney Water mains (mega litres)	Non-potable water supply (mega litres)		Total (mega litres)
		Collected rainwater	Treated groundwater	
Kingsgrove North construction compound (C1)	440	2	58	500
Kingsgrove South construction compound (C2) and Commercial Road construction compound (C3).	25	0	55	80
Bexley Road North construction compound (C4)	150	2	33	185
Bexley Road South construction compound (C5)	150	4	31	185
Bexley Road East construction compound (C6)	1	1	0	2
Arncliffe construction compound (C7)	480	5	100	585
Canal Road construction compound (C8)	340	3	67	410
Campbell Road construction compound (C9)	419	1	0	420
Landfill compound (C10)	2	0	0	2
Burrows Road construction compound (C11)	30	<1	0	30
Campbell Road bridge construction compound (C12)	30	<1	0	30
Gardeners bridge construction compound (C13)	30	0	0	30
Sydney Park construction compound (C14)	<1	0	0	<1

Power

A temporary bulk power supply for the use of roadheaders, tunnel support sites and construction compounds would be required during construction. The power supply would be sourced, through connections to the existing power supply network.

Construction power supply details for major construction compounds are summarised in **Table 24-4** including supply source and power demand. The potential routes for the power supplies are shown in **Figure 24-1**, **Figure 24-2** and **Figure 24-3**. Environmental impact assessment and approval of these power supplies are being progressed separately from the project and they do not form part of this EIS.

Table 24-4 Construction power supply for major construction compounds

Compound	Supply source substation	Likely supply route length (kilometres)	Connected load (megavolt-ampere)
Kingsgrove North (C1), Kingsgrove South (C2) and Commercial Road (C3) construction compounds	Punchbowl Substation	4	3
Bexley Road North (C4), Bexley Road South (C5) and Bexley Road East (C6) construction compounds	Canterbury Zone Substation	2	6
Arncliffe construction compound (C7)	Canterbury Zone Substation	4	2 x 36 (33kV)
Canal Road construction compound (C8)	Green Square Substation	2	6
Campbell Road construction compound (C9)	St Peters Substation	2	10

Ancillary facilities that are not supporting tunnelling works, such as the Landfill compound (C10), Burrows Road construction compound (C11), Campbell Road bridge construction compound (C12), Gardeners bridge construction compound (C13) and Sydney Park construction compound (C14), would not require access to high voltage power. These sites would be powered via diesel powered generators or a local connection to the existing power supply network.

Around 130,000 Megawatt hours of electricity and up to around 30,500 kilolitres of fuel (diesel and petrol) would be required to construct the project. As per the sustainability targets for the project (refer to **Chapter 28** (Sustainability), at least six per cent of construction energy would be sourced where possible from an accredited GreenPower energy supplier. It is expected that around two per cent of construction phase power requirements would be offset in accordance with the Commonwealth Government's National Carbon Offset Standard. This would be reviewed during detailed design to refine the approach to offsetting energy requirements, and to identify whether additional power consumption can be offset.

Figure 24-1 Indicative construction power supply routes - Kingsgrove North (C1), Kingsgrove South (C2) and Commercial Road (C3) construction compounds

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Figure 24-2 Indicative construction power supply routes - Bexley Road North (C4), Bexley Road South (C5), Bexley Road East (C6) and Arncliffe (C7) construction compounds

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Figure 24-3 Indicative construction power supply routes - Canal Road (C8) and Campbell Road (C9) construction compounds

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Construction waste

Waste streams expected to be generated during construction of the project, would include:

- Spoil from tunnelling activities including soil and rock
- Contaminated soil (if present)
- Wastewater from tunnel construction, dust suppression, the use of wash down areas and construction compounds (grey water)
- General construction waste.

These waste streams are discussed in more detail below.

Tunnelling spoil

The project would generate around 3,200,000 cubic metres of spoil. The majority of spoil would be generated from the excavation of the main alignment tunnels. Site preparation activities, excavation of dive structures, excavation of ventilation shafts, and cut and fill activities for the aboveground components of the project would also generate spoil. The indicative breakdown of spoil volumes generated at each construction compound from surface works and tunnelling is summarised in **Table 24-5**.

Table 24-5 Anticipated spoil generation

Construction compound	Spoil volume- surface works (cubic metres)	Spoil volume- tunnelling (cubic metres)	Spoil volume- total (cubic metres)
Kingsgrove North (C1)	237,130	100,540	337,670
Kingsgrove South (C2)	117,830	0	117,830
Commercial Road (C3)	0	43,088	43,088
Bexley Road North (C4),	0	450,937	450,937
Bexley Road South (C5)	0	300,624	300,624
Bexley Road East (C6)	0	0	0
Arncliffe (C7)	50,000	975,635	1,025,635
Canal Road (C8)	90,000	787,660	877,660
Campbell Road (C9)	90,000	0	90,000
Landfill Closure (C10)	0	0	0
Burrows Road (C11)	6,000	0	6,000
Campbell Road bridge (C12)	6,000	0	6,000
Gardeners Road bridge (C13)	0	0	0
Sydney Park (C14)	1,000	0	1,000
Total spoil	**597,960**	**2,658,484**	**3,256,444**

The tunnel support sites would act as the primary facilities for receipt and dispatch of spoil.

Based on the depth of the tunnel and the local geology, the majority of excavated spoil material would be uncontaminated crushed sandstone and shale, classified as virgin excavated natural material (VENM). This spoil would consist of mixed size crushed rock, ranging from shale and sand to lumps of rock.

Potential opportunities for onsite reuse of spoil include use for the formation of embankments and earth mound noise barriers, site rehabilitation, and the infill of temporary tunnel access shafts and declines. About 80 per cent of usable (eg uncontaminated) construction and demolition waste is anticipated to be reused and / or recycled as part of the project. A Waste Management Plan would be prepared as part of the Construction Environmental Management Plan for the project, detailing the appropriate procedures for waste management. Residual waste which cannot be re-used or recycled would be disposed of to a suitably licenced landfill or waste management facility. Sites which have been identified as being appropriately licenced and potentially having capacity for spoil disposal are outlined in **Table 24-6**.

These potential offsite spoil application sites have been identified as preferred based on an analysis of commercial viability, traffic considerations and community impacts through the various construction phases of the project. Further consultation would take place with those facilities to confirm they are able to accept the required materials within the necessary timeframe, with consideration also given to other projects taking place in the area at the same time.

Excavated spoil would be tested and classified in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* (EPA, 2014a) prior to being separated, stored and then transported away (if required) from each construction site. Spoil would be transported to disposal sites along nominated haulage routes. The identification of these haulage routes, potential impacts arising from their use and appropriate management measures are described in **Chapter 9** (Traffic and transport) and **Chapter 12** (Noise and vibration).

Stockpile management

Stockpiles would be located at the following construction compounds:

- Kingsgrove North (C1)
- Kingsgrove South (C2)
- Commercial Road (C3)
- Bexley Road North (C4)
- Bexley Road South (C5)
- Arncliffe (C7)
- Canal Road (C8)
- Campbell Road (C9)
- Campbell Road bridge (C12)
- Gardeners Road bridge (C13).

Construction stockpiles would also be located at the Alexandria Landfill. Suitable areas would be identified to allow for contingency management of unexpected waste materials, including contaminated materials, and to segregate materials for storage and recycling.

Measures would be implemented to manage stockpiles such as potentially locating stockpiles outside of overland flowpaths, riparian corridors and finished and contoured so as to minimise loss of material in flood or rainfall events. Stockpiles left exposed and undisturbed for longer than 28 days would be stabilised by compaction then either sprayed with suitable stabiliser, covered with anchored fabrics, or seeded with sterile grass.

Contaminated spoil

There is potential to encounter contaminated soil during construction of the project during surface works and / or from tunnelling activities. This potential and associated risk is assessed in **Chapter 17** (Contamination) through a preliminary risk evaluation.

In situ testing of soils in areas of potential contamination concern would be conducted to determine the appropriate waste classification. Contaminated spoil would need to be sampled and immobilised, before being transported and disposed of at a suitably licensed offsite location.

An Unexpected Finds Protocol would be implemented in the event of encountering previously unidentified area(s) or types of contaminated material. Where this happens, all relevant work would cease in the vicinity of the discovery in accordance with a unsuitable spoil management contingency procedure which would be included as part of the Spoil Management Strategy for the project. Relevant works would not recommence until the need for and scope of remedial action(s), if required, is identified in accordance with the requirements of the *Contaminated Land Management Act 1997*.

Special wastes

Acid sulfate soils

The potential for acid sulfate soils to be present within the construction footprint (**Chapter 16** (Soil and water quality)).

An acid sulfate soil management plan would be prepared as a sub-plan to the Construction Environment Management Plan to outline the requirements for the management of potential acid sulfate soils. Identified acid sulfate soil material would be stored temporarily in a bunded area, transported and treated and disposed of off-site at a licensed facility. Management of acid sulfate soils would be in accordance with the Guideline for the Management of *Acid Sulfate Materials* (RTA, 2005c).

Unexploded ordnance

Chapter 17 (Contamination) identified a former ammunition storage site as a potential area of contamination concern at the Bexley surface works. The site is located between Flatrock Road, Bexley Road and Wolli Creek and has the potential to contain unexploded ordnance and heavy metals. Prior to construction a due diligence assessment would be completed for explosive ordnance to further investigate the risk and identify appropriate management measures. The potential for heavy metals is discussed below.

Asbestos

There is the potential for asbestos containing materials to be present within noise mounds within Beverly Grove Park and within light industrial / commercial properties at Garema Circuit in Kingsgrove. Asbestos containing materials are known to occur at the Alexandria Landfill. The excavation, movement and disposal of asbestos containing materials would be undertaken in strict accordance with procedures detailed in the Asbestos Management Plan and Asbestos Removal Control Plans for the project, and the *Work Health and Safety Regulation 2011*. For further details on known and potentially contaminated sites within the project area, refer to **Chapter 17** (Contamination).

Heavy metals

There is the potential for heavy metals such as cadmium, arsenic, copper, lead, mercury, at magnesium, aluminium and iron to occur near the Commercial Road (C3) construction compound, Kingsgrove, due to the various historical and current commercial and industrial land uses that have occurred at this location. The excavation, movement and disposal of waste material that is identified as contaminated with heavy metals would be undertaken in strict accordance with the procedures detailed in the *Work Health and Safety Regulation 2011*. For further details on known and potentially contaminated sites within the project area, refer to **Chapter 17** (Contamination).

Materials excavated from within the Alexandria Landfill

The project would involve some excavation of Stockpile 21 within the Alexandria Landfill. Stockpile 21 is subject to a NSW EPA issued clean-up notice due to the presence of asbestos containing materials. Around 70,000 cubic metres of material to be excavated from Stockpile 21 would be reused onsite to maintain batter stability and for the construction of the stockpile mound in the south-east corner of the site (refer to **Figure 5-28** of **Chapter 5** (Project description) for the operational layout of the St Peters interchange). Excavated material that is identified as contaminated would be segregated from uncontaminated material on-site to prevent cross-contamination during landfill closure works, in accordance with a Construction Environmental Management Plan for the site. Additional detail regarding the management of contaminated material within the former Alexandria Landfill site is provided in **Chapter 16** (Soil and water quality), **Chapter 17** (Contamination), **Chapter 26** (Hazard and Risk), and **Chapter 10** (Air quality).

The Landfill Closure Management Plan would be implemented for works associated with the closure of the Alexandria Landfill. The Alexandria Landfill Closure Management Plan includes measures to manage excavated materials and wastes generated from works within the Alexandria Landfill and is provided at **Appendix F**.

In the instance that hazardous materials are encountered during construction works within the Alexandria Landfill site, it may be necessary to dispose of them off-site at a suitably licensed facility. Where materials excavated from within the Alexandria Landfill are identified as being potentially hazardous, they would be sampled at an appropriately licenced laboratory and sent offsite for as appropriate for treatment / disposal at a suitably licenced facility.

Spoil management strategy

A Spoil Management Strategy would be prepared and implemented for the project prior to the commencement of construction. The Strategy would take into account the construction staging and specific conditions of approval that may be applied to the project. The broad parameters within which the Strategy would be developed are summarised in **Table 24-6**.

Table 24-6 Spoil Management Strategy broad parameters

Parameter	Strategy response*
Spoil generation	About 3.2 million cubic metres of spoil
Spoil generation locations	Indicative volumes of spoil that would be generated at the construction compounds would include: • Kingsgrove North (C1), Kingsgrove South (C2) and Commercial Road (C3) construction compounds - about 500,000 cubic metres • Bexley Road North (C4) and South (C5) construction compounds - about 750,000 cubic metres • Arncliffe construction compound (C7) - about 1,025,000 cubic metres • Canal Road compound (C8) - about 880,000 cubic metres • Campbell Road compound (C9) - about 90,000 cubic metres • Burrows Road (C11) and Campbell Road bridge construction compounds (C12) - about 12,000 cubic metres • Sydney Park construction compound (C14) - about 1,000 cubic metres.
Spoil management hierarchy	Spoil would be managed following the hierarchy of avoidance, minimisation, reuse, recycling and finally disposal.
On-site management	Spoil would be transported from the tunnel face to the surface by truck or conveyer belt. Spoil would be stored and processed at construction site compounds. Environmental and workplace health and safety mitigation and management measures would be applied.
Spoil testing and classification	Spoil testing would be limited to initial testing to confirm the excavated material is VENM. VENM would be reused where possible.
Spoil category	Spoil would generally fall into one of the following categories, according to which it would be classified, stored and transported separately: • VENM, including materials such as clay, gravel, sand, soil or rock fines excavated from non-contaminated areas, and which do not contain sulfidic ores or soils, or any other wastes • Excavated natural material (ENM) (naturally occurring rick and soil such as sandstone clay and soil containing at least 98 per cent by weight natural material, and which does not meet the definition of VENM, and which does not contain processed materials, asbestos, acid sulphate soils or sulfidic ores, and which is therefore kept separate from VENM) • General solid waste • Potentially some contaminated materials. In order to determine which category spoil falls into, it may be necessary to conduct a soil analysis.

Parameter	Strategy response*
Potential spoil reuse locations	Potential spoil reuse locations would be consulted with during detailed design. Identified potential spoil reuse locations include: • Boral CSR Brick Pit, Townson Road, Schofields – capacity of around 550,000 cubic metres. Licensed to receive wastes onsite (types of waste not restricted in Environment Protection Licence 2014) • Defence Housing Australia Schofields Aerodome, Quakers Road, Quakers Hill – capacity of around 500,000 cubic metres. Further consultation would be required with Defence Housing Australia to confirm whether this site can receive such wastes • Austral Bricks, 738-780 Wallgrove Road, Horsley Park - capacity of around 3,000,000 cubic metres. Environment Protection Licence 546 allows the receipt of wastes onsite if those wastes are covered by a current resource recovery exemption under clause 51A of the *Protection of the Environment Operations (Waste) Regulation 2005*, and is also licensed to receive and apply wastes to land where this does not require licensing under the Act. Resource recovery exemptions relevant to the types of spoil generated by the project include those for excavated natural materials and excavated public road materials • Sakkara Riverstone West (North West Growth Centre development), Brandon Road, Riverstone - capacity of around 3,500,000 cubic metres. Further consultation would be required with this developer to confirm whether this site can receive such wastes • Kurnell Landfill Company - capacity of around 7,000,000 cubic metres. This site can receive virgin excavated materials, building and demolition wastes, and asphalt wastes only. Cannot receive contaminated wastes.
Spoil transport	Spoil would be transported from construction compounds by road using trucks.

* Quoted spoil volumes are accurate to the nearest 10,000 cubic metres

Wastewater

Tunnel construction would result in significant volumes of groundwater inflow that would require treatment and disposal. Wastewater volumes generated during tunnel construction would vary depending on construction activity, tunnel groundwater infiltration rate and excavated tunnel length. In addition, wastewater would be generated from other construction activities including dust suppression, wash down areas and stormwater runoff from construction compounds (grey water). Indicative total wastewater volumes generated over the duration of the construction period are identified in **Table 24-7.**

Construction water would either be re-used on site wherever feasible (refer **Table 24-3**), or discharged into the local stormwater system in accordance with the requirements of an environmental protection licence (if required). Preference would be given to reusing as much water as is practicable before discharging. Additional information regarding reuse of water during construction is provided in **Chapter 26** (Sustainability).

Table 24-7 Indicative wastewater volumes

Compound	Wastewater volume (mega litres)	Watercourse discharge point
Kingsgrove North construction compound (C1)	86	Wolli Creek
Commercial Road construction compound (C3)	86	Wolli Creek
Bexley Road South construction compound (C5)	340	Wolli Creek
Arncliffe construction compound (C7)	676	Cooks River
Canal Road construction compound (C8)	370	Alexandra Canal
Landfill Closure compound (C9)	108	Alexandra Canal
Total	1,666	

Five water treatment plants would be used during construction of the project. These would be located at the Kingsgrove North compound (C1), the Commercial Road construction compound (C3), the Bexley Road South construction compound (C5), the Arncliffe construction compound (C7) and the Canal Road construction compound (C8). Details of water treatment methods and discharge water quality are provided in **Chapter 16** (Soil and water quality). A leachate treatment system would be installed at the landfill and is discussed in **Chapter 17** (Contamination). For further information on water treatment plants proposed to collect and treat construction water, surface water runoff and groundwater inflows, as well as the expected groundwater discharge volumes during both construction and operation, refer to **Chapter 16** (Soil and water quality).

An updated water balance would be prepared during detailed design. The outcomes of this study would be used to further improve water efficiency during construction and operation.

General construction waste

General construction waste generated by the project would include:

- Demolition waste from existing structures that require removal
- Green waste from the removal of trees, shrubs and ground covers that are unable to be mulched and reused within the project
- General construction waste including:
  - Packaging materials such as crates, pallets, cartons, plastics and wrapping materials
  - Surplus construction material and general site reinstatement such as fencing, sediment, concrete, steel, formwork and sand bags
  - Timber formwork, scrap metal, steel, concrete, and plasterboards
- Site office waste generated by on site personnel such as paper, cardboard, plastic, glass and food waste
- Construction vehicle waste (operation and maintenance) including waste fuels and oil, adhesives, lubricants, engine coolant, roadheader picks, batteries, hoses and tyres
- Sewage waste generated from the use of construction compounds.

Potential adverse impacts arising from waste management associated with construction of the project include:

- Excessive volumes of materials directed to landfill due to insufficient recycling and reuse
- Excessive volumes of materials directed to landfill due to unnecessary or inefficient resource consumption and inadequate collection, classification and disposal of waste
- Dust impacts due to incorrect storage, handling and disposal
- Contamination of soil, surface and / or groundwater from the inappropriate storage, transportation and disposal of liquid and solid waste.

- Demolition waste generated by the project has the potential to contain hazardous materials, in particular asbestos containing materials. Such waste would be managed and disposed in accordance with:
  - *Work Health and Safety Act 2011*
  - Code of Practice for the Safe Removal of Asbestos 2nd Edition
  - Code of Practice for the Management and Control of Asbestos in Workplaces
  - Protection of the Environment Operations (Waste) Regulation 2014, in particular Part 7 Transportation and management of asbestos waste
  - AS2601:2001 Demolition of Structures.

Waste types and volumes generated during construction of the project would be typical of that produced on tunnel construction projects of this scale. Approximately 100,000 cubic metres of non-spoil waste would be disposed of between June 2016 and October 2016, and a further 40,000 cubic metres between April 2017 and March 2018.

Several licenced disposal sites have been investigated for the disposal of non-spoil construction waste. In particular, the Transpacific Waste Management Services site at Erskine Park has capacity for a further approximate 300,000 cubic metres of landfill. Transpacific Waste Management Services are currently seeking development approval to increase the landfill volume of this site by 150,000 cubic metres. Further, Transpacific Waste Management Services have other suitable sites identified and are currently in negotiations to secure these sites to provide ongoing general solid waste disposal services. Consequently, it is expected that existing and proposed metropolitan waste management facilities would have capacity to receive waste streams generated by construction of the project.

Waste management activities associated with construction of the project would not pose a significant risk to the environment with the implementation of standard mitigation measures as provided in **Table 24-10**.

Operation resource consumption

Water resources

Operation of the project would require around four mega litres of water per annum. The majority of water would be required for the operation and regular testing of the tunnel deluge system, which forms part of the fire and life safety system. Other uses of water during operation include water use in buildings and general maintenance activities (for example tunnel washing).

The primary source of water during operation would be potable water. However, alternative sources, such as rainwater harvesting, would be explored during detailed design. Other sustainability initiatives to reduce water consumption are discussed in **Chapter 28** (Sustainability).

Power

The project has been designed to minimise operational energy consumption and maximise efficiency. The vertical alignment of the main alignment tunnels would allow consistent vehicle speeds to be maintained, thereby minimising fuel use. Further, low carbon energy generation options would be investigated as part of the design process in order to reduce the demand on mains electricity where feasible. During operation, the project would consume around 30,000 megawatt hours of electricity per annum as a result of:

- Ventilation, hydraulic and lighting systems in the main alignment tunnels, which would consume the greatest quantity of power
- Daily use of traffic management system and variable message signs
- Building and equipment, eg server and computer equipment, tolling facilities, water pumps, heating, lighting and air conditioning.

For further details of the operational management measures to reduce the project's power consumption, refer to **Chapter 22** (Greenhouse gas).

Peak oil

Peak oil refers to the fact that oil production may peak or has already peaked, and that oil production would decline thereafter. The impact could increase the cost and reduce the availability of transport fuels. Peak oil issues in relation to transport generally include the use of fossil fuels, the energy efficiency of vehicles and construction products derived from fossil fuels.

The environmental impacts of the project have been assessed in accordance with statutory requirements and the SEARs. Although peak oil is not considered in these requirements, Roads and Maritime Services acknowledges that it is prudent to consider peak oil.

Despite efforts to limit demand for road transport, it is expected that the need for transport will continue to grow as described in **Chapter 3** (Strategic context and project need). The WestConnex program of works is intended to link Sydney's west with the airport and the Port Botany precinct, increasing travel speeds, decreasing travel distances and improving travel efficiency. This may result in an overall reduction in the quantity of fuel consumed.

Further, by alleviating road congestion pressures, the project would indirectly facilitate the use and reliability of road based public transport (refer to **Chapter 3**). The project would also be able to be utilised by non-fossil fuel powered vehicles.

Government and industry initiatives relevant to peak oil but outside the scope of this project include the *NSW Government Resource Efficiency Policy* (OEH, 2014a) and the participation of Roads and Maritime, Austroads and industry in research with the goal of developing more sustainable road construction materials and practices reducing reliance on products derived from oil.

24.1.2 Operation waste management

Solid waste

Waste generated by the operation of the project would be limited. Routine maintenance, repair activities, and operation of the motorway control centre would contribute to the majority of operational waste for the project. Predominant operational waste would include:

- General office waste such as paper, plastics and food waste
- Green waste from landscaping activities and waste grit from soil and road sweepers
- Road materials and general litter along the motorway
- Contaminated waste from potential fuel spills and leaks
- Chemicals, oils and liquids used for road maintenance activities.

No additional management measures would be required to accommodate operational waste and it would be managed by standard work practices and existing metropolitan waste management facilities. Waste generation and management during operation of the project would be minimal.

Wastewater

As the tunnels would be drained, there would be a low level of ongoing inflow of groundwater into the tunnels. This would require the ongoing capture, treatment and discharge of groundwater during the operation of the project. The predicted daily groundwater inflow into the main alignment tunnels is about 1,700 kilolitres. Other sources of operational wastewater within the tunnels include stormwater entering the tunnels via the portals, deluge water, washdown water and hydrant water.

Wastewater collected within the tunnels would be captured and treated as follows:

- Wastewater collected from sections of the main alignment tunnels located east of the Cooks River have the potential to be contaminated, and as such would be captured and treated separately via a two-step treatment using a groundwater treatment plant and an artificial wetland. The treated water would be discharged into the Cooks River.
- Wastewater from sections of the main alignment tunnels located west of the Cooks River would be captured and treated at a groundwater treatment plant prior to discharge to Cook's River.

Discharge water quality would be determined in consultation with the NSW Environment Protection Authority and having regard to ANZECC water quality guidelines.

For details regarding leachate management at Alexandria landfill refer to **Chapter 17** (Contamination).

Further information on groundwater inflow, drainage and treatment is provided in **Chapter 16** (Soils and water quality), **Chapter 18** (Flooding and drainage) and **Chapter 19** (Groundwater).

24.2 Environmental management measures

Measures to avoid, minimise or manage resource consumption and waste generation during construction are outlined in **Table 24-8.**

Table 24-8 Environmental management measures – resource and waste

Impact	No	Environmental management measures	Timing
Construction			
Resource consumption	WM01	Construction energy consumption would be reduced through initiatives such as: • Use of roadheaders, which can excavate a more efficient shape for the road tunnel than tunnel boring machines, resulting in less spoil generation and less energy consumption for handling, management and transport of spoil • Local materials procurement where feasible and cost effective to reduce fuel consumption for transport • Selection of efficient construction plant and equipment where possible • Use of recycled materials where feasible • Efficient practices on site (for example, switching off engines when not in use) • Use of energy efficient or solar powered lighting for temporary construction facilities • Investigating the use of biofuel for construction vehicles.	Construction
	WM02	Where feasible and reasonable, construction material would be sourced from within the Sydney region.	Pre-construction and construction
	WM03	Unnecessary resource consumption would be avoided by making realistic predictions of the required quantities of resources such as construction materials	Construction

Impact	No	Environmental management measures	Timing
	WM04	Resource recovery would be applied to the management of construction waste and would include: • Recovery of resources for reuse-reusable materials generated by the project would be segregated for reuse either on-site or off-site where possible, including the reuse of the major waste streams (VENM and ENM) • Recovery of resources for recycling - recyclable resources (such as metals, plastics and other recyclable materials) generated during construction and demolition • Resources would be segregated for recycling • These materials would then be sent to an appropriate recycling facility for processing. • Recovery of resources for reprocessing - cleared vegetation would be mulched or chipped on-site and used for landscaping, in the absence of a higher beneficial use being identified.	Construction
	WM05	Where reasonable and feasible, Packaging Take Back arrangements would be implemented with suppliers.	Construction
Management of waste	WM06	Wastes would be managed (classified, handled and stored) and reused / recycled / disposed of in accordance with relevant State legislation and government policies including the POEO Act*, Waste Avoidance and Resource Recovery Act 2001, Waste Avoidance and Resource Recovery Strategy 2014-2021* (EPA, 2014b), and the sustainable procurement objective of the WestConnex sustainability strategy (WestConnex Delivery Authority, 2015).	Construction
	WM07	A Construction Waste Reuse Recycling and Energy plan (CWRREMP) would be prepared as part of the Construction Environmental Management Plan detailing appropriate procedures for waste management. The Construction Waste Recycling Reuse Environment Management Plan would ensure waste disposal and energy use is minimised by tracking and reporting performance and applying corrective action as required.	Construction

Impact	No	Environmental management measures	Timing
	WM08	Wastes would be managed using the waste hierarchy principles of: • Avoidance of unnecessary resource consumption to reduce the quantity of waste being generated. • Recover resources for reuse on-site or off-site for the same or similar use, without reprocessing. • Recover resources through recycling and reprocessing so that waste can be processed into a similar non-waste product and reused. • Disposal of residual waste.	Construction
	WM09	Residual waste would be disposed of to a suitably licensed landfill or waste management facility where there are no other feasible and reasonable options for waste avoidance, reuse or recycling. Waste materials requiring removal from the site would be classified, handled and stored in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* (EPA, 2014a) until collection by a contractor for disposal.	Pre-construction and construction
	WM10	Off-site reuse of waste would comply with relevant NSW Environment Protection Authority resource recovery exemptions and requirements.	Construction
	WM11	Asbestos handling and management would be undertaken in accordance with the project's Asbestos Management Plan and relevant legislation, policies and standards: • *Work Health and Safety Act 2011* • *Code of Practice for the Safe Removal of Asbestos 2nd Edition (NOHSC, 2005a).* • *Code of Practice for the Management and Control of Asbestos in Workplaces (NOHSC, 2005b).* • *Protection of the Environment Operations (Waste) Regulation 2014* – Part 7 Transportation and management of asbestos waste. • Australian Standard AS2601:1991 Demolition of Structures.	Pre-construction
	WM12	Measures would be implemented to manage stockpiles such as potentially locating stockpiles outside of overland flowpaths, riparian corridors and finished and contoured so as to minimise loss of material in flood or rainfall events. Stockpiles left exposed and undisturbed for longer than 28 days would be stabilised by compaction then either sprayed with suitable tackifier, covered with anchored fabrics, or seeded with sterile grass.	

Impact	No	Environmental management measures	Timing
Excess spoil	WM13	A Spoil Management Strategy would be developed prior to the commencement of construction and implemented during construction. The strategy would identify spoil disposal sites and describe the management of spoil on-site and during off-site transport.	Pre-construction
	WM14	Where possible and fit for purpose, spoil would be beneficially reused within the project before off-site reuse or disposal options are pursued.	Construction
	WM15	Before being transported from construction sites, excavated spoil would be classified in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* (EPA, 2014a) to ensure appropriate reuse or disposal.	Construction
Wastewater	WM16	Feasible and reasonable opportunities for wastewater reuse on-site or for construction purposes would be pursued (such as dust suppression both in the tunnels and for surface works).	Construction
	WM17	Wastewater not used on-site would be discharged into the local stormwater system in accordance with the requirements of an environment protection licence issued for the project.	Construction
Contaminated soil	WM18	An Unexpected Finds Protocol would be implemented in the event of encountering previously unidentified area(s) or types of contaminated material. Where this happens, all relevant work would cease in the vicinity of the discovery in accordance with a unsuitable spoil management contingency procedure which would be included as part of the Spoil Management Strategy for the project. Relevant works would not recommence until the need for and scope of remedial action(s), if required, is identified in accordance with the requirements of the *Contaminated Land Management Act 1997*.	Construction

Impact	No	Environmental management measures	Timing
Operation			
Management of waste	OPWM01	Wastes would be managed and disposed of in accordance with relevant State legislation and government policies including the POEO Act, *Waste Avoidance and Resource Recovery Act 2001*, *Waste Avoidance and Resource Recovery Strategy 2014-2021* (EPA, 2014b), and the sustainable procurement objective of the *WestConnex sustainability strategy* (WestConnex Delivery Authority, 2015).	Operation
Operational water requirements	OPWM02	Opportunities for reuse of wastewater would be considered in preference to discharge to the local stormwater system.	Detailed design and operation
	OPWM03	In order to reduce demand on local water supplies, options would be investigated for providing water required for operation of the deluge system from wastewater produced through the tunnel drainage system where it meets appropriate quality parameters.	Detailed design and operation

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