WASTE MANAGEMENT

CHAPTER TWENTY-FOUR

24 Waste management

This chapter provides an assessment of waste associated with the project and identifies mitigation measures to minimise impacts.

24.1 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to waste management and where these requirements are addressed in this Environmental Impact Statement are outlined in Table 24-1.

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

Ref.	Secretary's environmental assessment requirements	Where addressed
16. Waste		
16.1	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 **b.** Estimates / details of the quantity of bulk earthworks and spoil balance to be generated during the construction of the project **c.** Handling of waste including measures to facilitate segregation and prevent cross contamination **d.** Management of waste, including indicative location and volumes of spoil material **e.** Waste minimisation and re-use **f.** Lawful disposal or recycling locations for each type of waste using a hierarchy which prioritises higher value end use **g.** Contingencies for the above, including managing unexpected waste volumes.	Waste is addressed in Sections 24.6 Section 24.7.
16.2	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.	Sediment / leachate control is addressed in Chapter 18 (Soils, contamination and water quality). Noise is addressed in Chapter 10 (Construction noise and vibration). Dust is addressed in Chapter 22 (Air quality).

24.2 Regulation of waste

Waste management and recycling is regulated in NSW by the NSW Environment Protection Authority through the *Protection of the Environment Operations Act 1997* (refer to Chapter 2 (Planning and assessment process), for discussion on this Act), 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 waste avoidance and resource recovery through (amongst other things) the establishment of the following waste hierarchy:

1. Avoidance of waste – the first priority in waste management includes actions to reduce the amount of waste generated
2. Resource recovery – the second priority in waste management involves opportunities for re-use (without further processing), recycling (processing waste materials to make the same or different products), reprocessing and energy recovery
3. Disposal – the least desirable option in the waste management hierarchy involves the disposal of waste in an appropriate manner so as to minimise the potential adverse environmental impacts associated with its disposal.

To support the above waste hierarchy, the NSW Environment Protection Authority released the *NSW Waste Avoidance and Resource Recovery Strategy 2014–21* (Environment Protection Authority, 2014a), which provides a framework and targets for waste management and recycling in NSW to 2021–22. Targets established under this strategy comprise:

- Avoiding and reducing the amount of waste generated per person in NSW
- Increasing recycling rates to 70 per cent for municipal solid waste; 70 per cent for commercial and industrial waste; and 80 per cent for construction and demolition waste
- Increasing waste diverted from landfill to 75 per cent
- Managing problem wastes better, and establishing 86 drop-off facilities and services across NSW
- Reducing litter, with 40 per cent fewer items (compared to 2012) by 2017
- Combatting illegal dumping, with 30 per cent fewer incidents (compared to 2011) by 2017.

Transport for NSW, as a NSW Government agency, has a general responsibility to support these targets by:

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

Transport for NSW's commitment to managing waste during construction and operation of the project is outlined in Section 24.3.

24.3 Sustainability strategy

Transport for NSW has developed a project-specific sustainability strategy for the Chatswood to Sydenham project. This strategy includes initiatives and targets to manage waste during construction and operation of the project. Further discussion on the initiatives and targets contained in the project-specific sustainability strategy (including how these initiatives and targets would be implemented) is provided in Chapter 25 (Sustainability).

24.4 Assessment methodology

- A desktop assessment was carried out and comprised:
- A review of spoil volumes
- A review of the likely waste streams and volumes, including wastewater and demolition materials
- Identification of the environmental impacts associated with the generation (and subsequent disposal) of waste materials, with consideration of:
  - Waste minimisation and re-use potential
  - The level of hazard associated with the types of waste generated
  - The capacity of disposal facilities to receive the volumes of waste generated by the project
- A spoil management strategy to identify how spoil would be managed during construction, including likely volumes, likely nature and classification of excavated material, opportunities for recycling, potential disposal sites, stockpile management, and method(s) and route of transportation. The spoil management strategy also considered the cumulative effects of spoil haulage and disposal activities associated with other major infrastructure projects within Sydney (cumulative impacts are assessed in Chapter 26 (Cumulative impacts))
- Targets for the beneficial re-use of solid wastes, wastewater and other construction wastes in accordance with the project's sustainability strategy (refer to Chapter 25 (Sustainability))
- Management strategies to adequately address waste during construction and operation, including:
  - Managing construction waste through the waste 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 NSW Office of Environment and Heritage's *Waste Classification Guidelines* (DECCW, 2009b).

24.5 Waste generation

This section outlines waste generation anticipated to be associated with construction and operation of the project. The potential impact associated with waste generation is assessed in Section 24.6 and Section 24.7.

24.5.1 Construction stage

The main construction activities anticipated to generate waste are outlined in Table 24-2 along with the likely materials produced.

Table 24-2 Indicative types of waste generated during construction

Activity	Materials produced
Tunnelling, station excavations, cuttings and general earthworks	Spoil comprising virgin excavated natural material (uncontaminated soil and crushed rock); tunnel boring machine cutter heads and associated equipment replacement (conveyer belts etc.); tunnel boring machine lubricants (bentonite slurry or similar); contaminated materials and potential acid sulfate soils; waste water including groundwater inflows to tunnels and station excavations.
Demolition of buildings and other structures	Concrete, bricks, tiles, timber (treated and untreated), metals, plasterboard, carpets, electrical and plumbing fittings and furnishings (such as doors and windows), hazardous waste (including asbestos and insulation).
Dust suppression, wash down of plant and equipment, and staff amenities at construction sites (such as toilets)	Sediment-laden and / or potentially contaminated wastewater, sewage and grey water.
Tunnel and station fit-out and general construction activities and resource use	Concrete waste, timber formwork, scrap metal, steel, plasterboard, cable and packaging material.
Maintenance of construction plant, vehicles and equipment	Adhesives, lubricants, waste fuels and oils, engine coolant, batteries, hoses and tyres.
Activities at offices and crib rooms	Putrescibles, paper, cardboard, plastics, glass and printer cartridges.
Clearing and grubbing of vegetation, landscaped and / or turfed areas	Green waste.

The types and quantities of construction waste generated by the project would be site specific and would vary throughout the stages of construction.

The largest volumes of construction waste are anticipated to be generated during the excavation of tunnels, stations, with smaller quantities of spoil also generated during the excavation of the ancillary shaft at Artarmon and the temporary retrieval shaft at Blues Point. This would predominantly comprise spoil (consisting of uncontaminated soil and crushed rock) and wastewater (from water used during excavation, and groundwater inflows).

Indicative volumes of spoil anticipated to be generated during construction of the project are outlined in Table 24-3. As discussed in Chapter 7 (Project description – construction) spoil from tunnel boring activities would be extracted from the Chatswood dive site, Marrickville dive site and Barangaroo Station (as reflected in Table 24-3), while spoil from other construction sites would generally be excavated from station sites and shafts.

Table 24-3 Indicative volumes of spoil generated during construction of the project

Activity	Materials produced (m^3)	Expected spoil composition
Chatswood dive site – dive excavation	60,000	Sandstone
Chatswood dive site – tunnelling	460,000	Sandstone
Artarmon substation	2,000	Sandstone
Crows Nest Station	150,000	Shale / sandstone
Victoria Cross Station	175,000	Sandstone
Blues Point temporary site	8,000	Sandstone
Barangaroo Station	145,000	Sandstone
Barangaroo Station – tunnelling	90,000	Sandstone / marine sediment
Martin Place Station	175,000	Sandstone
Pitt Street Station	160,000	Sandstone
Central Station	230,000	Sandstone
Waterloo Station	115,000	Shale / sandstone
Marrickville dive site – dive excavation	70,000	Shale / sandstone
Marrickville dive site – tunnelling	560,000	Shale / sandstone
Total	2,400,000	

As shown in Table 24-3, it is envisaged that the project would generate about 2.4 million cubic metres of spoil. Strategies that would be developed to address spoil management are outlined in Section 24.6.1.

The volumes of construction wastes are expected to be comparable to other similar infrastructure projects (including Sydney Metro Northwest, which is currently under construction) and have not been estimated as part of this Environmental Impact Statement (due to the early design stage of the project and the materiality of such estimates on the conclusions of the assessment). These construction wastes are expected to be manageable through the application of standard waste management strategies (addressing waste generation, storage, disposal and re-use) and the project-specific sustainability initiatives documented in Chapter 25 (Sustainability).

24.5.2 Operation stage

The main types of activities anticipated to generate waste during operation of the project are outlined in Table 24-4 along with the likely waste materials produced.

Table 24-4 Indicative types of waste generated during operation

Waste-generating activity	Waste materials produced
Disposal of general litter in station bins and cleaning activities associated with trains, stations and other infrastructure	General non-recyclable and putrescible waste (such as food waste from station rubbish bins), recyclable wastes such as plastics and aluminium cans, office waste including paper and plastics.
Infrastructure maintenance	Cable and conduit off-cuts from maintenance of electrical infrastructure, solvents, paints, adhesives, cleaning fluids, greases, acids and alkali materials, and spent spill kit absorbent materials used to clean up accidental spills during maintenance.
Capture and treatment of groundwater and stormwater ingress into tunnels and stations	Sediment-laden and / or potentially contaminated wastewater, solids, filter cake (consisting of oxides of iron and manganese) and water treatment chemicals from the water treatment plant.
Use of station customer facilities (such as toilets)	Sewage and grey water.

As discussed in Chapter 6 (Project description – operation), the capture and treatment of groundwater and stormwater ingress into the tunnels and stations would require the operation of a water treatment plant at Sydenham (located adjacent to the Marrickville dive structure). Treatment of groundwater and stormwater may generally involve the removal of dissolved iron and manganese prior to disposal to adjacent catchments (assumed to be the Alexandria Canal).

Waste materials produced from the water treatment plant would predominantly comprise wastewater (to be treated in accordance with all applicable guidelines) and solids filter cake (consisting of oxides of iron and manganese). At maximum operating capacity, the water treatment plant is estimated to produce up to 54,000 litres of wastewater per hour; however, the actual volume of wastewater produced from this facility would depend on the volume of groundwater and stormwater inflow into the tunnels and stations.

The volumes of other wastes generated during the operation of the project (as listed in Table 24-4) would be considerably lower than those generated during construction and would be typical of similar infrastructure projects, including the existing Sydney Trains network. The volumes of these wastes have not been estimated as part of this Environmental Impact Statement (due to the early design stage of the project and the materiality of such estimates on the conclusions of the assessment); however, volumes of these other wastes are expected to be manageable through the application of standard waste management strategies (outlined in Section 24.8).

24.6 Potential impacts – construction

Potential waste management issues during construction would include:

- Waste being directed to landfill due to the inadequate collection, classification and disposal of waste, which would increase the demand for landfill capacity within the Sydney region
- Contamination of soil, surface and / or groundwater from the inappropriate storage, transport and disposal of liquid and solid wastes
- An increase in vermin from the incorrect storage, handling and disposal of putrescible waste from construction sites
- Incorrect classification and / or disposal of waste, including the incorrect storage, handling and disposal of contaminated spoil and other hazardous materials (for example, asbestos from building demolition)
- Excessive amounts of materials being ordered, resulting in a large amount of left-over, unused resources
- Lack of identification of feasible options for recycling or re-use of resources.

The above issues are considered to be manageable through standard mitigation measures. These measures would be developed in accordance with the project's sustainability strategy (refer to Chapter 25 (Sustainability)) and would address the following:

- Classification of waste in accordance with the current guidelines
- Estimates / details of the quantity of bulk earthworks and spoil balance to be generated during the construction of the project
- Handling of waste including measures to facilitate segregation of waste into stockpiles of spoil, concrete, steel, timber, paper and cardboard and vegetation to make it easier to recycle components and prevent cross contamination
- Management of waste, including indicative location and volumes of spoil material
- Waste minimisation and re-use
- Lawful disposal or recycling locations for each type of waste using a hierarchy which prioritises higher value end use
- Contingencies for the above, including managing unexpected waste volumes.

Management strategies that would be developed to address construction waste are discussed further below.

24.6.1 Spoil management

Spoil generation

It is envisaged that the project would generate about 2.4 million cubic metres of spoil. The majority of spoil would be generated from the excavation of tunnels and stations. Relatively smaller quantities would be generated by site preparation activities, excavation of vertical access shafts, dive structures and cut and fill activities for the aboveground components of the project.

The majority of excavated spoil would be uncontaminated crushed sandstone and shale classified as 'virgin excavated natural material'. In general, this would consist of mixed-size crushed rock, ranging from clay and sand to lumps of rock. The volume and source of spoil generated at each construction site are outlined in Table 24-3. Strategies that would be developed to address spoil management are provided below.

Spoil management hierarchy

The strategy for spoil re-use would follow a hierarchy of options, as presented in Table 24-5.

Table 24-5 Spoil management hierarchy for the project

Priority	Re-use options	Possible re-use options
1	Within the project	• Re-use spoil in the project for fill embankments and mounds within a short haulage distance of the source • Re-use spoil to restore any pre-existing contaminated sites within the project boundary • Re-use spoil as a feed product in construction materials).
2	Environmental work	• Re-use spoil for coastal protection, such as beach nourishment and land raising • Re-use spoil in flood mitigation projects.
3	Other development projects (including other Sydney Metro projects)	• Re-use spoil for fill embankments and mounds on projects within a financially feasible transport distance of the site • Re-use spoil for land reclamation or remediation projects • Re-use sand for manufacturing concrete and shale for manufacturing bricks and tiles.
4	Land restoration	• Re use spoil to fill disused facilities (for example mines and quarries) to enable either future development or site rehabilitation.
5	Landfill management	• Re-use spoil to cap completed landfill cells • Re-use spoil in daily covering of landfill waste.

Spoil re-use opportunities

While the project would target 100 per cent of beneficial re-use of the usable spoil generated during construction, it is recognised that there would only be limited opportunities for onsite spoil re-use as the project has very limited onsite requirements for fill and construction site space is limited. The quantities and locations of such onsite re-use opportunities would be determined during the detailed design of the project.

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

The spoil produced by the project would have the following potential re-use opportunities:

- Clean granular fill is likely to be suitable for use as structural fill
- Excavated moist 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 re-use on site without substantial moisture conditioning.

The geology of the spoil material as well as its consistency and quality would determine the re-use options.

Potential spoil use for land restoration and landfill management

Spoil could be used for filling former quarries in the Sydney region. Former quarries and other sites that are potentially available for large-scale disposal of virgin excavated natural material are listed in Table 24-6. Potential spoil disposal sites would be determined during the detailed design of the project.

The disposal of spoil at these locations may require separate new or modified planning approval and an associated environmental protection licence under the Protection of the *Environment Operations Act 1997*. A waste levy would be payable for each tonne of waste directed to landfill under this Act.

Table 24-6 Possible large-scale disposal sites and quarries for virgin excavated natural material in the Sydney region

Potential disposal location	Existing estimated capacity (million m^3)	Haulage distance
CSR PGH Quarry, Schofields	1.1	Chatswood – 41km Marrickville – 47km
Austral Bricks No. 2 and No. 3 Plants, Horsley Park	0.6	Chatswood – 41km Marrickville – 49km
CSR PGH Quarry, Horsley Park	2	Chatswood – 41km Marrickville – 49km
Hornsby Quarry	1.8	Chatswood – 15km Marrickville – 36km
Gosford Quarry	2.5	Chatswood – 59km Marrickville – 83km

24.6.2 Management of other construction wastes

Demolition waste

As outlined in Chapter 7 (Project description – construction), it is anticipated that construction of the project would require the demolition of about 79 buildings. Demolition waste would be managed through the waste hierarchy established under the *Waste Avoidance and Recovery Act 2001* (refer to Section 24.2).

Demolition waste would be segregated and stockpiled on site, with materials such as bricks and tiles, timber, plastic and metals being separated where practicable and sent to a waste facility with recycling capabilities.

All demolition waste would be classified in accordance with the *Waste Classification Guidelines* (OEH, 2009) and directed to a waste management facility that is lawfully permitted to accept that type of waste.

Asbestos

There is the potential for asbestos containing materials to be present within demolished buildings / structures. The disturbance, movement and disposal of asbestos containing materials would be carried out in strict accordance with the *Work Health and Safety Regulation 2011* and applicable guidelines.

Contaminated spoil

Given that the project would predominantly be constructed within sandstone and shale, the potential for substantial volumes of contaminated spoil to be generated during tunnelling and excavation is expected to be low. Notwithstanding, 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 18 (Soils, contamination and water quality).

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. 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*.

Any spoil classified as being contaminated in accordance with *NSW Waste Classification Guidelines Part 1: Classifying Waste* (NSW Environment Protection Agency, 2014b) would be directed to a waste management facility that is lawfully permitted to accept that type of contaminated waste.

There are a number of solid waste landfills in Sydney that are licensed to accept contaminated soils. It is anticipated that the volumes of contaminated spoil generated by the project could be readily accommodated at these facilities.

Further discussion of contamination including asbestos and other hazardous materials is provided in Chapter 18 (Soils, contamination and water quality).

Acid sulfate soils

As discussed in Chapter 18 (Soils, contamination and water quality), there is a high probability of encountering acid sulfate soils during excavation and other ground disturbance at Barangaroo (opposite Erskine Street) and potentially between Waterloo Station and Marrickville dive site. Impacts associated with the disturbance of acid sulfate soils are described in Chapter 18 (Soils, contamination and water quality), as are measures to mitigate impacts. Acid sulfate soils would be disposed of in accordance with the *NSW Waste Classification Guidelines Part 4: Acid Sulfate Soils* (NSW Environment Protection Agency, 2014c).

Wastewater

As discussed in Chapter 17 (Groundwater and geology), the excavation of the tunnels, stations and shafts are likely to intercept groundwater aquifers resulting in the need to capture, treat and discharge water. Construction water treatment plants would be required at the three tunnelling support sites, each station site and the ancillary shaft excavation site which would treat all intercepted groundwater to meet the requirements of an environmental protection licence issued to the project. Treatment of construction water is discussed further in Chapter 18 (Soils, contamination and water quality).

The re-use of treated water would be maximised during the construction works by re-circulating water to the tunnel cutting face and for surface dust suppression; however there would be a surplus of treated water requiring discharge from the sites. It is anticipated that water would be discharged to the local stormwater system or directly to a local surface watercourse, although options such as Sydney Water trade waste agreements would be investigated during detailed design.

All wastewater requiring discharge would be managed in accordance with any relevant conditions contained in the environmental protection licence issued to the project.

Further information on wastewater management and water treatment is provided in Chapter 18 (Soils, contamination and water quality).

24.7 Potential impacts – operation

Potential waste management issues that could occur during operation would include:

- Waste from stations and maintenance activities being directed to landfill due to the inadequate collection, classification and disposal of waste, which would increase the demand for landfill capacity within the Sydney region
- Waste (such as litter) from station buildings being blown into the surrounding environment if adequate bins are not provided or emptied regularly
- Wastewater from stations (toilets and station-cleaning activities)
- Disposal of wastewater from tunnels and stations
- An increase in vermin from the incorrect storage, handling and disposal of putrescible waste at stations
- Excessive amounts of maintenance materials being ordered, resulting in a large amount of left-over, unused resources.

The above issues are considered to be manageable through standard mitigation measures. These measures would be developed in accordance with the project's sustainability strategy (refer to Chapter 25 (Sustainability)).

24.8 Mitigation measures

The mitigation measures that would be implemented to address potential waste management impacts are listed in Table 24-7 and Table 24-8.

Table 24-7 Mitigation measures – waste management– construction

Ref	Mitigation measure	Applicable location(s)[1]
WR1	All waste would be assessed, classified, managed and disposed of in accordance with the NSW Waste Classification Guidelines.	All
WR2	100 per cent of spoil that can be reused would be beneficially re-used in accordance with the project spoil re-use hierarchy.	All
WR3	A recycling target of at least 90 per cent would be adopted for the project.	All
WR4	Construction waste would be minimised by accurately calculating materials brought to the site and limiting materials packaging.	All

1 *STW: Surface track work; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement work; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; facility; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes..*

Table 24-8 Mitigation measures – waste management – operation

Ref	Mitigation measure	Applicable location(s)[1]
WM5	Generation of operation phase waste would be minimised.	All

1 *STW: Surface track work; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement work; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; facility; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.*