BaT project

Chapter 15
Waste

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15. Waste

15.1 Introduction

The purpose of this chapter is to identify and describe potential waste streams and their management during construction and operation of the Project.

This chapter addresses section 11.16 to section 11.20 of the Terms of Reference (ToR).

Additional information regarding the generation and management of specific waste streams is also discussed in other Environmental Impact Statement (EIS) chapters, including:

- **Chapter 6 – Soils and topography** – acid sulphate soils (ASS) and contaminated land
- **Chapter 9 – Hydrology** – treated water discharge.

Spoil, as generated through the excavation of material, is not considered to be a waste. The management of spoil generated by the Project is discussed in **Chapter 3 – Project description**.

15.1.1 Methodology

This assessment focusses on the study corridor defined in **Chapter 1 – Introduction**, however, consideration has also been given to impacts on environmental values outside of the study corridor as a result of waste, where relevant.

The purpose of this assessment is to describe the waste streams generated by the Project's construction and operation in the context of the applicable regulatory framework. The assessment involved:

- defining waste management objectives in relation to legislation and standards protecting environmental values and the waste management hierarchy
- describing all expected waste streams from the Project activities during the construction and operational phases
- developing a process by which waste from the Project would be managed and monitored.

15.1.2 Legislative and policy framework

Waste management in Queensland is regulated by the *Environmental Protection Act 1994* (EP Act) and *Waste Reduction and Recycling Act 2011* (WRR Act). Subordinate legislation includes the *Waste Reduction and Recycling Regulation 2011* and the *Environmental Protection (Waste Management) Regulation 2000* (Waste Regulation). Together with the *Environmental Protection Regulation 2008*, these instruments provide the legal and strategic framework for managing waste in Queensland.

The ToR requires consideration of the Environmental Protection (Waste Management) Policy 2000. This policy has been repealed, with the requirements under this policy now contained in the Waste Regulation.

The EP Act defines 'waste' (section 13 (1)) as anything, other than a resource approved under the WRR Act, that is:

a) left over, or an unwanted by-product, from an industrial, commercial, domestic or other activity; or

b) surplus to the industrial, commercial, domestic, or other activity generating the waste.

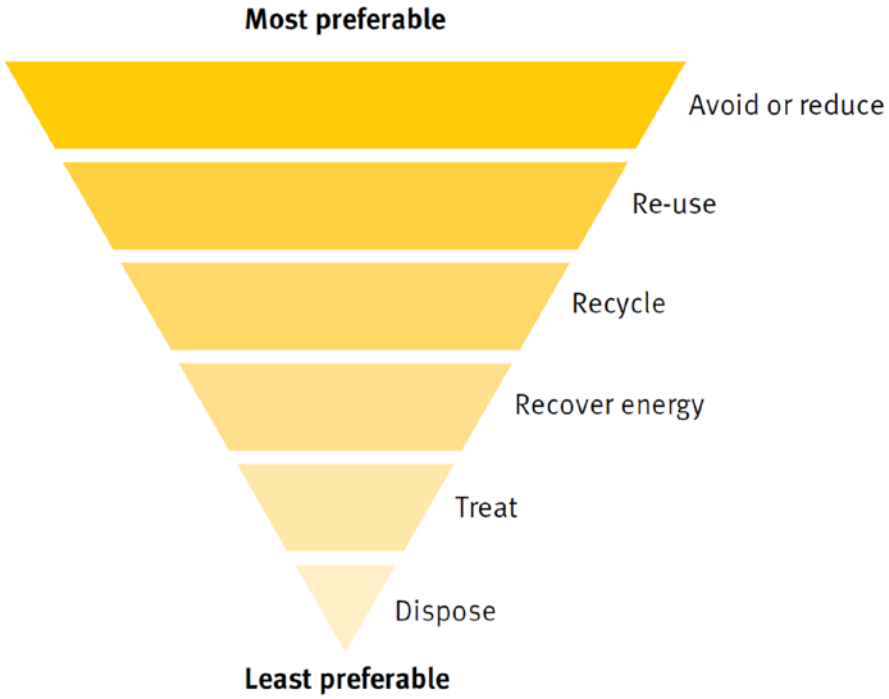
General waste, limited regulated waste and regulated waste is further defined under the Waste Regulation. Schedule 7 of the Waste Regulation specifically prescribes what materials constitute regulated waste while Schedule 12 prescribes general waste and limited regulated waste.

Certain waste management activities including the disposal and transport of waste, are considered to be Environmentally Relevant Activities (ERAs) and require approval under the EP Act. The Waste Regulation also contains particular requirements for the handling of specific waste streams.

Recently, changes were enacted to the EP Act under the *Environmental Protection (Greentape Reduction) and Other Legislation Amendment Act 2012*. While the WRR Act still provides a strategic framework for managing wastes (based on the waste hierarchy), it fundamentally relied on the levy[1] to drive targets. Queensland's *Waste Reduction and Recycling Strategy 2010-2020* has also been withdrawn, and an 'industry led' strategy is under development.

The WRR Act provides a framework for managing wastes through a waste management hierarchy. This hierarchy (refer to **Figure 15-1**) describes an overall approach to waste with avoidance the most preferred.

Figure 15-1 Waste management hierarchy



15.2 Waste generation

There is the potential for a variety of solid and liquid wastes to be generated during the construction and operation of the Project. Significantly less waste is expected to be generated during the operation of the Project relative to the construction.

[1] Levy is currently set at zero

Waste generated by the Project can be categorised as:

- construction and demolition (C&D) waste
- operational waste.

The waste streams are categorised into general solid waste, inert waste, green waste, recyclable waste and regulated waste.

15.2.1 Construction and demolition waste

Solid waste materials would be generated during construction, repair, alteration or demolition of buildings, and development of infrastructure such as roads, bridges, tunnels and railways required for the Project. The quantity and type of construction and demolition waste is site-specific and dependent on the location within the study corridor, land uses, design features and construction methodologies. The areas of demolition are outlined in **Table 15-1**.

Table 15-1 Demolition activities

Proposed demolition location	Description
Southern Connection	Demolition of rail depot facility
Woolloongabba Station	Demolition of the GoPrint building at 867 Main Street, Woolloongabba
George Street Station	Demolition of 63 George Street building
Roma Street Station	Removal of an area of Platform 10 at the Roma Street Station
Northern Connection	Removal of Queensland Rail maintenance facility, Normanby maintenance and storage sheds

In addition to the waste items listed in **Table 15-1**, some hazardous materials may be encountered during demolition activities in sections of the railway corridor within the study corridor such as:

- asbestos in service pipes and older buildings
- creosotes and arsenic in wooden sleepers, ballast and soils.

Asbestos materials have the potential to be present in the Project construction and demolition areas in the form of building materials. Asbestos is not easily identifiable and therefore the potential for asbestos materials within buildings follows a general rule based on the year of the building construction. Buildings built:

- before the mid-1980s are more than likely to contain asbestos materials
- between the mid-1980s and 1990 are likely to contain asbestos material
- after the 1990s are unlikely to contain asbestos materials.

The Queensland Government, through the Department of Housing and Public Works, developed the Built Environment Materials Information Register (BEMIR), which is an environmental management system containing known asbestos materials within public buildings. The Queensland Investment Corporation (QIC) and GoPrint buildings currently located on the sites for the George Street Station and Woolloongabba Station, respectively, are identified in this register.

A summary of the major waste streams expected to be generated from construction and demolition activities is provided in **Table 15-2**.

Table 15-2 Potential construction and demolition wastes

Waste type	Project activity	Waste classification
Top soil and green waste	Site establishment	Inert
Contaminated soil	Excavation	Regulated waste
Buildings	Demolition activities	Inert material, possible asbestos in older buildings
Concrete, bricks and tiles	Demolition activities	Inert
Timber (untreated)	Demolition activities	Inert
Timber (treated)	Demolition activities	General solid waste
Metals (ferrous and non-ferrous)	Demolition activities	Inert
Plaster board	Demolition activities	Inert
Asbestos sheeting	Demolition activities	Regulated waste
Carpets	Demolition activities	General solid waste
Electrical and plumbing fittings	Demolition activities	Inert
Furnishings (e.g. furniture, doors and windows)	Demolition activities	Inert
Hazardous waste (e.g. hydrocarbons, chemicals, paints, refrigerant/ air conditioning gases)	Demolition activities	Regulated waste
Bitumen, road base aggregates, soil and concrete	Demolition of roads	Inert
General domestic and food wastes	Crib rooms and site offices	General solid waste
Packaging material – pallets, plastic wrapping, polystyrene products and cardboard	Construction activities – delivery of materials and store yard waste	General solid waste – if segregated, some components are potentially recyclable
Potentially contaminated soil	Construction activities	Regulated waste, if contaminated
Scrap metal and steel	Construction activities	Inert
Timber formwork (untreated)	Construction activities	Inert
Timber formwork (treated)	Construction activities	General solid waste
Concrete, pavements and aggregates	Construction activities	Inert
Plasterboard, geotextiles and geosynthetic materials	Construction activities	Inert
Cable, conduit and pipework offcuts	Construction activities	Inert
Medical and first aid station waste	Construction activities	General solid waste
Office wastes (paper, cardboard)	Construction activities	General solid waste
Tyres, batteries, adhesives, lubricants, cleaning agents, fuels, coolants, waste oil etc.	Minor maintenance activities, vehicle refuelling of heavy machinery and TBM operation	Regulated waste
Silt and sediment	Maintenance of erosion and sediment control devices at construction sites	General solid waste – if segregated, some components are potentially recyclable

Waste type	Project activity	Waste classification
Treated water from groundwater and equipment wash down	Water management system	Liquid waste
Water-borne sludge or residue	Wastewater treatment plant	Regulated waste
Absorbent materials and spent spill kit materials	Refuelling pads and construction sites	Regulated waste

The percentage of total construction material that may result as waste during construction is outlined in **Table 15-3**.

Table 15-3 Estimated waste materials during construction period

Material type	Material removed from site during construction	
	Lower estimate (per cent)	Upper estimate (per cent)
Concrete (excluding precast items)	1	2
Steel (including reinforcing)	1	2
Formwork*	100	100
Hazardous excavated material	100	100
Paints, chemicals and solvents	1	5
Oils, lubricants and grease**	5	10
Fire retardants	1	5
Cabling, conduits and ducting	1	5

Notes:
** Formwork is used on a temporary basis during construction and would be removed from site at the end of construction period.*
*** The proportion of oil to be removed from the site during tunnel boring machine (TBM) decommissioning has not been included in this estimate. The exact quantity of oil removed during decommissioning of the TBM would be determined by the specification of the TBM.*

Concrete, bricks, asphalt, soil, rubble and ferrous metals are the most common materials recycled from the construction waste streams in Australia (National Waste Report, 2010). Based on recent recovery rates from construction wastes in Queensland, it is estimated that less than 2 per cent of concrete material and less than five per cent of general demolition waste removed from site and taken to a recycling facility would be disposed of to a landfill as waste.

An estimate of general and recyclable waste material generated during construction of the Project and removed from site is summarised in **Table 15-4**. Estimated quantities of construction and demolition wastes generated during construction are presented in **Table 15-5**. Quantities of waste generated by each of the waste streams would be refined during detailed design.

Table 15-4 Estimated general and recyclable wastes quantities during construction period

Type of waste	Estimated rate of generation	Estimated quantity removed from site*
General waste (food scraps and other non-recyclable waste) from office and construction staff	0.6kg/ person/ week	690kg/ week
Paper and cardboard waste from office staff	1.6kg/ person/ week	160kg/ week (recyclable)
Other recyclable waste (containers, drink bottles etc.) from office and construction staff	0.3kg/ person/ week	345kg/ week (recyclable)

*Note: * All construction worksites at peak workforce commitment, based on 160 full time equivalent (FTE) office staff and 640 FTE construction workers.*

Table 15-5 Estimated construction and demolition waste quantities

Location	Concrete (excluding precast items) (m^3)	Steel (including reinforcing) (tonnes)	Formwork (m^2)*	Hazardous excavated material ('000m^3)	Paints, chemicals and solvents (L)	Oils, lubricants and grease (L)	Fire retardants (m^3)	Cabling, conduit and ducting (m^3)	Packaging (m^3)	Waste water (kL/day)***	Immiscible liquids (oily water/ sludge) (tonnes)	Tyres (tonnes)
Southern Connection	300-500	40-60	2200-4500	2.5	<120	10,400-12,400	<12	<54	<25	<12	100 (allocation for all locations)	25 (allocation for entire construction period)
Woolloongabba Station	200-400	40-80	3000-6000	0.7	<50	<600-12.000	<10	<4	<10	<5		
George Street Station	500-1000	60-120	3000-6000	2.2	<50	<600	<10	<4	<10	<2		
Roma Street Station	300-5000	20-40	3000-6000	0.3	<50	<600	<10	<4	<10	<2		
Northern Connection	<100	<10	300-600	0.6	<20	3,600**	<2	<4	<5	<5		

Notes:
** Formwork is used on a temporary basis during construction and would be removed from site at the end of the construction period. It has been assumed that 5-10 per cent of the formwork is removed as waste with >90 per cent of the formwork removed for further use on this or other projects, along with other construction equipment, machinery and tools.*
*** An allocation has been included for oil removed during TBM decommissioning. The exact quantity of oil removed during decommissioning would be determined by the specifications of the TBM.*
**** Waste water includes water used in the operation of the TBMs and water used for dust suppression, but does not include sewage or grey water. Additionally, ground water seepage into tunnels has not been included in waste water as this is dependent on site conditions and cannot be estimated at present.*

15.2.2 Operational waste

The major waste streams to be generated during the operational phase of the Project are summarised in **Table 15-6**.

The volumes of waste generated during operation of the Project are expected to be insignificant in comparison to the construction phase. Quantities of waste would depend on operational frequencies of bus and trains, passenger numbers, maintenance regimes etc. These details are unknown at this stage of the Project. As such, quantities of operational phase waste cannot be accurately determined at this time.

Table 15-6 Operational wastes expected to be generated by the Project

Waste type	Project activity	Waste classification
Groundwater inflow, pavement and tunnel wash down water	Tunnel infrastructure maintenance	Liquid waste
Tunnel wastewater, sludges or residue	Tunnel wastewater treatment plants	Regulated waste
Waste paints and solvents	Infrastructure maintenance	Regulated waste
Surface water runoff	Above ground infrastructure	Liquid waste
Tyres, batteries, adhesives, lubricants, cleaning agents, fuels, coolants, waste oil, etc.	Maintenance of vehicles and trains	Regulated waste
Electrical cable and conduit offcuts	Maintenance of electrical services within the rail and bus corridor	General solid waste, potentially recyclable
General waste	General maintenance of public areas	General solid waste, potentially recyclable
Empty chemical containers	General maintenance of public areas	Regulated waste
Packaging material – pallets, plastic wrapping, polystyrene products and cardboard	General maintenance of infrastructure and buildings	General solid waste – if segregated, some components are potentially recyclable
Glass, aluminium cans, plastic bottles, paper and cardboard	Public place and commercial recycling bins	General solid waste, potentially recyclable
General waste	Public place and commercial recycling bins	General solid waste, potentially recyclable
Office waste	Offices and commercial uses	General solid waste, potentially recyclable
Electrical insulation – SF_6 (sulphur hexafluoride)	Maintenance of electrical equipment – electrical switchgear and control gear	Regulated waste
Silt and sediment	Maintenance of erosion and sediment control devices	General solid waste
Green waste – weeds, vegetation trimmings	General maintenance of landscaping	Green waste

15.2.3 Secondary impacts

Waste generated during construction and operation has the potential to cause secondary impacts if inappropriately managed. They include:

- dust resulting from the inappropriate storage, handling and disposal of excavated material
- soil and water contamination including surface water and groundwater contamination from material spills during handling and haulage
- soil and water contamination including surface water and groundwater contamination from inappropriate storage, handling and disposal of solid and liquid waste and materials separated for recycling, reuse or recovery
- soil and water overflows from sediment control structures and sediment ponds during extreme rainfall events
- increase in the incidence of vermin, insects and pests resulting from the inappropriate storage and handling of putrescible waste
- impact on social amenity during construction as a result of poor housekeeping in construction areas
- inefficient use of resources.

However, waste and resource recovery activities associated with the Project are not expected to pose a significant risk to the environment or public health with the implementation of effective waste management and resource recovery control measures.

15.3 Impact management

The waste management strategy for the Project would align with the Queensland Government's hierarchy, with materials being managed in the following order of preference:

- avoid
- reuse
- recycle
- recover
- treat
- dispose.

Actions to achieve these objectives are described in the following sections and in **Chapter 18 – Draft Outline EMP**. This includes a subsequent commitment to develop a more specific and performance driven Waste and Resource Recovery Management Plan (WRRMP) prior to construction commencing. **Chapter – 18 Draft Outline EMP** also details how the achievement of these objectives would be monitored and audited.

15.3.1 General overview

This section provides a general overview of actions to be undertaken during design, construction and operation of the Project.

Avoid

Opportunities to avoid the generation of waste and, if avoidance is not possible, reducing waste would be identified and undertaken during design, construction and operation of the Project. Strategies for reducing waste during construction and operation of the Project would consider:

- incorporating materials that are fit for purpose and consider whole of life requirements
- utilising materials and products that have a recycled component wherever they are cost and performance competitive, and where environmentally preferable to the non-recycled alternative
- implementing systems to identify, quantify and monitor waste generation
- implementation of Project office sustainability measures through the selection of energy and resource efficient goods and equipment (e.g. low wattage fluorescent lighting, inverter air conditioning, insulation panelling to reduce energy consumption, waterless urinals, foot pedal or automatic shutoff hand waste basins and rainwater harvesting to reduce water consumption)
- ordering goods in bulk to minimise packaging waste and develop contract conditions/ arrangements with suppliers to reduce the quantity of packaging materials supplied with building materials and return of packing materials to the supplier
- making arrangements with suppliers to return any construction materials not used
- training staff to avoid generation of, or reuse construction waste.

Of these actions, the appropriate selection of materials during design is seen as a key initiative. Fit for purpose materials would consider whole of life requirements (as opposed to initial capital cost), with durability and extended performance warranties principle considerations. This approach would reduce the intervals for refurbishment (and maintenance) and the associated quantities of waste.

Material selection is primarily a component of design, with drawings and specifications nominating the products for use. Standards such as the NSW Sustainable Design Guidelines for Rail (version 2.0) and Integrated Vic Roads Environmental Sustainability Tool (INVEST) would be used to guide the development of these documents during detailed design of the Project. This would include a material/ energy flow analysis showing the life cycle costing for key components and materials.

The NSW Sustainable Design Guidelines for Rail (version 2.0) provide guidance on maximising natural resource use efficiency in design. This includes initiatives such as procurement of energy efficient tunnel ventilation (e.g. appropriately sized vent shafts and fans, power factor correction units etc.), and water efficient amenities (e.g. water efficient cooling towers and deluge systems, and prioritise procurement of water efficient fittings and amenities).

Reuse

Reuse is a process by which waste otherwise destined for disposal is cleaned, processed or repaired for use, for the purposes of prolonging the original product lifetime prior to treatment or reprocessing. Strategies for the reuse of waste during construction would consider:

- developing demolition procedures which facilitate recovery of materials for reuse, segregation of different types of materials for recycling in preference to demolition and disposal
- providing salvaging contractors with the opportunity to salvage (remove) building materials prior to demolition so that items can retain their value and be reused

- chipping and mulching of vegetation cleared during construction and reuse of mulched material for landscaping purposes
- stockpiling of topsoil free of weeds and storage for reuse, where practicable
- reusing waste concrete and pavements for road construction (sub-base layer) or as hard stand areas in construction compounds or crushed and used for construction haul paths, erosion and sediment controls such as at entry/ exit points and for lining temporary drainage lines
- training staff to identify opportunities for reuse material during construction
- engaging a salvage specialist to identify opportunities in the open market for reuse of materials that are not able to be reused in the Project.

Where appropriate, these measures would also be implemented during operation of the Project.

Recycle

Recycling is a process by which waste material, otherwise destined for disposal, is collected, sorted, reprocessed or remanufactured and is then used to make another product. Strategies for recycling during construction and operation of the Project would consider:

- collection of kerb and pavement materials and transport to crushing and recycling plants
- provision of recycling facilities for general rubbish that is glass, plastic, waste paper and metals, using colour-coded bins
- collection of demolition materials for transportation to a resource recovery and recycling depot where reuse on site is not possible
- segregation of demolition materials by type to facilitate recycling and resource recovery efforts.

Recover

Resource recovery means finding uses for waste by way of reuse, recycling, processing or energy recovery. Resource recovery is recovering materials and end-of-life products from the waste stream that have a reuse, recycling or energy value. Materials recovered can be used in the manufacture of new products. Recovery of value includes energy by utilising components of waste as a fuel, production of compost using organic solid waste as a medium, and reclamation of land.

Strategies for the recovery of waste during construction would consider:

- recovery of fixtures, such as lights and other electrical fittings, doors, wash basins, toilets, windows and sheds, through sales and/ or charity organisations
- recovery of rail infrastructure for later use such as ballast, rail tracks, concrete sleepers, gantries, signals and fencing
- demolition of buildings in a manner that enables recovery of materials
- engaging a salvage specialist to identify opportunities for resource recovery.

If recovered items and materials are to be sold this should occur in line with due processes for disposing of such items and materials in a commercial market.

Treat

With the exception of groundwater, the treatment of waste would not be undertaken on-site during construction or operation. All commercial forms of treatment would be undertaken at approved, off-site facilities.

Groundwater would be treated through purpose built management systems with subsequent water used during construction. Excess water would be disposed as trade waste in Queensland Urban Utilities' sewer system.

Disposal

Waste unable to be reused, recycled or recovered would be disposed of in appropriately licensed commercial landfill sites and sewage treatment systems.

15.3.2 Additional actions

Additional actions are proposed in order to manage regulated waste, hazardous materials and dangerous goods, asbestos and contaminated soils. An overview of these actions, specific to material is provided as follows.

Hazardous materials and dangerous goods

The sound management of hazardous waste and dangerous goods would be a key component of waste management to prevent adverse environmental and health impacts. Management of hazardous and dangerous goods for this Project would be guided by a Hazardous Goods Management Plan, as a sub-plan to the EMP, prepared and implemented in consultation with Workplace Health and Safety Queensland.

Provision would be made at the various construction worksites for the storage of Dangerous Goods (including fuel and hazardous waste), according to the Dangerous Goods Codes. Products likely to be stored and used at construction worksites or within tunnel areas include:

- petroleum or other hydrocarbon based products
- hazardous materials/ dangerous goods residues and containers, including explosives
- various chemicals (lubricants, cleaning agents, adhesives)
- wastewater treatment chemicals (for tunnel water treatment)
- batteries.

Safety Data Sheets (SDS) would be required to be kept at the storage location of all hazardous materials and dangerous goods. The SDS would be used to assess the potential impact of waste materials from the use of these materials/ products and determine the disposal and waste management measures.

Hazardous materials and potential sources of hazardous wastes would be documented and a register of hazardous and regulated waste updated and maintained as required. The register is required to be updated for each new hazardous material introduced on site. For each potential hazardous waste identified, the disposal, storage, treatment and emergency response to accidental release requirements would also be documented and implemented.

Transportation of hazardous wastes, regulated wastes and contaminated soils would be undertaken by a suitably licensed waste contractor. Waste tracking requirements consistent with the Waste Regulation would be implemented during construction.

The storage and transportation of hazardous waste materials would be undertaken in accordance with Australian Standards.

Storage and transport of materials would be undertaken according to:

- Australian Standard (AS) 1216 Classification, Hazard identification and Information Systems for Dangerous Goods
- AS 1678 Emergency Procedure Guides – Transport
- AS 1940 Storage and Handling of Flammable and Combustible Liquids
- AS 3780 The Storage and Handling of Corrosive Substances
- AS 2809 Road Tank Vehicles for Dangerous Goods
- AS 2931 Selection of Use of Emergency Procedure Guides for Transport of Dangerous Goods
- AS 2187 Explosives – Storage, Transport and Use
- *Explosives Act 1999*
- *Work Health and Safety Act 2011*
- National Code of Practice for the Safe Removal of Asbestos 2nd revision.

Management of used fire retardants within the tunnel or at the stations would include measures to contain, capture and dispose of potentially contaminated water and materials. Appropriate spill response plans would also be prepared as part of the Project. The wastes from spill incidents would be managed as outlined in **Chapter – 18 Draft Outline EMP**. Standard procedures for the storage, handling, spill response and disposal of hazardous waste would be implemented. Spill containment material and spill kits would be available for use in the event of a spill incident.

Sulphur Hexafluoride (SF_6)

AS 2791-1996 High-voltage switchgear and control gear – use and handling of sulphur hexafluoride (SF_6) in high-voltage switchgear and control gear comprehensively documents end of life requirements associated with sulphur hexafluoride (SF_6) filled electrical equipment (such as insulation, switchgear and control gear).

The Energy Networks Association (ENA) Industry Guideline for SF_6 Management outlines:

- requirements for the removal of SF_6 filled equipment from service for disposal
- recycling and reuse of SF_6 equipment and cylinders
- recycling of SF_6 filled electrical equipment.

The Project would comply with the requirements of the ENA Industry Guideline (or subsequent revisions) during construction and operation.

Asbestos

Asbestos is likely to be encountered during demolition activities. Two types of asbestos exist, bonded and fibrous. Bonded asbestos is any product where the asbestos is bonded with cement or resin binder to make it more stable. Bonded asbestos is of low health and environmental risk when undisturbed. Fibrous asbestos is any product that contains asbestos in a dusty or fibrous form. Fibrous asbestos is a dangerous product and should only be handled by a licensed asbestos waste contractor.

Demolition plans and schedules would include a phase to assess whether the structure to be demolished contains asbestos material and work procedures developed accordingly. Based upon the potential adverse health impacts from handling of materials containing asbestos, all materials suspected of containing asbestos would be disposed to an appropriately licensed landfill by a certified asbestos waste contractors.

Buildings and dwellings to be demolished during construction could potentially contain asbestos materials and therefore have the potential to generate asbestos contaminated demolition waste. The BEMIR would be consulted to identify public buildings within proposed demolition areas which may contain asbestos.

Contaminated soil

Appropriate disposal methods (and locations) for contaminated soil would be implemented during construction of the Project. This includes prior testing to determine the potential for contaminates in areas such as the GoPrint site (Woolloongabba Station), railway corridor and Roma Street Station. Further detail on the management of contaminated soil is discussed in **Chapter 6 – Soils and topography**.

Acid sulphate soil

The likelihood and management of ASS is discussed in **Chapter 6 –Soils and topography**. Subject to further investigations, an ASS management plan would be developed, incorporating best management and monitoring practices through the design, pre-construction and construction phases to eliminate or minimise environmental impacts associated with ASS. ASS mitigation measures would accord with the hierarchy of ASS management principles detailed in the Queensland Acid Sulphate Soil Technical Manual – Soil Management Guidelines (version 3.8) (2002), which include: avoidance, minimisation of disturbance, neutralisation and hydraulic separation.

Groundwater

Inflows of groundwater into the tunnel would be collected and treated via a purpose built water management system. Post-treatment, water would be discharged to Queensland Urban Utilities' sewerage system as trade waste.

Groundwater impacts associated with the Project are discussed further in **Chapter 9 – Hydrology**.

15.3.3 Impact management summary

Table 15-7 identifies the measures proposed to manage waste associated with the construction and operation of the Project.

Table 15-7 Proposed waste management measures

Impact	Project phase	Management measure
Generation of waste (including general and demolition waste)	Detailed design, Construction and Operation	Implement measures to avoid, reuse, recycle, recover, treat and dispose waste, as described in **section 15.3.1**
Presence of asbestos during demolition activities, generating asbestos contaminated demolition waste	Construction	Develop and implement measures for the management of asbestos in accordance with the EP Act and the *Work Health and Safety Regulation 2011* and the Queensland guidelines How to Manage and Control Asbestos in the Workplace and How to Safely Remove Asbestos (Workplace Health and Safety Queensland, 2011)

Impact	Project phase	Management measure
Presence and disposal of contaminated soil	Construction	Management and disposal of contaminated land to be undertaken in accordance with measures outlined in **Chapter 6 – Soils and topography**
Presence and disposal of ASS	Construction	Management and disposal of ASS to be undertaken in accordance with measures outlined in **Chapter 6 – Soils and topography**
Storage and disposal of hazardous materials and dangerous goods	Construction and Operation	Implement a Hazardous Goods Management Plan, prepared in consultation with Workplace Health and Safety Queensland
Disposal of sulphur hexafluoride (SF_6) filled electrical equipment (i.e. insulation, switchgear and control gear)	Construction and Operation	Implement measures in accordance with the requirements of the Energy Networks Association (ENA) Industry Guideline

15.4 Summary

This chapter has described the waste management requirements and strategies developed for the Project. **Chapter 18 – Draft Outline EMP** includes policy, performance criteria, implementation strategies and monitoring, auditing, reporting and corrective actions for waste management as detailed in this chapter. The waste management strategy for the Project is based on the principles of avoidance, reuse, recycle, recovery and disposal.

Throughout the construction of the Project, consideration would be given to the salvation and on-site segregation of construction and demolition materials to facilitate, reuse, resource recovery and recycling. Careful planning would be undertaken during the design and construction planning phases to:

- minimise double handling during resource recovery activities and promote segregation of materials by providing sufficient area for storage and segregation of materials
- separate and segregate the different material types on-site, where practicable
- manage movement of excavated material within the site area and external to the site
- develop procedures to record, monitor, audit and report the offsite destination of each load of excavated material, resource recovered materials and residual waste.

Wastes generated during Project operation are typical of the current networks for bus and rail. Materials would include recyclable wastes such as paper, plastic and glass and small quantities of waste oils and cleaning agents. Groundwater inflows would also result and be managed via purpose built water management systems. Waste quantities during this phase of the Project are not considered significant and are able to be managed using recognised and proven methods.

Waste and resource recovery activities associated with the Project are not anticipated to pose a significant risk to the environment or public health with the implementation of effective waste management and resource recovery control measures. The volume of waste generated by each of the waste streams would be determined during detailed design.