CHAPTER 21

Waste and Resource Management

GOWRIE TO HELIDON ENVIRONMENTAL IMPACT STATEMENT

IR_1536

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21.1 Summary

The purpose of this chapter is to describe baseline waste and resource management conditions that will be affected by the Project and to establish waste management mitigation measures for the Project to reduce the impact on the existing waste management system and the environment and to provide measures for reuse of waste as a resource.

To provide context for the assessment that follows in this chapter, significant waste is defined as waste generation from the Project that is in excess of 10 per cent of the current waste generation rates within the region at a broad category level. Below the 10 per cent threshold, waste will be managed through business as usual practices that are undertaken in accordance with statutory requirements and broad policy directives at the time. These statutory requirements are subject to amendment from time to time to reflect advances in waste management policy and can be considered consistent with reasonable best practice at the time.

While this chapter does not provide detailed analysis of these business as usual activities, the Project will have an obligation to ensure that the management of its waste streams is being undertaken in a manner that is consistent with regional waste management practices and compliant with imposed approval conditions. This chapter describes the waste streams that are likely to be generated by the Project through construction and operational phases and the potential impact of those on the surrounding environment.

Construction of the Project will generate green waste through clearing of heavily vegetated areas within the new rail corridor. In addition, construction and demolition waste, general waste and spoil will also be generated as a result of construction and operational activities within both the new and existing rail corridor. Spoil is the surplus of excavated material that is not required to be reused in the Project's functional formation or is unsuitable for reuse in the Project's functional formation due to its excavated untreated characteristics. Such material may be reused within or outside the Project corridor for landscaping or other purposes, subject to satisfying a range of requirements. Waste and resource management measures will be adopted to manage the impact associated with the generated waste and spoil during the Project phases, with more detailed management of spoil discussed in Appendix T: Spoil Management Strategy.

The waste management strategies and the mitigation measures proposed for this Project are aligned with the principles of the Queensland Waste Management and Resource Recovery Strategy (WMRRS) (Department of Environment and Science (DES) 2019f) and the Queensland *Waste Reduction and Recycling Act 2011* (WRR Act). However, some materials including excess earth material, cleared vegetation generated on the Project will be also be considered as a resource if there is a beneficial use for these within the Project disturbance footprint, adjacent Inland Rail projects or in the local area.

21.2 Terms of Reference

The Terms of Reference (ToR) describe the matters the proponent must address in the Environmental Impact Statement (EIS) for the Project. as detailed in Table 21.1 and in Appendix B: Terms of Reference Compliance Table.

TABLE 21.1: TERMS OF REFERENCE FOR WASTE MANAGEMENT

Terms of Reference requirements		Where addressed in the chapter and the broader EIS
Impact assessment		
11.165.	For wastes, besides wastewater (which is addressed in the Water section of this ToR), describe and quantify all expected significant waste streams (including spoil) from the proposed Project activities during the construction and operational phases of the Project.	Section 21.6 Wastewater is also discussed in Chapter 13: Surface Water and Hydrology
11.166.	Describe potential spoil disposal sites and their ability to service the Project.	Section 21.7.1.1 Spoil is also discussed in Chapter 6: Project Description and Appendix T: Spoil Management Strategy

Terms of Reference requirements		Where addressed in the chapter and the broader EIS
11.167.	Define and describe the objectives and practical measures for protecting or enhancing environmental values from impacts by wastes. Take into account best practice waste management strategies as outlined in the National Waste Policy 2009 and the *Waste Reduction and Recycling Act 2011* and the *Environmental Protection Regulation 2008*.	Sections 21.8 and 21.9
11.168.	Describe the quantity, and physical and chemical characteristics of waste rock, any attributes that may affect its dispersal in the environment, and its associated risk of causing environmental harm.	Section 21.7.1.1 Additional information in Chapter 9: Land Resources and Appendix T: Spoil Management Strategy
Mitigation measures		
11.169.	Assess the proposed management measures against the preferred waste management hierarchy, namely: avoid waste generation; cleaner production; reduce; recycle; reuse; reprocess and reclaim; waste to energy; treatment; disposal. This includes the generation and storage of waste.	Sections 21.8, 21.9 and 21.7.1.1
11.170.	Describe how nominated quantitative standards and indicators may be achieved for waste management, and how the achievement of the objectives would be monitored, audited and managed.	Sections 21.9.2 and 21.9.4
11.171.	Detail waste management planning for the proposed Project especially how these plans would be applied to prevent or minimise environmental impacts due to waste at each stage of the Project.	Sections 21.8 and 21.9
11.172.	Provide details on natural resource-use efficiency (such as energy and water), integrated processing design, and any co-generation of power and by-product reuse as shown in a material/energy flow analysis.	Section 21.9 Natural resource use efficiency, including by-produce re-use, is primarily addressed in Chapter 7: Sustainability. Integrated processing design and co-generation of power are not applicable to the Project.

Section 11.161 of the ToR for the Project requires the quantity and physical and chemical characteristics of waste rock to be described. 'Waste rock' is a term that is primarily associated with the exploration and mining industry, relating to overburden, interburden or coarse rejects from those activities. Waste rock in that sense is not relevant to this Project. The potential for acid rock to occur within the Project footprint and the associated impacts if it is encountered is outlined in Section 21.7.1.1 and in Chapter 9: Land Resources, Section 9.7.2. Further characterisation of material from the tunnel's construction, along with cuts will be determined during the detailed design and construction phases of the Project, depending on the outcomes of further geotechnical investigations.

The suitability and extent of the material intercepted by the Toowoomba Range Tunnel cannot be estimated with accuracy due to the variable nature of basalt flows deposited on the undulating Jurassic sedimentary paleo topography. Typically, the spoil characteristics are monitored as the excavation progresses with samples taken directly from a temporary stockpile.

21.3 Legislation, policies, standards and guidelines

Waste and resource management is primarily regulated by the Queensland Government, with the Commonwealth providing broad policy guidance based on national-level outcomes and international obligations. Local governments, and commercial and industrial generators of waste, are responsible for managing waste within their local areas and/or from their activities as required by the Queensland Government regulatory framework.

Local governments play an important role in providing household waste collection and recycling services, managing landfill sites, delivering education programs, providing and maintaining litter infrastructure. Commercial and industrial generators also play an important role in ensuring that the waste generated from their activities is dealt with in a manner consistent with environmental regulations and broader waste management principles.

The legislation, policy and guidelines relevant to waste and resource management of the Project are summarised within Table 21.2. Further guidance on legislation and corresponding potential approval requirements associated with the Project are provided in Chapter 3: Project Approvals.

TABLE 21.2: REGULATORY CONTEXT

Legislation, policy or guideline	Relevance to the Project
Commonwealth	
National Environment Protection Measures (Implementation) Act 1998 (Cth)	National Environment Protection Measures (NEPMs) related to the waste and resource management relevant to the Project include: ▸ National Environment Protection (Used Packaging Materials) Measure 2011: Where possible, all efforts will be made for sustainable procurement of goods by considering the entire life cycle of the material. The material procurement will consider the reusability and recycled content of the material. The packaging from materials used in the Project will be recycled or reused where possible. ▸ Movement of Controlled Waste between States and Territories: The movement of controlled waste between States is not likely to be undertaken as part of the construction and operational phases of the Project. ▸ National Environment Protection (Assessment of Site Contamination) Measure 1999: Where required, contaminated land within the Project will be assessed and managed in accordance with principles of NEPM. Chapter 9: Land Resources provides more details on the land parcels listed on the Environmental Management Register (EMR) and Contaminated Land Register (CLR) including areas used for explosive production or storage, along with the outcomes of contaminated land studies to date. The *National Environment Protection (National Pollutant Inventory) Measure 1998* provides the framework for the development and establishment of the National Pollutant Inventory (NPI), which is an internet database designed to provide publicly available information on the types and amounts of certain substances being emitted to air, land and water. Mobile emission sources (e.g. moving rollingstock) operating outside the boundaries of a fixed facility are excluded from reporting under the NPI NEPM. ARTC will only need to report emissions from Inland Rail to the NPI if fixed facility emissions exceed reporting thresholds, including the tunnel.
National Greenhouse and Energy Reporting Act 2007 (Cth)	Provides a framework for the reporting and dissemination of information in relation to greenhouse emissions.
2018 National Waste Policy: Less waste, more resources (Cth)	The Policy provides a framework for collective action by businesses, governments, communities and individuals until 2030. The policy identifies five overarching principles underpinning waste management in a circular economy. These include: ▸ Avoid waste ▸ Improve resource recovery ▸ Increase use of recycled material and build demand and markets for recycled products ▸ Better manage material flows to benefit human health, the environment and the economy ▸ Improve information to support innovation, guide investment and enable informed consumer decisions. The policy embodies shifting away from 'take, make, use and dispose' to a more circular approach where the value of resources are maintained for as long as possible. It sets a national framework for action by governments, the business sector, the waste and resource recover industries and communities to achieve sustainable waste management. The policy also facilitates annual reporting of waste emissions to air, land and water through the NPI.
Australian Dangerous Goods Code ed. 7.6 2018 (Cth) (National Transport Commission, 2018)	The transportation of waste, that constitutes as a dangerous good, must be undertaken in accordance with specific requirements. Dangerous goods anticipated to be used by the Project are further described in Chapter 20: Hazard and Risk.

Legislation, policy or guideline	Relevance to the Project
Construction and Demolition Waste Guide–recycling and re-use across the supply chain (Department of Sustainability, Environment, Water, Population and Communities (DSEWPC), 2012a)	This guide outlines opportunities for business and industry to invest in activities that will create profit and improve environmental outcomes by extracting valuable resources from the construction and demolition waste stream.
State	
Environmental Protection Act 1994 (Qld)	Overarching environmental protection legislation in Queensland. Australian Rail Track Corporation (ARTC) has a general environmental duty and must report any potential environmental harm as a result of waste management activities. The movement of certain regulated wastes must be tracked. Spoil disposal permits are likely for the Project given that a number of the land parcels within the Project disturbance footprint are listed on EMR.
Environmental Protection Regulation 2019 (Qld)	Subordinate legislation to provide more specific guidance on administration of the *Environmental Protection Act 1994* (Qld) (EP Act). Prescribed environmental relevant activities (ERAs), defined in Schedule 2 of the Environmental Protection Regulation 2019 and will be determined in the detailed design and preconstruction phases of the Project. In the context of waste and resource management for the Project, an approval may be required for the following Environmentally Relevant Activities ERAs under the Environmental Protection Regulation 2019: ▸ ERA 8—Chemical storage ▸ ERA 14—Electricity generation ▸ ERA 16—Extractive and screening activities of ERA ▸ ERA 33—Crushing, milling, grinding or screening of material ▸ ERA 57—Regulated waste transport ▸ ERA 64—Water treatment. Regulated waste transport (ERA 57) is the transporting of regulated waste in a vehicle. Rather than obtain approval to transport regulated waste, ARTC and/or its construction contractor will engage a licensed waste transportation contractor to transport regulated waste from the Project footprint to appropriately licensed disposal facilities. The requirement for ERAs will be confirmed during detailed design by the construction contractor and where applicable approvals will be by the construction contractor. Subsequent applications for ERAs will consider relevant guidelines including, but not limited to, *Guideline: Environmental authorities—Approval processes for environmental authorities* (DES, 2019a) and the relevant guidelines regarding application requirements for activities with impacts to land, water and air. Refer to Chapter 3: Project Approvals for more details on the above-mentioned ERAs.
Waste Reduction and Recycling Act 2011 (Qld) (WRR Act)	Sets out the order in which waste will be managed in this Project based on the waste management hierarchy shown in Figure 21.2 and provides guidance on the requirements of the exempt waste application process. The end of waste (EOW) framework under the Act also promotes resource recovery opportunities and aims to transform the perception of waste from being seen as waste to being valued as a resource.

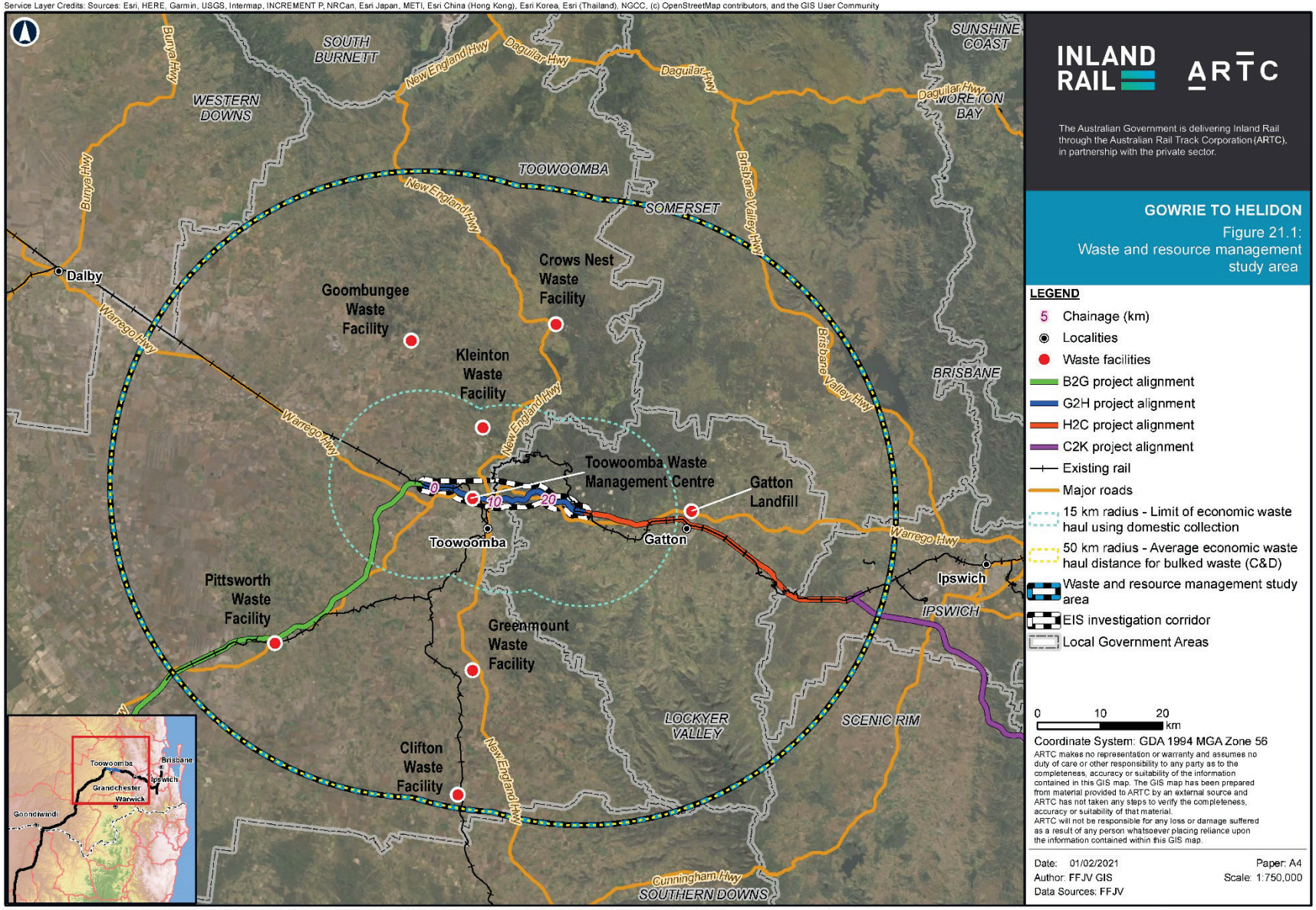
Legislation, policy or guideline	Relevance to the Project
End of waste framework (Chapter 8 and Section 8A of the WRR Act)	The End of Waste (EOW) framework promotes resource recovery opportunities and aims to transform the perception of waste from being seen as waste to being valued as a resource. The EOW framework consists of: ▸ EOW codes: related to registered resource producers and resource users ▸ EOW approvals: considered on a trial basis for reusing waste as resources for which an EOW code has not been developed for the waste. A waste can be approved as a resource if the Department of Environment and Science (DES) considers that it meets specified quality criteria for its specific use. It is the registered resource producer's responsibility to ensure that the resource meets the specified criteria and quality characteristics prior to supplying the resource to the user for approved use. If a waste is approved as a resource under the EOW framework, it is no longer considered a waste under Section 13 of the EP Act. However, if the resource is not used in accordance with the EOW code or approval, it is deemed to be a waste. Operating under an EOW code can have the following benefits: ▸ Less regulation for the reuse of waste, e.g. approvals relating to regulated waste are not required. ▸ Volumes of waste disposed to landfill are reduced, reducing the cost associated with disposal.
Waste Reduction and Recycling Regulation 2011 (Qld)	Overarching legislation for strategic management of Queensland's waste industry. Promotes waste avoidance and reduction and resource recovery and efficiency actions. The Queensland Government has developed a new WMRRS to reduce the amount of waste generated and grow the resource recovery and recycling industry. By amendment in 2019, a waste levy has been incorporated into legislation, which commenced on 1 July 2019.
Queensland Waste Management and Resource Recovery Strategy (Department of Environment and Science (DES), 2019f)	Provides plans and strategies towards 2050 on future management of waste in Queensland to achieve the set targets. The document will be used to ensure the content of the EIS waste chapter is aligned with Queensland future waste strategies. Underpinned by the waste levy, the strategy focuses on transitioning to the principles of a circular economy. It provides the framework to help deliver coordinated, long-term and sustained growth for the recycling and resource recovery sector while reducing the amount of waste produced and ultimately disposed of, by promoting more sustainable waste management practices for business, industry and households.
Biosecurity Act 2014 (Qld) and Biosecurity Regulation 2016	Under this Act, there is a biodiversity obligation to manage biosecurity risks and threats. As outlined in Chapter 11: Flora and Fauna, 17 restricted matter flora species have been recorded within the Project disturbance footprint. Clearing and grubbing activities will result in the removal of restricted matters though it will result in the contamination of vegetation stockpiles and potential soil stockpiles. Biosecurity management plans will be developed to guide these activities, along with the disposal options as outlined in the Biosecurity Regulation 2016 (e.g. disposal at a waste facility or leaving the matter in plastic and leaving the material in sun until the vegetative material is decomposed).
Public Health Act 2005 (Qld)	The objective of this Act is to protect and promote the health of the Queensland public and to ensure that waste is identified as one of public health risks that needs to be managed. The waste management chapter aims to minimise this risk during the delivery of the Project.
Recycling and Waste in Queensland (DES, 2020j)	The report presents data and trends in waste recovery and disposal in Queensland which will be used to provide a benchmark for the assessment of the generated waste from this Project.

21.4 Methodology

The following tasks have been undertaken for the waste and resource management assessment for the Project.

21.4.1 Study area

The impact assessment for waste and resource management focuses on the Project disturbance footprint including the permanent disturbance footprint and the temporary construction disturbance footprint. Consideration has also been given to impacts on environmental values and sensitive receptors beyond the Project disturbance footprint, as a result of waste generation and management, including cumulative impacts from existing waste management facilities, third-party facilities and potential permanent borrow pit sites. Combined, these areas comprise the waste and resource management study area for the Project, as shown in Figure 21.1.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SOUTH BURNETT
WESTERN DOWNS
SUNSHINE COAST
MORETON BAY
TOOWOOMBA
SOMERSET
BRISBANE
LOCKYER VALLEY
SCENIC RIM
IPSWICH
SOUTHERN DOWNS
Dalby
Goombungee Waste Facility
Crows Nest Waste Facility
Kleinton Waste Facility
Toowoomba Waste Management Centre
Gatton Landfill
Toowoomba
Gatton
Ipswich
Pittsworth Waste Facility
Greenmount Waste Facility
Clifton Waste Facility
Bunya Hwy
New England Hwy
Warrego Hwy
Dalby Hwy
Brisbane Valley Hwy
Cunningham Hwy
0
10
20
Toowoomba
Brisbane
Ipswich
Grandchester
Warwick
Goondiwindi
INLAND RAIL
ARTC
The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.
GOWRIE TO HELIDON
Figure 21.1:
Waste and resource management study area
LEGEND
5 Chainage (km)
Localities
Waste facilities
B2G project alignment
G2H project alignment
H2C project alignment
C2K project alignment
Existing rail
Major roads
15 km radius - Limit of economic waste haul using domestic collection
50 km radius - Average economic waste haul distance for bulked waste (C&D)
Waste and resource management study area
EIS investigation corridor
Local Government Areas
0 10 20 km
Coordinate System: GDA 1994 MGA Zone 56
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Date: 01/02/2021
Paper: A4
Author: FFJV GIS
Scale: 1:750,000
Data Sources: FFJV
Map by: GN/LCT/KG Z:\GIS\GIS_3200_G2H\Tasks\320-EAP-201909130756_G2H_Waste_Mgt_Figures\320-EAP-201909130756_ARTC_Fig21.1_waste_and_resource.mxd Date: 1/02/2021 13:44

21.4.2 Approach

The following tasks have been undertaken for assessing potential waste impacts and resource management opportunities as a consequence of the Project:

- Establishing a basis of significance for waste generated from the Project to give quantitative definition to the ToR
- Identifying environmental values
- Identifying potential waste generation during construction and operational phases of the Project
- Identifying potential impacts
- Assessment of identified impacts
- Identifying mitigation and management measures.

These are discussed further in the following sections.

21.4.3 Establish basis of significance

The ToR (refer 11.165) requires the identification and assessment of significant waste streams that may arise from the Project. To aid in the assessment of environmental impact, a determination of significant waste streams has been made as follows:

- Waste at a broad category level that comprises less than 10 per cent of current waste generation within the region for that category, is deemed to be insignificant and able to be managed under current waste management arrangements within the region. Mitigation for this waste is covered under standard industry practice measures that comply with statutory requirements and waste management policy. As such, these industry standard measures are not discussed further in this chapter.
- Waste at a broad category level that comprises greater than 10 per cent of current waste generation within the region for that category, is deemed to be significant and requires specific mitigation measures. These wastes and the proposed mitigation measures are detailed within this chapter and within Appendix T: Spoil Management Strategy.

The 10 per cent increase in intensity of waste generation to define significance has been adopted for this assessment as this value is commonly used in materiality assessment.

21.4.4 Identifying the environmental values

The environmental values that may be affected by waste generated during the relevant phases of the Project were identified using publicly available information, aerial photography, mapping, legislation. policies and guidelines and other chapters of the EIS such as Chapter 7: Sustainability, Chapter 9: Land Resources and Chapter 20: Hazard and Risk. The environmental values which are as defined under the EP Act are discussed in Section 21.5.1.

21.4.5 Identifying existing waste facilities

The waste management facilities relevant to the Project and their capacities were also reviewed as a part of this section to determine their ability to accept and accommodate the estimated generated waste and including excess material which could not be reused by the Project or other projects in the area (i.e. spoil).

Consultation was undertaken with local councils to ascertain current and forecast landfill capacities and waste transport service providers to understand capacities and industry processes. The Department of Transport and Main Roads was also consulted regarding spoil management transport, acknowledging the key drivers of safety for road users, traffic management, and pavement life (refer Appendix D: Community Consultation).

21.4.6 Identifying project waste streams and classifications

The WMRRS (DES, 2019f) and Environmental Protection Regulation 2019 were used to assist classifying the expected produced waste. The approximate quantities of the generated waste are estimated based on the design information and relevant industry accepted practices in waste generation estimation at the time of producing the EIS. It is anticipated the quantities may change on progressing further with the detailed design. For comparison purposes, waste data provided in *Recycling and Waste in Queensland 2019*(DES 2020j) has been used.

21.4.7 Identification of potential impacts

The potential impacts that may arise from the Project during construction and operation phases are described in Section 21.8. The potential impacts have been derived from an appreciation for waste generation and management issues that typically arise during the development of large-scale linear transport infrastructure.

21.4.8 Assessment of risk and likelihood of identified impacts

The potential impacts relating to waste and resource management (any waste material that will be reused and/or recycled is treated as a resource) to sensitive receptors have been assessed using a risk assessment methodology, which considers the likelihood and consequence of a potential impact and its resultant level of risk before and after mitigation measures are implemented. The risk assessment methodology applied through this draft EIS is described in further detail in Chapter 4: Assessment Methodology.

In addition to the methodology described in Chapter 4: Assessment Methodology, and as noted in Section 21.4.3, a definition of significance (10 per cent above current waste generation rates within the region for headline categories) has been applied to enable a risk-based assessment for the Project against the ToR.

21.4.9 Identification of mitigation and management measures

Mitigation measures have been identified in Section 21.9.2 to avoid or reduce the scale of potential impacts from the Project on environmental, social and economic values. Mitigation measures have been developed in accordance with relevant legislative requirements identified in Chapter 3: Project Approvals, aligning with the 2018 National Waste Policy and the WRR Act hierarchy depicted in Figure 21.2.

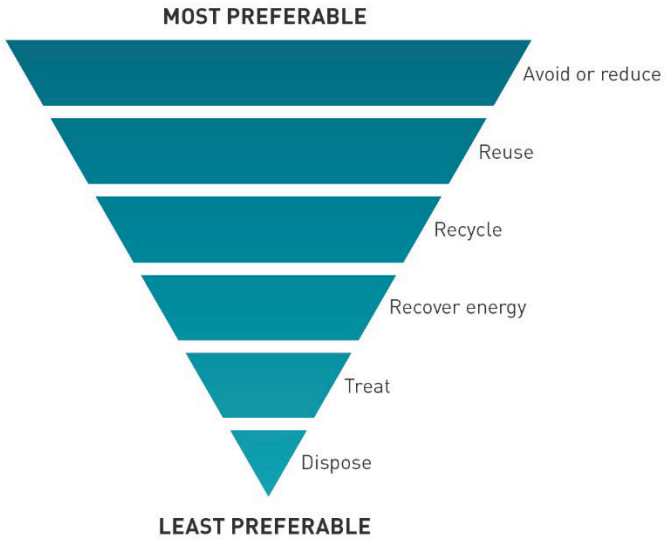

FIGURE 21.2: WASTE AND RESOURCE MANAGEMENT HIERARCHY

Source: DES, 2019f

Business as usual waste management practices are developed to conform to waste management policy and regulatory requirements that are in force at the time. Consequently, waste reduction, reuse, diversion and recycling targets are embedded, where reasonable and practical, in the waste management system's response to the regional waste management needs. Business as usual waste management practices are applied to waste streams that are deemed insignificant (i.e. those waste streams from the Project that contribute <10 per cent additional waste to the pre-existing condition). The assessment has assumed that the system has at least 10 per cent latent capacity to manage these waste streams over the duration of the Project.

Opportunities for avoiding and reducing the generation of waste through design optimisation will be identified and implemented in future stages of design and construction. Mitigation measures are therefore presented for reuse and lower tiers of the waste management hierarchy, as illustrated in Figure 21.2.

The generated waste materials were identified for reuse without further processing. If the materials are identified unsuitable either due to contamination or not meeting the specification standards, they will be treated prior to reuse to avoid disposal to landfill. Furthermore, opportunities to recycle the waste materials and any potential for the recovery of the energy from the waste were identified, to avoid disposal to landfill. Materials that are not able to be recycled or reused (even with treatment) will be disposed of at licensed waste management facilities.

Section 21.9.2 provides a breakdown of how the identified mitigation measures correlate to the Waste Management Hierarchy. Where appropriate, protocols are outlined for the safe collection, storage, handling and transport of identified waste streams to protect environmental and community values as well as meeting the auditing and compliance requirements.

21.5 Environmental environment

This section describes existing environmental values and waste management operations in proximity to the Project.

21.5.1 Environmental values

Under Section 9 of the EP Act, an environmental value is the quality or physical characteristic of the environment that is conducive to ecological health, public amenity or safety. In accordance with this definition, the following environmental values have been identified as being in proximity to the Project:

- Human receptors
  - Site personnel
  - Landholder and communities adjacent the Project
  - Drivers, pedestrians and residents who use roads, footpaths and recreational areas within the waste and resources study area
- Environmental receptors
  - Receiving environment: air, water bodies and surrounding flora and fauna
  - Areas of ecological significance
  - The diversity of ecological processes and associated ecosystems surrounding the Project.
- Commercial and industrial receptors, including:
  - Existing land uses and the productive capacity of land (i.e. its potential for use for cropping activities and animal husbandry)
  - Vehicle operators travelling on the State-controlled road and local government road networks
  - Waste collection, recycling and disposal facilities within a reasonable transportable distance of the Project.

21.5.2 Waste generation

This Project is located within the South East Queensland (SEQ) and Darling Downs–Maranoa regions, where grazing is the predominant land use. Other land uses within the general region of the Project include the residential areas of Toowoomba and the heavily vegetated areas of the Toowoomba Range within the Lockyer Valley (refer Chapter 8: Land Use and Tenure).

Municipal waste generated within these regions is managed by Lockyer Valley Regional Council (LVRC) and Toowoomba Regional Council (TRC) through collection, material recovery and disposal activities and associated infrastructure. Commercial, industrial, construction and demolition (C&D) waste arising from development projects is predominantly managed through waste management contractors and in some instances their associated facilities, with the local councils providing secondary and supplementary services for these waste streams. Table 21.3 provides a breakdown of the categories of waste generated and disposed of to landfill from the SEQ and Darling Downs–Maranoa regions.

TABLE 21.3: WASTE DISPOSAL RATE BY REGION FY 2018-2019 [1]

Waste stream	Darling Downs–Maranoa (including TRC)	SEQ (including LVRC)	Total
Commercial and industrial waste	47,400 t	1,179,817 t	1,227,217 t
Construction and demolition waste	16,098 t	2,001,385 t	2,017,483 t
General waste (municipal waste)	112,791 t	1,282,087 t	1,394,878 t
Green waste[2]	28,538 t	301,173 t	329,711 t
Regulated waste (including asbestos, contaminated soil)		Not reported regionally	

Table notes:
t = tonnes
1. *Recycling and Waste in Queensland 2019* (DES, 2020j)
2. Denotes amount managed by local authorities and accounts for approximately 90 per cent of total green waste collected and managed within the region

21.5.3 Licensed waste management facilities

Waste collection, recycling and disposal facilities and services for domestic uses are provided by local governments within the waste resource and management study area. Commercial and industrial land uses primarily rely on private waste transportation contractors for the collection and offsite transportation of wastes.

The management of waste for the Project will be aligned with the Waste Management Hierarchy (DES, 2019f), explained in Section 21.4.9 and where possible the generation of waste and disposal to landfill will be minimised. However, there will still be some residual waste remaining as a result of the Project activities that will need to be disposed of at licensed waste management facilities. Due to the extent of the Project, the western portion and tunnel related work areas may seek to use waste facilities in the Toowoomba region (e.g. Toowoomba Waste Management Centre) while those portions in the east will be in a position to efficiently use waste disposal and composting facilities in the Lockyer Valley such as the Gatton Landfill and Transfer Station.

While there are existing waste management facilities within the Lockyer Valley, these facilities may not have sufficient capacity to accept large volumes of construction waste due to their small size, with their main purpose to service local communities. The same principle applies to small waste management facilities within the Toowoomba region. However, this assumption is highly dependent on the volume of waste generated by the local community and the available capacity at the time of construction of the Project.

Considering environmental impacts and costs associated with waste transportation and based on industry experience, waste management facilities within haulage distance of 50 kilometres (km) for bulk waste and 15 km for municipal waste of the Project have been identified. Details of the existing waste management facilities in proximity to the Project, which have the potential to accept waste from the Project, are listed in Table 21.4 and their location relative the Project is illustrated in Figure 21.1. The Toowoomba Waste Management Centre is the major facility that has the greatest potential to service the Project due to its annual capacity and proximity to the Project.

Available and permissible annual capacity of the waste management facilities listed are subject to commercial in-confidence information and are not typically disclosed. However, based on preliminary consultation with the operators including Toowoomba Waste Management Centre and the assessment of the current licence limits for waste acceptance, it is likely the waste management facilities outlined in Table 21.4 will be able to accommodate the waste generated from this Project. Similarly, the lifespans of the potential waste receival facilities was determined in consultation with the operators and a review of the existing environmental authority regulating the facility under the Environmental Protection Regulation 2019.

The waste acceptance criteria and acceptance rate will be confirmed in consultation with the relevant operator once the timing for construction of the Project is confirmed.

The Project proposes to manage excess material within the rail corridor, including a stockpile at the western tunnel portal. Noting that initial discussions with TRC indicated limited capacity to accept the volume of spoil generated by the Project, though it may accept some material for capping purposes. This principle of retaining material onsite is reflected in the spoil management hierarchy in Appendix T: Spoil Management Strategy.

Traffic impacts associated with the offsite disposal of waste have not been assessed, as waste volumes generated during construction and operation of the Project are not expected to be significant (refer Sections 21.6.2 and 21.6.3). Consequently, the number of vehicular movements to transport waste from construction laydown areas to established waste facilities is not expected to significantly increase the number of vehicles per day using the road network. Spoil haulage has, however, been considered, with regard to the movement of material from the intermediate ventilation shaft to the western tunnel portal. The traffic impact assessment for the Project is discussed in Chapter 19: Traffic, Transport and Access and Appendix U: Traffic Impact Assessment.

TABLE 21.4: WASTE MANAGEMENT FACILITIES

Facility	Type	Operator	Location	Capacity (tonnes/year (t/yr))	Lifespan	Waste stream accepted
Toowoomba Waste Management Centre	Landfill	Toowoomba Regional Council	Hermitage Road, Toowoomba	ERA 60, >100,000 but <200,000 t/yr	20+ years	▸ General waste ▸ Contaminated soil (with prior approval from TRC Waste Services) ▸ Clean fill ▸ Treated timber
Clifton Waste Facility	Landfill	Toowoomba Regional Council	Logan Road, Clifton	ERA 60, >2,000 but <5,000 t/yr	<3 years	▸ Industrial and commercial waste ▸ Clean fill ▸ Green waste ▸ Construction and demolition waste such as rock, concrete, asphalt ▸ Treated and untreated timber
Goombungee Waste Facility	Landfill	Toowoomba Regional Council	Centenary Road, Goombungee	ERA 60, >50 t but <2,000 t/yr	<5 years	▸ Green waste ▸ Clean fill ▸ Recyclables ▸ Treated/untreated timber (regulated waste)
Pittsworth Waste Facility	Landfill	Toowoomba Regional Council	Corner Tip Road and Hausler Road, Pittsworth	ERA 60, >2000 t but <5,000 t/yr	<5 years	▸ Green waste ▸ Commercial and Industrial waste ▸ Treated/untreated timber (regulated waste) ▸ Clean fill
Yarraman Waste Facility	Landfill	Toowoomba Regional Council	D'Aguilar Highway, Yarraman	ERA 60, >50 t but <2,000 t/yr	<5 years	▸ Green waste ▸ Commercial and industrial waste ▸ Clean fill
Greenmount Waste Facility	Landfill	Toowoomba Regional Council	123 Falknau Road, East Greenmount	ERA 60, >50 t but <2,000 t/yr	<5 years	▸ Commercial and industrial waste ▸ Clean fill ▸ Green waste ▸ Recyclables ▸ Treated/untreated timber (regulated waste)

Facility	Type	Operator	Location	Capacity (tonnes/year (t/yr))	Lifespan	Waste stream accepted
Crows Nest Waste Facility	Transfer station	Toowoomba Regional Council	South Street, Crows Nest	ERA 60, <50,000 t/yr	Landfill is closed and the site operates as a transfer station. ERA for the transfer station has not been sighted	▸ Commercial and industrial waste ▸ Green waste ▸ Timber treated/untreated (regulated waste) ▸ Scrap metal ▸ Paper and cardboard ▸ Plastic containers
Kleinton Waste Facility	Transfer station	Toowoomba Regional Council	Kleinton School Road, Kleinton	ERA 60, >50 t but <2,000 t/yr	Landfill is closed and the site operates as transfer station. ERA for the transfer station has not been sighted	▸ Commercial waste ▸ Green waste ▸ Clean fill ▸ Treated/untreated timber (regulated waste)
Greater Toowoomba Waste Management Facility	Transfer station	Toowoomba Regional Council	270 O'Mara Road, Wellcamp	Not applicable	Indefinite as transfer station but does not operate as waste repository	▸ Green waste (vehicles over 4.5 t) ▸ Commercial waste (vehicles up to 4.5 t) ▸ Scrap metal (vehicles over 4.5 t) ▸ Inert waste ▸ Untreated timber
JJ Richards and Sons	Transfer station	JJ Richards and Sons	51 Wilkinson Street, Harlaxton	Not applicable	Indefinite as transfer station but does not operate as waste repository	▸ General waste ▸ Scrap metal ▸ Waste oil ▸ Oily water ▸ Dangerous goods
Gatton Landfill and Transfer Station	Landfill	Lockyer Valley Regional Council	Fords Road, Gatton	ERA 60, >10,000 but <20,000 t/yr	5+ years	▸ Commercial and Industrial waste ▸ Construction and demolition waste (scrap metal, concrete) ▸ Asbestos (prior approval required) (regulated waste) ▸ Green waste ▸ Recyclable material ▸ E-waste ▸ Tyres (regulated waste) ▸ Motor oil (regulated waste)

Facility	Type	Operator	Location	Capacity (tonnes/year (t/yr))	Lifespan	Waste stream accepted
Laidley Transfer Station	Transfer station	Lockyer Valley Regional Council	Burgess Road, Laidley Heights	Not applicable	Indefinite as transfer station but does not operate as waste repository	▸ Commercial waste ▸ Green waste ▸ Scrap metal ▸ Recyclable material ▸ Concrete
Helidon Transfer Station	Transfer station	Lockyer Valley Regional Council	Seventeen Mile Road, Helidon	Not applicable	Indefinite as transfer station but does not operate as waste repository	▸ Green waste ▸ Scrap metal ▸ Recyclable material ▸ E-waste ▸ Motor oil
Grantham Transfer Station	Transfer station	Lockyer Valley Regional Council	Back Ma Ma Road, Grantham	Not applicable	Indefinite as transfer station but does not operate as waste repository	▸ Green Waste ▸ Scrap Metal ▸ Recyclable Material ▸ E-waste
Withcott Transfer Station	Transfer station	Lockyer Valley Regional Council	Spa Water Road, Blanchview	Not applicable	Indefinite as transfer station but does not operate as waste repository	▸ General waste ▸ Commercial waste ▸ Green waste ▸ Scrap metal ▸ Recyclables
Murphys Creek Transfer Station	Transfer station	Lockyer Valley Regional Council	Milora Road, Upper Lockyer	Not applicable	Indefinite as transfer station but does not operate as waste repository	▸ Green waste ▸ General waste ▸ Motor oil ▸ Recyclables ▸ Scrap metal

21.6 Project's waste generation

21.6.1 Waste streams

As discussed in Section 21.4.3, significant waste is defined as waste generation from the Project that is in excess of 10 per cent of the current waste generation rates within the region at a broad category level.

Quantities of wastes have been estimated based on information from the constructability assessment, design documentation and bill of quantities for the Project. Where uncertainty exists regarding waste quantities, estimates have been rationalised through reference to *Integrated Solid Waste Management: Engineering Principles and Management Issues Report* (Tchobanoglous et al.,1993). These details will be subject to further refinement during progression of the detail design as the construction approach is confirmed.

The assessment of waste streams has been made at the broad category level to determine if these streams were significant, using data available at the time of the EIS preparation such as deign information, bill of quantities and construction methods.

With the exception of spoil detailed in Table 21.6, no significant waste streams have been identified for the Project. Consequently, as the ToR requires assessment of significant waste streams, the requirement to assess all waste generated, including the characterisation of such waste will only apply to spoil. As the quantities attributable to the broad categories of waste (e.g. construction and demolition, commercial and industrial, municipal solid waste etc.) are mostly insignificant (except for spoil), then further classification is by association also insignificant.

The WMRRS (DES, 2019f) and Environmental Protection Regulation 2019 have been used to assist in the classification of the waste expected to be produced through the delivery of the Project. The waste streams that may be generated, and the potential Project source for each, is summarised in Table 21.5.

TABLE 21.5: WASTE STREAMS, DESCRIPTION AND POTENTIAL PROJECT SOURCE

Waste stream	Description	Potential Project source
Commercial and industrial waste	Waste that is produced by business and commerce and includes waste from schools, restaurants, offices, retail and wholesale businesses, and manufacturing industries. In the case of green waste, it includes material delivered by commercial operations	▸ Site offices ▸ Tunnel control buildings
Construction and demolition waste	Non-putrescible waste arising from the construction or demolition activities. C&D waste includes materials such as brick, timber, concrete and steel	▸ Demolition/removal of existing structures ▸ Work fronts ▸ Demobilisation of construction facilities, e.g. site offices ▸ Maintenance activities
General waste (municipal waste)	Wastes not defined as regulated waste under legislation. General wastes comprise putrescible wastes (easily decomposed, treated by composting) and non-putrescible wastes (not easily decomposed, may be recyclable)	▸ Site offices ▸ Work fronts ▸ Laydown areas ▸ Tunnel control buildings
Green waste	Includes grass clippings, tree, bush and shrub trimmings, branches and other similar material resulting from landscaping or maintenance activities	▸ Clear and grubbing activities ▸ Site preparation works ▸ Maintenance activities
Recyclable waste	Waste types that can be reconditioned, reprocessed or reused. What constitutes recyclable waste may change between LGAs, as it depends what the local government has declared to be recyclable waste for the area	▸ Site offices ▸ Work fronts ▸ Laydown areas ▸ Tunnel control buildings

Waste stream	Description	Potential Project source
Regulated waste	Waste that is commercial or industrial and is of a type or contains a constituent of a type mentioned in Regulated waste is any waste that contains chemicals and elements as defined in Schedule 9 of the Environmental Protection Regulation 2019 and is categorised into two groups based on the risk level. Regulated wastes require specific controls or actions as defined by legislation. Listed hazardous, regulated, controlled or trackable wastes typically have unique handling and disposal requirements to manage specific hazards associated with them. Regulated waste includes asbestos, pesticides, a range of chemicals and other industrial wastes (i.e. grease trap waste)	▸ Used containers and residues of hazardous chemicals and dangerous goods ▸ Vehicle, plant and equipment maintenance (e.g. tyres, lead acid batteries, etc.) ▸ Demolition/removal of existing structures, including rail infrastructure (e.g. asbestos, lead-based paint etc.) ▸ Portal ablution facilities ▸ Tunnel water management system, including the wastewater treatment plant

Based on a review of the assumed construction method and the design information, accepted waste streams and their quantities were estimated for the different phases of the Project. Where possible, the quantities were assessed against the latest waste data available for Queensland waste disposal to landfill as provided in Table 21.3.

The quantities and waste types will be refined and finalised during the detailed design phase and will be incorporated into a Waste Management Sub-plan that will be part of the Construction Environmental Management Plan (CEMP).

21.6.2 Construction phase waste

The waste generated during the construction of the Project will be produced as a result of:

- Site preparation:
  - Demolition and/or relocation of the existing structures, existing rail infrastructure, utilities and other redundant infrastructure elements within the Project disturbance footprint
  - Vegetation clearing and grubbing which includes grass slashing and tree and stump removal
  - Topsoil stripping
  - Establishment of laydown and stockpile areas
  - Establishment of site offices
  - Installation of temporary and permanent fencing
  - Installation of drainage and water management controls
  - Construction of site access roads
- Civil works:
  - Bulk earthworks
  - Construction of cuts and embankments
  - Embankment preparations
  - Local road network upgrades and realignments
  - Tunnel portal development
  - Rail corridor works
  - Establishment of site facilities (e.g. concrete batching plant, flash-butt welding facility)
- Structure construction:
  - Temporary site offices
  - Drainage infrastructure
  - Bridge and viaduct infrastructure

    - Tunnel staging and tunnel control and ventilation facilities
- Track works:
    - Installation of ballast, sleepers and rails
    - Rail systems infrastructure and wayside equipment
    - Signals
    - Turnouts
    - Asset monitoring infrastructure
- Demobilisation and removal of construction facilities:
    - Removal of site facilities (e.g. site offices and amenities and associated infrastructure)
    - Removal of and where applicable rehabilitation temporary access/haul roads
    - Removal and where applicable rehabilitation of laydown areas and hardstands.

A detailed discussion of construction activities required to establish the Project is in Chapter 6: Project Description.

The wastes stream and estimated quantities of waste generated for each stage during the construction phase are in Table 21.6. For material that can be assessed against SEQ and Darling Downs–Maranoa annual waste generation rate in Table 21.3, the total calculated waste volume is averaged across the four-year period of construction to represent the annual residual percentage.

TABLE 21.6: WASTE CLASSIFICATION AND POTENTIAL QUANTITIES DURING THE CONSTRUCTION PHASE

Activity	Waste/ resource	Waste classification	Estimated quantity	Quantity re-used within Project (as per design)	Residual % of annual C&D waste generation in SEQ and Darling Downs-Maranoa
Vegetation clearance	Grass, tree logs and stumps	Green waste	Approximate clearing area of 3,200,000 square metres (m^2)	100%	Not applicable—to be reused within the Project if not contaminated (e.g. restricted matter flora species may be disposed of offsite or buried as per the Biosecurity Regulation 2016)
Topsoil stripping	Topsoil	Construction and demolition waste	Approximately 200,000 cubic metres (m^3)	100%	Not applicable—to be reused within the Project if not contaminated
Access track and bulk earthworks, tunnel portal development	Spoil	Construction and demolition waste	Approximately 1,000,000 m^3	0%. Quantity represents material that is unsuitable for immediate re-use within the project without amelioration. Quantity and fate to be determined through further characterisation, detailed design and development of mitigations.	17% of annual C&D waste production
Compound/office waste	Litter, packaging, paper, aluminium	General waste (including recyclables)	114 t	0%. Recyclables/recoverable materials to be recovered as part of current waste management arrangements for the region.	0.001%
Removal of existing structures	Asbestos cement material	Regulated waste	Unquantified	0%	Data on regional proportion of regulated waste is not available
Removal or relocation of existing rail infrastructure structures (e.g. signals)	Asbestos Wiring and concrete (regarded as contaminated)	Regulated waste	Unquantified	0%. Recyclable/recoverable materials to be recovered "off-project" as part of current waste management arrangements for the region. Regulated waste to be managed in accordance with regulatory requirements	Data on regional proportion of regulated waste is not available
Installation and construction of road	Road base	Construction and demolition waste	Unquantified	Up to 100% contingent on satisfying the requirements of the Draft *EOW Code: Recycled Aggregates (ENEW07604819)* (DES, 2020a)	Unquantified Opportunities for reuse will be considered consistent with the intent of Draft *EOW Code: Recycled Aggregates* (ENEW07604819) (DES, 2020a)

Activity	Waste/ resource	Waste classification	Estimated quantity	Quantity re-used within Project (as per design)	Residual % of annual C&D waste generation in SEQ and Darling Downs-Maranoa
Installation and construction of rail system	Ballast	Construction and demolition waste	Approximately 2,500 t	Up to 100% contingent on satisfying the requirements of the Draft *EOW Code: Recycled Aggregates (ENEW07604819)* (DES, 2020a)	0.025% Opportunities for reuse will be considered consistent with the intent of Draft *EOW Code: Recycled Aggregates* (ENEW07604819) (DES, 2020a)
Installation and construction of rail system	Sleepers	Construction and demolition waste	Approximately 1,445 sleepers	0%. Recovered concrete sleepers to be managed "off-project" in accordance with *EOW Code: Returned Concrete (ENEW07278517)* (DES, 2020b)	Unquantified Opportunities for reuse will be considered consistent with the intent of *EOW Code: Returned Concrete* (ENEW07278517) (DES, 2020b)
Installation and construction of rail system	Rail (steel)	Construction and demolition waste	Approximately 156 t	0%. Recovered steel track to be managed ''off-project' as part of current waste management arrangements for the region.	0.002% Where practical, opportunities for reuse will be explored
Construction of culverts crossing and concrete pipes, bridge and viaducts	Precast concrete	Construction and demolition waste	Approximately 89 items	0%. Recovered concrete elements to be managed 'off-project' in accordance with *EOW Code: Returned Concrete (ENEW07278517)* (DES, 2020b).	Unquantified Opportunities for reuse will be considered consistent with the intent of *EOW Code: Returned Concrete* (ENEW07278517) (DES, 2020b)
Tunnel construction	Precast concrete	Construction and demolition waste	Approximately 7,300 t	0%. Recovered concrete elements to be managed 'off-project' in accordance with *EOW Code: Returned Concrete (ENEW07278517)* (DES, 2020b).	0.073%
Construction of culverts, bridge/viaducts and tunnel including portals and shaft	In situ concrete	Construction and demolition waste	Approximately 10,600 m^3	Up to 100% contingent on satisfying the requirements of the *EOW Code: Solid Concrete Washout (ENEW07602819)* (DES, 2020c).	0.1% Opportunities for reuse will be considered consistent with the intent of *EOW Code: Solid Concrete Washout* (ENEW07602819) (DES, 2020c)
Construction of structures	Waste oil, solvents, paints, coolants	Regulated waste	Unquantified	0%. Regulated waste to be managed in accordance with regulatory requirements.	Data on regional proportion of regulated waste is not available

All procured material (i.e. concrete, steel, timber and ballast) will be required to meet material specifications and adopted quality assurance criteria. Inevitably, some procured materials will fail to comply with material specifications and adopted quality assurance criteria. For the purpose of this waste assessment, it has been assumed that two per cent of the total quantity of material procured will be non-compliant with quality requirements and therefore may be waste, if an alternative use cannot be identified. This percentage has been adopted based on the waste allowance made in the bill of quantities for the Project.

Wastes generated from construction site compounds are mainly general office waste with some potential for recycling which will be managed as business as usual through the existing waste management system. The site amenities and compounds will be returned to suppliers for reuse and as a result, construction decommissioning and demobilisation waste is expected to be minimised.

Portable ablution facilities required for construction will be managed by a license contractor, with siting of the facilities to consider the *Development Guidelines for Water Quality Management in Drinking Water Catchments* (Seqwater, 2017). There may also be an opportunity to directly tie into the existing wastewater network in the Gowrie area, which will be explored in consultation with TRC during detailed design.

Wastewater generated from stormwater discharges during the construction phase of the Project has been assessed for water quality impacts and mitigation measures identified in Chapter 13: Surface Water and Hydrology. In the event that water quality objectives cannot be achieved for waters to be released, alternate treatment/disposal options will be implemented prior to release or reuse.

Water (including groundwater) collected from within the tunnel infrastructure will require specific management in regard to release into receiving waters. The use of a tunnel boring machine is likely to involve a bentonite slurry, the slurry along with any groundwater inflows will be pumped to a separation plant/water treatment plant at the western tunnel portal (refer Chapter 13: Surface Water and Hydrology). The water and where applicable the bentonite will then be reused onsite, with contaminated material to be segregated and disposed of by a licensed waste contractor.

21.6.3 Operational phase waste

Waste generated during the operational phase will arise primarily from planned and unplanned maintenance activities such as rail track upgrades and replacements, drainage structure management and general asset upkeep.

The waste streams anticipated to be generated during the operation phase of the Project are shown in Table 21.7. These waste streams have been identified based on what is typically generated during the undertaking of maintenance activities on ARTC's existing freight railway networks and will likely be managed as part of the wider Inland Rail Program under relevant environmental procedures and policies.

Once operational, the Project will be incorporated into the broader Inland Rail network. There are no railway yards or maintenance depots proposed between the Gowrie and Helidon; therefore, railway operations for the Project will involve movement of trains through the region between adjoining sections of Inland Rail and there will be no locomotive-derived waste produced during operation. However the Project includes the Toowoomba Range Tunnel and associated infrastructure.

The quantities of waste produced by each maintenance activity will depend on the frequencies of planned and unplanned maintenance tasks, which will vary with the age of asset components and the occurrence and intensity of natural and Project hazards (refer Chapter 20: Hazard and Risk).

There may be larger volumes of waste generated infrequently across the life of the Project. For example, the operational life of the Project is 100 years; however, the design life for components of the Project are 20 years and the maintenance and refurbishment of these components may generate large quantities of a certain waste stream (e.g. ballast). The quantity and nature of these waste streams cannot be quantified, with these activities to be managed under relevant environmental procedures and policies at and when the works are scheduled to occur.

Therefore, the quantities of waste produced by maintenance activities cannot be established at this stage of Project development. Regardless, typical volumes generated on ARTC's existing freight railway networks indicate that none of the waste types specified in Table 21.7 would be considered significant in accordance with the definition established in Section 21.4.3 (i.e. less than 10% per cent of the annual C&D for SEQ and Darling Downs–Maranoa regions). For example, track upgrades and replacements would be equivalent to less than 1 per cent of the annual C&D for SEQ and Darling Downs–Maranoa regions.

Table 21.7 outlines the activities and waste streams expected to be generated during the operational phase. As outlined in Table 21.5 there may been opportunities for reused of some of the material as per the EOW procedures, while other materials will be removed from the Project by a licensed waste contractor and disposed of at a licensed waste disposal facility.

TABLE 21.7: WASTE CLASSIFICATION DURING THE OPERATIONAL PHASE

Activity	Waste/resource	Waste classification
Vegetation management	Vegetation	Green waste (non-putrescible)
General maintenance	Debris, litter and packaging	Green waste (non-putrescible)
Track repair	Timber, steel, sleepers, contaminated soil, paint, diesel, ballast	Construction and demolition/regulated waste
Embankment/landform re-profiling	Soil and potentially contaminated solid waste	Construction and demolition/regulated waste
Rail track replacement/upgrade	Scrap metal. electrical cable, conduit offcuts at signals	Construction and demolition/regulated waste
Infrastructure maintenance	Chemical containers, scrap metal, oil spills	Construction and demolition/regulated waste
Tunnel and tunnel operational facilities	Debris, litter and packaging	Green waste (non-putrescible)
	Chemical containers, scrap metal, oil spills	Construction and demolition/regulated waste
	Groundwater inflow, pavement and tunnel washdown water	Liquid waste (tunnel water management system)
Site visit	Oil spills, solvent spills	Regulated waste

The Project buildings associated with the Toowoomba Range Tunnel will connect into the existing wastewater management networks. However, the proposed water treatment plant at the eastern tunnel portal will rely on licensed contractors to remove any waste material produced, including hydrocarbons wastewater, sludges, residue and sediment.

21.6.4 Waste storage areas

Waste storage areas will be located and managed to ensure that risks to the environment are avoided or minimised. Designated waste storage areas will be provided at each construction work front, including the western and eastern tunnel portal laydown areas, for sorting and segregating waste prior to collection by licensed contractors.

As a minimum, the following will be considered when determining the locations of waste storage areas within the Project disturbance footprint:

- Waste characteristics and leachability
- Potential for nuisance and pollution generation (odour, dust and litter)
- Proximity to, and the sensitivity of, the surrounding environments and receptors
- Potential for impacts to human health
- Site conditions, duration of storage and climatic conditions.

Each storage area will be sited on a hardstand and will have a suitable containment system for the waste stream being stored.

21.6.4.1 General waste storage areas

Designated areas with sufficient space for waste storage, handling and collection activities will be provided at each construction work front. These waste storage areas will enable the sorting and segregation of waste prior to collection by appropriately licensed contractors. Each storage area will be provided on hardstand or within suitable bunding for the waste stream being stored.

Good housekeeping and regular removal of residual waste would be practiced at waste storage areas to maintain safety, facilitate identification of reusable items and minimise opportunities for pests to proliferate in the area.

Restricted matters will also need to be managed with consideration to the Biosecurity Regulation 2016 and the WRR Act. The treatment (including prior to construction), segregation and storage of contaminated material and disposal will be managed under a biosecurity management plan.

21.6.4.2 Contaminated material storage areas

If required, appropriate storage areas for contaminated soil will be identified subject to findings of site contamination investigations undertaken during the detail design phase. The potential for contaminated soil to be encountered within the Project footprint is discussed in Chapter 9: Land Resources.

Contaminated soil that is identified in advance and is to be excavated will be subject to a site management plan that is prepared in accordance with the requirements of the EP Act. Depending on the type and levels of contamination encountered, contaminated material may be reused for construction activities within the rail corridor, such as through encapsulation within zoned embankment. In some instances, contaminated material may require treatment prior to being suitable for reuse. The onsite management and remediation of contaminated soil would be further informed by a review of sampling results, exposure risks, onsite treatment or encapsulation opportunities and requirements for ongoing management.

A disposal permit from DES would also be required for the transportation of contaminated soil by a licensed service provider to an appropriately licensed facility.

21.7 Spoil production

The Project is anticipated to generate approximately three million cubic metres of excavated material from tunnelling and earthworks during construction. The design was developed to achieve, as close as possible, a net cut to fill balance to reduce the import of material and disposal of surplus or unsuitable material to landfill.

Approximately 2,100,000 m^3 of the excavated material will be reused within the Project as fill, leaving an excess of approximately one million cubic metres as spoil. The majority of the excess material, approximately 730,000 m^3, will result from the construction of the tunnel (excluding the portals).

Contaminated material has not been identified within the Project disturbance footprint however, if unexpected acid sulfate soils, acid rock or areas of contaminated land are encountered during additional pre-construction surveys, the material will not be reused unless treated appropriately. The management of waste materials will be carried out in accordance with a land resources unexpected finds protocol/procedure to be included in the Waste Management Sub-plan within the CEMP.

Excavated material that may not meet the specifications to be used as fill or capping material for the Project construction would be due to factors such as:

- Compaction requirement: Materials that cannot be compacted to an acceptable density to achieve the required engineering design characteristics are not considered suitable for reuse. Silt, over wet material and material with organic matter may be un-compactable materials
- Moisture content: Based on the natural moisture content, the material may either be too wet or too dry in its current condition to meet the required specifications or consistency. Treatments for improvement, such as spreading and addition of lime, can be undertaken to modify the moisture content and consistency of clayey soils
- Organic content: Materials with organic content are typically considered unsuitable due to being highly compressible, degradable and susceptible to collapse. These materials may be suitable for use in topsoil and vegetation rehabilitation applications with blending
- Dispersive: Dispersive materials (Emerson Class <4) have a high potential for erosion, therefore their usage is restricted to areas where they are not exposed to free water. Dispersive materials that can meet all other Type A to D general fill requirements may potentially be incorporated into the core of a zoned embankment or used together with adequate design solutions, such as chemical additives and compaction, to manage the soil behaviour. General fill types will be appropriate to the adopted design and performance expectations of the zoned embankment. The outer zone material for the zoned embankment will be durable and erosion resistant (General Fill Type A). The general earth fill upper zone will be general earth fill Type A and Type B. The lower zone may be general earth fill (Type A–D) or rockfill in accordance with their respective placement depth criteria. The differentiation of the fill types is dependent on their particle size distribution, which determines the compaction ability of the general earth fill. Type A or Type B fill have a minimum California Bearing Ratio (CBR) of 3 per cent whereas Type C and D fill have a minimum CBR of 1 per cent

- Contamination: Contaminants may be present in the material due to several factors. The presence of contaminated land has been assessed as part of Chapter 9: Land Resources. Based on the land uses within the Project disturbance footprint and the findings of a desktop assessment, potential sources of contamination for the Project may include:
  - Agricultural activities: hydrocarbons (fuel and oil storage and use), pesticides and herbicides, asbestos and lead paint, arsenic (cattle dips), landfilling
  - Quarries: hydrocarbons (fuel and oil storage and use), metals/metalloids, hazardous materials
  - Landfilling and waste disposal: hazardous materials, hydrocarbons, metals/metalloids, phenols, polychlorinated biphenyls, phthalates, volatiles and pesticides and herbicides
  - Existing rail corridor: metals, asbestos, hydrocarbons, pesticides/herbicides
  - Roads: metals and hydrocarbons
  - Unexploded ordnance (UXO)
  - Acid sulfate soils (ASS)/rocks
  - Unknown fill material: Asbestos, metals/metalloids, hydrocarbons

  Due to the topographic position, no ASS are anticipated to occur along the alignment. Similarly, due to the geological setting and the characteristics of the mapped geological units, the risk of encountering naturally occurring asbestiform (NOA) materials during excavation is considered negligible. A potential risk of UXO (2″ mortars and grenades) has been identified for the G2H alignment, between Project Chainage (Ch) 15.50 km to Ch 18.35 km, with Ch 25.00 km onwards noted to be in proximity of the Helidon UXO areas for explosives storage. If encountered, any UXO could detonate causing a safety issue to both human health, machinery the environment, including the release of chemicals and further contamination. Areas identified at risk will be assessed to identify and then remove any UXO prior to site or construction activities taking place
- Reactivity: Reactive materials with significant shrink swell potential may lead to excessive movement within the fill. Reactive materials that can meet Type C/D fill requirements may potentially be incorporated into the core of a zoned embankment or used where they are protected from significant moisture variations. Alternatively, chemical treatment may be considered to modify the reactivity of the clayey materials. Reactive soils are anticipated to be present along the alignment—mainly west of the Great Escarpment, overlying the basalts and alluvium derived from basalt
- Acidity: Acidic soils such as the surface layers of kurosols expected to be encountered generally with a pH less than 5.5. In-situ treatments, such as the addition of lime, can be a successful method of ameliorating soil acidity. While the acidity of the soils has no impact on the engineering characteristics of the materials, the reusability of the stripped topsoil can be improved if the acidity is managed
- Oversize materials: Blasted or ripped rock with particles larger than 150 millimetres (mm) are typically excluded from earthworks, as they cannot be adequately compacted. The oversize material may be considered for use as rock fill or rip-rap, provided the relevant durability, shape and weight requirements are met. Oversize sedimentary rock fragments are typically broken down to approximately 150 mm size particles by tracked earthmoving machinery, such as excavators and dozers
- Unstable: Colluvial material that has formed as a landslide debris is considered meta-stable and is known to be prone to slope instability. If encountered in the foundation of embankments or other structures, it will potentially need to be removed and replaced. However, the material itself is not considered unsuitable and can be considered for reuse, provided the engineering characteristics are within the Project-specific specifications. Potential landslide locations have been identified within the vicinity of the eastern tunnel portal.
- Atterberg Limits or weighted plasticity index values exceeding the maximum limits stated in the Project specification.

Appendix W: Geotechnical provides more details on the site geology, surface soils and rock types expected to be encountered during the excavation works. Chapter 9: Land Resources provides more details on the handling and management of the waste rock material.

21.7.1.1 Spoil management strategy

The cut and fill assessment was undertaken for the Project in isolation, for the purpose of informing the primary Project approvals. In the detailed design and construction phases of the Project and adjacent Inland Rail projects, there will be opportunities to optimise the use and placement of spoil material outside of the extent of each individual project. It is not appropriate to undertake this level of assessment until the construction contractors have been appointed and the level of design including earthwork balance and placement strategies has been further progressed. The assessment of the cumulative impacts of combining the management of spoil across more than one project will be undertaken once the detailed design and earthwork balance and placement strategies are available. Cumulative impacts for the current spoil disposal approach are in Chapter 22: Cumulative Impacts.

Spoil produced by the Project will be managed in accordance with Appendix T: Spoil Management Strategy, considering the spoil management hierarchy in Table 21.8 and Figure 21.3.

TABLE 21.8: SPOIL MANAGEMENT HIERARCHY

Rank	Options	Example
1	Avoid and reduce spoil	Reduce the amount of spoil generated by the Project by reducing the extent and scale of cut where an immediate reuse opportunity in proximity to the source location does not exist, e.g. sections of the Project where a surplus of material will be generated
2	Reuse within the rail corridor (with or without treatment)	Reuse within the Project, subject to the material complying with the ARTC Earthworks Material Specification, to establish formation, fill embankments and mounds within short haulage distance of the source location. The material may also be used in drainage works (e.g. rip-rap), rehabilitation and restoration works in particular temporary areas required for construction, and landscaping
3	Reuse for environmental works and land restoration (third parties)	Reuse for environmental works and land restoration, subject to the material complying with the relevant specifications for the materials intended use Examples include: ▸ Reuse in the rehabilitation of native vegetation ▸ Reuse for landscaping ▸ Reuse for land reinstatement, including mines (New Hope Acland, Commodore) and quarries, subject to satisfying closure and operational requirements ▸ Reuse for landfill covers (day and interim covers) and final capping (where deemed suitable)
4	Reuse on other development	Reuse for fill embankments and mounds on projects within a reasonable haulage distance from the site source location (e.g. 50 km), subject to the material complying with the relevant specifications required for the intended purpose of the material. Priority will be given to the other sections of the Inland Rail Program. The material may also be provided to landholders directly impacted by the Project or on adjacent properties for local land use practices (e.g. upgrade access tracks, erosion controls etc.)
5	Dispose	The design allows for the storage of excess material (i.e. spoil) from the construction of the tunnel as a stockpile within the proposed rail corridor at the western tunnel portal (i.e. disturbance footprint). The stockpile material will be reused for future projects outside or within the Project disturbance footprint including the reuse purposes shown in the option ranked third in this table. Consultation with TRC has indicated that there is limited capacity to accommodate spoil as a waste from the Project at the existing landfills; however, use as cover or final capping is considered an opportunity as noted above. Offsite disposal will only occur if the material is considered unsuitable without treatment for other uses, e.g. due to contamination.

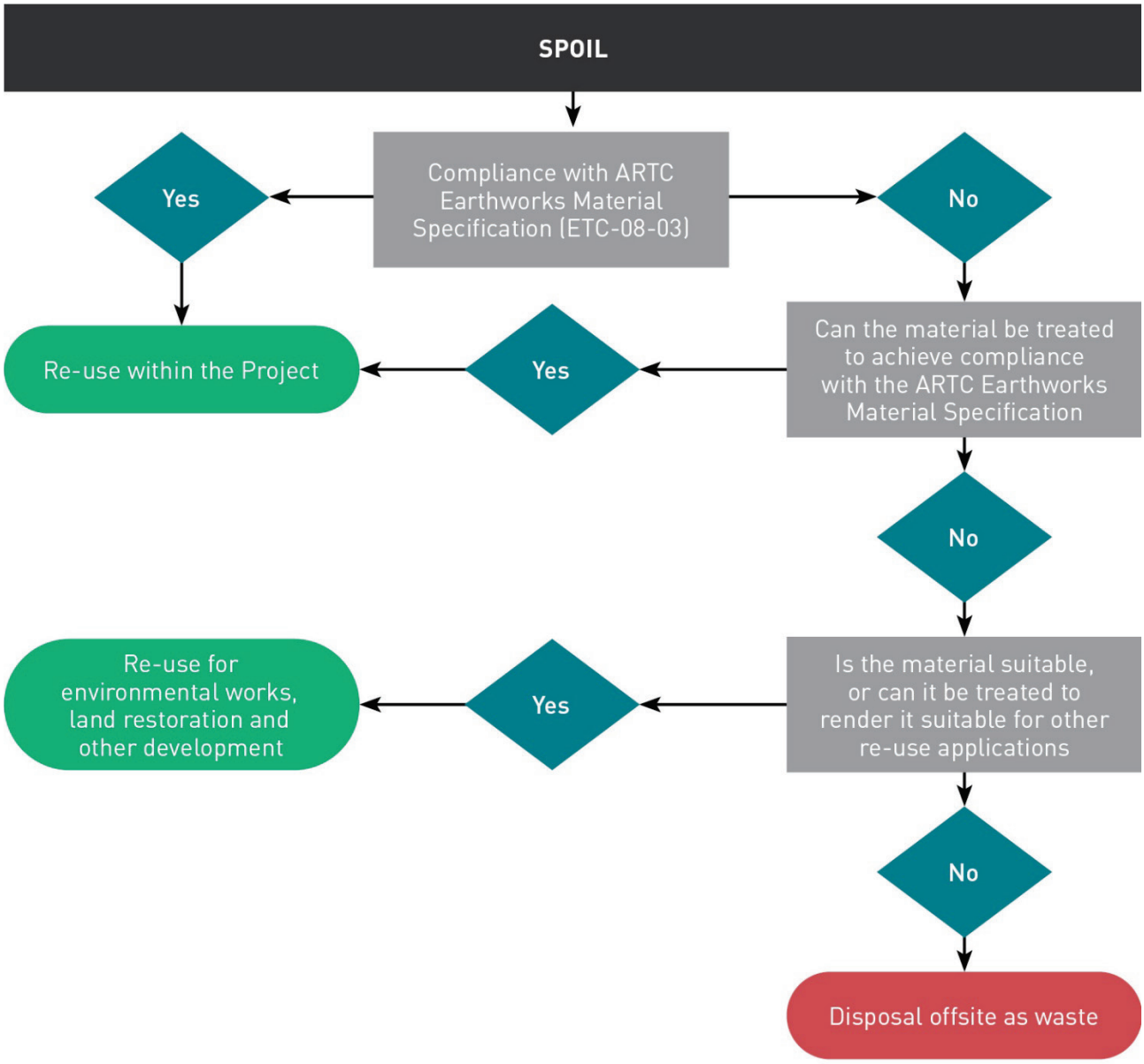

FIGURE 21.3: SPOIL MANAGEMENT HIERARCHY

The following spoil reuse options as per the requirements of the ARTC Earthworks Material Specification and the Earthworks and Material Management Framework will be considered for the management of any material that is not suitable to be reused within the Project and is stockpiled at western tunnel portal:

- The material may be used for the construction Rail Maintenance Access Roads, road embankments and mounds within short haulage distance of the source, reused for rehabilitation and landscaping
- The material may potentially be used as fill material for other projects including the Inland Rail NSW/Queensland Border to Gowrie (B2G) and Helidon to Calvert (H2C) projects, along with Toowoomba Regional Council's Charlton Sports Precinct development
- Rehabilitation of the existing quarries within the vicinity (50 km) of the Project, as identified through discussions with operators (e.g. Harlaxton and Withcott quarries)
- Daily cover for waste management facilities (e.g. Toowoomba Waste Management Centre)
- Noise attenuation mounds and/or landscaping mounds
- Profile and capping soils (subject to demonstration of compliance with material specifications) for waste management facilities that are anticipating closure in the near future (e.g. Clifton, Goombungee, Pittsworth landfills)
- Fill material for the extension of the rail formation for future passing loops

- Beneficial use off-site, subject to treatment and/blending of unsuitable material (due to contamination or geotechnical aspects) with chemical additives which will allow for reuse and avoid disposal
- Subject to suitability, incorporation into commercial soil manufacturing processes (e.g. Candy Soil)
- Rehabilitation of the Toowoomba Bypass laydown area at Withcott
- Any spoil material that cannot be reused without treatment e.g. due to contamination, saturation or geotechnical reasons will be disposed at a designated waste facility that accepts spoil with those characteristics.

Waste rock

Waste rock is a term typically derived from the resources industry, where waste rock sometimes has pyritic qualities. Appendix W: Geotechnical and Chapter 9: Land Resources provides information on the physical characteristics of rock generated from the Project, including management requirements in the event that acidic materials are encountered during Project activities. The geotechnical and soil investigation, which included site walkovers and geotechnical sampling, did not identify the presence of ASS or acid rock, which occur naturally when sulfide minerals are exposed to air and water and accelerated through excavation activities, which increases rock exposure to air, water and microorganisms, within the land resources study area. Based on the geological conditions within the land resources study area, the likelihood of encountering acid rock is considered to be low. Therefore, all rock that is won through excavation has been assumed to be reused for the Project and is not defined as a waste. This is subject to the material being tested to determine the waste classification and suitability for reuse, in accordance with the relevant guidelines, specifications and CEMP.

If rock is not contaminated it may be crushed and reused onsite as aggregate for fill, construction pads/laydown areas or road base. Under the Environmental Protection Regulation 2019 (EP Regulation), an approval for ERA 33 is not required for the extraction of material from a place for constructing a road or railway at the place. An approval for ERA 33 will only be required for the crushing, milling, grinding or screening of material exceeding 5,000 t/yr if the activity is undertaken outside of the Project. It has been assumed that such activities would be undertaken by a third-party commercial operation which would be responsible for obtaining the requisite ERA permit to allow this activity to occur. As such, these places are not included within this assessment.

In accordance with the Draft Outline Environmental Management Plan (Draft Outline EMP) (refer Chapter 23: Draft Outline Environmental Management Plan), soil conditions across the Project disturbance footprint will be appropriately characterised at a suitable scale through additional geotechnical surveys during the detailed design phase of the Project to inform design and environmental management measures.

The suitability and extent of the material intercepted by the Toowoomba Range Tunnel cannot be estimated with accuracy due to the variable nature of basalt flows deposited on the undulating Jurassic sedimentary paleo topography. Typically, the spoil characteristics are monitored as the excavation progresses with samples taken directly from a temporary stockpile.

Potential spoil reuse and disposal locations

The Toowoomba Waste Management Centre is the closest major waste management facility that can accept clean fill material and its location is shown in Figure 21.1. There is an opportunity for the generated unusable spoil to be used as a daily cover at this facility and also at the Gatton Landfill, subject to consultation with the landfill managers.

Closed or closing landfills within the region, existing or previously used borrow sites, disused /abandoned quarries and mines that require rehabilitation may also be suitable locations for receiving clean excess spoil that is deemed unsuitable for use within the Project disturbance footprint. These locations will not be licensed to accept waste per-se and will be unable to accept contaminated spoil if produced; however, exemptions may be granted to accept clean spoil to assist in the partial rehabilitation of these facilities. As per Environmental Protection Regulation 2019, clean spoil is any natural substance found in the earth that is not contaminated with waste or hazardous contaminant, Furthermore, the acceptance of clean spoil on these sites to aid in rehabilitation without stockpiling is contingent on the timing of spoil generation and its temporal alignment with remediation/ rehabilitation activities. Appendix T: Spoil Management Strategy provides more details on the location of these sites.

Any spoil material that cannot be reused due to unsuitability of composition and not meeting the specifications for the required application or if identified to be contaminated will be treated to allow reuse and avoid disposal. The excess spoil will be placed and appropriately stabilised within the Project disturbance footprint in areas such as the western tunnel portal. This stockpile material may be reused as a resource material for future adjoining projects.

21.8 Potential impacts

Waste generation during the construction and operation phases of the Project may result in the following potential impacts on the environmental values identified in Section 21.5.1:

- Depletion of natural resources and sustainability of natural resources (e.g. construction materials, fuel)
- Waste disposal, additional to current levels, resulting in increased consumption of airspace and reduction of community access to waste facilities within the region
- Uncontrolled release of waste from the improper storage, or failure of management systems resulting in contamination of receiving environments (i.e. land, surface water and air)
- Risks to human health and safety of site personnel, through the release of pollutants from the poor management of regulated wastes.
- Increase in the incidence of vermin, insects and pests from uncontrolled release of waste and inappropriate storage and handling of putrescible wastes
- Increased transportation of waste materials on and offsite, resulting in:
  - The increase of greenhouse gas (GHG) emissions due to the combustion of hydrocarbons from the operation of vehicles/plant
  - Decreased amenity of land uses adjacent to the Project from the generation of dust and road deterioration.
- Reduced visual amenity of land uses adjacent to the Project.

The construction of the Project will generate several waste streams that will be managed by maximising opportunities to avoid or reduce, reuse and recycle; however, there will be waste streams for which this cannot be achieved, e.g. municipal solid waste arising from non-resident workforce accommodation. In these instances, wastes will be disposed of at appropriately licensed facilities (refer Table 21.4).

As established in Table 21.6 and Table 21.7, the waste volumes likely to be produced by the Project are insignificant in the context of broader waste generation practices in the region (refer Table 21.3). The ability of waste-receiving facilities listed in Table 21.4 to receive wastes generated by the Project has been determined based on initial consultation with operators, a review of environmental authority licensing under the EP Act and consideration of the Project's contribution to the regional waste management network. Feedback from consultation with TRC and LVRC has indicated that the facilities listed in Table 21.4, which are owned and/or managed by these councils, are expected to have sufficient combined capacity to accept waste materials generated by the Project. The confirmation of waste-acceptance criteria and available/permissible annual disposal rates will be undertaken in consultation with the relevant operator once the construction schedule and sequencing is confirmed.

The likelihood of potential impacts from significant waste generation during the construction and operation without mitigation is assessed in Table 21.9. Further discussion regarding the environmental values and the potential impacts as a result of waste generation during the construction and operation of the Project of these values may be found in other chapters of the EIS, including Chapter 8: Land Use and Tenure, Chapter 9: Land Resources, Chapter 10: Landscape and Visual Amenity, Chapter 11: Flora and Fauna, Chapter 12: Air Quality, Chapter 13: Surface Water and Hydrology, Chapter 16: Social, Chapter 19: Traffic, Transport and Access and Chapter 20: Hazard and Risk.

TABLE 21.9: LIKELIHOOD OF POTENTIAL PROJECT IMPACTS ON ENVIRONMENTAL VALUES

Environmental value	Potential impact	Construction	Operation
▸ Depletion of natural resources ▸ Sustainability of natural resources (e.g. construction materials, fuel)	Excessive use of natural resources and disposal of the excess as waste to landfill	Unlikely	Unlikely
▸ Available landfill capacity for waste disposal	Airspace consumption and material reduction of community access to landfill	Unlikely	Unlikely

Environmental value	Potential impact	Construction	Operation
▸ Sensitive receptors: human, environment, businesses and the receiving environment: air, water bodies and surrounding flora and fauna ▸ Health and safety of the site personnel and nearby sensitive receptors ▸ Productive capability of land (i.e. its potential for use for agricultural or other uses) ▸ The diversity of ecological processes and associated ecosystems surrounding the Project.	Uncontrolled release of waste can cause contamination of land, surface waters and ground waters which can affect the productivity of agricultural land and ecological values	Possible	Unlikely
▸ Increased traffic and attendant disruption such as noise, dust and traffic	Increase in greenhouse gas emissions arising from waste transportation activities	Almost Certain	Unlikely
▸ Visual amenity	Decrease in visual amenity due to waste transportation activities	Likely	Unlikely

21.9 Mitigation measures

This section describes the measures that either have been, or will be adopted by the Project to avoid, minimise or mitigate potential impacts attributed to waste. The mitigation measures have been developed to consider best practice management measures as outlined in:

- 2018 National Waste Policy
- WRR Act
- EP Regulation.

ARTC will use a hierarchical approach to waste management from the most preferable (avoid or reduce, re-use, recycle, recover energy and treat) to the least preferable (disposal) and prioritise waste management strategies to avoid generation. Where waste cannot be avoided, waste materials will be segregated by type for collection and removal by licensed contractors.

The *Inland Rail Environmental and Sustainability Policy* provides sustainability-related commitments throughout design, construction and operation of the Project. Sustainability considerations with regards to waste and resource management are included in Chapter 7: Sustainability. Integrated processing design and co-generation of power is not applicable to the Project.

Resource-use efficiency and by-product reuse is a core principle of the Inland Rail Environment and Sustainability Policy, which underlies the waste management and mitigation measures that are proposed for the Project. There are both environmental and economic benefits to investigating and maximising opportunities for resource use efficiency and by-product reuse, while also unlocking potential for innovation. It is in ARTC's interest to investigate and implement reuse and recycling initiatives, given the relative remoteness of some sections of the Project and the costs involved in the transportation and disposal of waste. The integrated processing design and co-generation of power is not applicable to the Project.

The approach to resource efficiency that will be adopted for the Inland Rail Program, and this Project, is summarised in Figure 21.4.

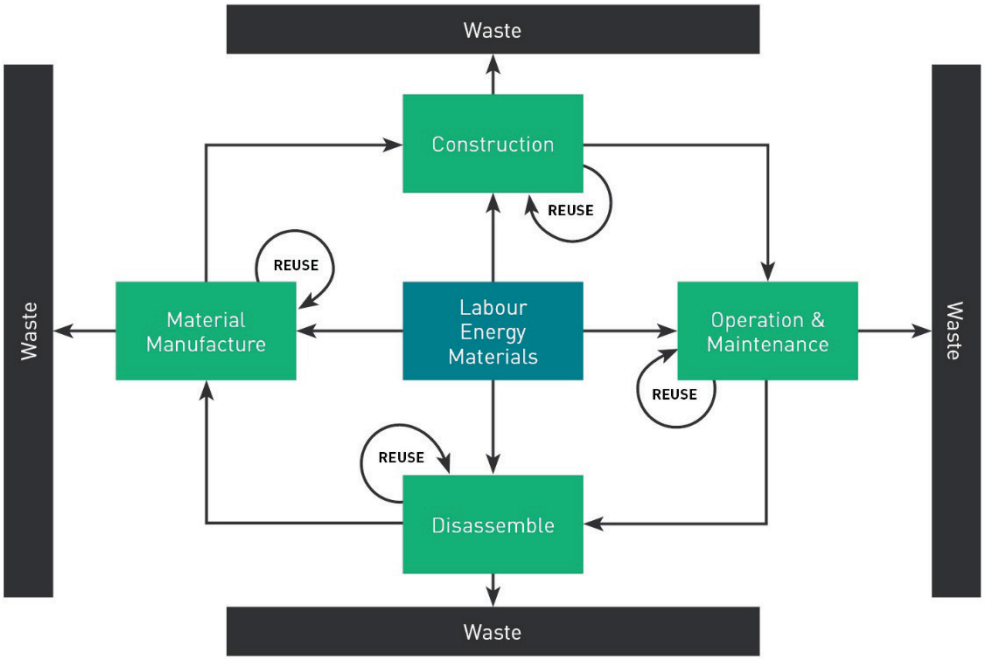

FIGURE 21.4: APPROACH TO RESOURCE USE EFFICIENCY AND BY-PRODUCT REUSE

The *Inland Rail Sustainable Procurement Policy* also details commitments for sustainable procurement to drive positive economic and social outcomes, while providing a benefit to the environment through reduced resource use and greenhouse gas emissions. This policy is included in Appendix G: Corporate Policies.

The section below outlines the mitigation measures proposed for the Project including considerations in Project design and the additional measures to manage the environmental impacts in other phases of the Project. The impacts are initially assessed with consideration of the Project design mitigation measures and then reassessed to determine residual risk after the inclusion of the additional mitigation measures.

The effectiveness of the mitigation measures will be assessed by regular monitoring to determine the adequacy of the proposed control measures. The collected data will then be assessed against the targets established in the Queensland WMRRS (DES, 2019f) to determine the significance of the generated waste stream impacting the environment.

Waste management will be undertaken by appropriately licensed operators who are obligated to adhere to the above policies and legislation. The Waste Management Sub-plan for the Project will include the principles of the EP Act, the WRR Act and WMRRS (DES, 2019f). The Waste Management Sub-plan will provide management processes for key waste streams and the adaptation of the waste hierarchy to avoid the production of waste in the first instance, followed by reuse, treatment and recycling. The current targets for 2027 (when the Project is due to commence operations) requires a minimum diversion of 75 per cent for construction and demolition waste and 55 per cent for general waste from landfill. As these targets reflect current government policy, they are treated as minimum requirements for the Project.

To assess the performance of the waste management activities against the determined targets, the generated waste streams and quantities would be monitored regularly (e.g. monthly) and audited at least once a year from the source of generation to the point of destination which could be either the waste disposal facility or the recycling facility. The disposal receipts for the waste types and quantities will be kept within a construction site register and will be available for review to demonstrate compliance with the agreed targets during routine construction auditing.

The Waste Management Sub-plan will also be included in monitoring and auditing procedures.

21.9.1 Design considerations

The mitigation measures and controls in Table 21.10 have been factored into the Project design. These design measures have been identified through collaborative development of the design and consideration of environmental constraints and issues. These design measures are relevant to the construction and the operational phases of the Project. This chapter has been developed on the basis of preliminary design effort and further optimisation of the design will occur during the detailed design phase to more fully characterise the material that will be generated during construction, its volume and to enhance excavated material reuse within the Project and adjacent projects.

TABLE 21.10: INITIAL DESIGN MITIGATION OF RELEVANCE TO WASTE AND RESOURCE MANAGEMENT

Aspect	Initial mitigation measures
Waste	▸ Optimisation of the Project rail corridor vertical alignment to reduce the quantity of spoil material generated ▸ Disturbance footprint limited to the extent required for safe construction and operation to reduce clearing requirements ▸ Cut and fill balance and minimisation of transport requirements for import/landfill disposal of spoil ▸ Design includes a spoil stockpile at the western tunnel portal. The stockpile will be profiled and revegetated and will mitigate amenity impacts associated with the construction and operation of the Toowoomba Range Tunnel ▸ There is over 6 km of viaducts proposed which limits the extent of cut and fill activities, along with potential clearing extents.

21.9.2 Proposed mitigation measures

To manage the Project risks during construction and operation, a number of mitigation measures have been proposed for implementation in future phases of Project delivery, as in Table 21.11. These additional mitigation measures have been identified to address Project-specific issues and opportunities, address legislative requirements and accepted Queensland Government plans, policies and practices.

Table 21.11 identifies the relevant Project phase, the impacts and aspects to be managed and the proposed mitigation measures, which are then factored into the assessment of residual risk in Table 21.13.

Any surplus material such as concrete and excavated material if not contaminated as per NEPM guidelines or if treated for those initially found unsuitable, would be reused as a subgrade/fill material where it conforms to the required specifications. Any waste material which cannot be reused (treated or untreated), recycled or not viable to recover its energy for the Project, will be transported to nearby waste management facilities for further management.

Management of specific waste types that are expected to be generated by the Project are further detailed in Table 21.12 as per the waste management hierarchy shown in Figure 21.2 and the approach to resource use efficiency shown in Figure 21.4.

The draft Outline EMP (refer Chapter 23: Draft Outline Environmental Management Plan) provides further context and the framework for implementation of these proposed mitigation and management measures.

While initial consultation has been undertaken, further liaison with operations of the waste facilities identified in Table 21.4 during the detailed design phase post-EIS is warranted. The outcomes of the discussions will inform the construction approach by confirming the capacity for each of the identified waste streams, along with any potential constraints that may limited a landfills capacity to receive the material in the short- or long-term.

TABLE 21.11: PROPOSED WASTE AND RESOURCE MANAGEMENT MITIGATION MEASURES

Delivery Phase	Aspect	Proposed mitigation measures
Detailed Design	Waste	▸ Cut and fill balance and minimisation of transport requirements for the import/disposal of spoil will be considered further during detailed design by implementing the spoil management hierarchy in Appendix T: Spoil Management Strategy: ▸ Aim to maximise the reuse of local sources of aggregate and treatment of dispersive and reactive materials to improve mass haul ▸ Aim to maximise the reuse of material excavated below the rail embankment for less critical parts of infrastructure ▸ Aim to maximise the reuse of excavated material as a stabilised structural fill ▸ Optimise the number, width and depth of cuts to avoid the generation of material that would be considered surplus to Project requirements ▸ Continue to investigate the viability of the reuse of basalt material from the excavation of the tunnel as capping and structural material ▸ Continue to investigate the viability of the reuse of excavated material as high-quality general fill or structural fill to minimise the import of rock amour ▸ Continue to investigate the viability of the reuse of dispersive and sodic soils as generally fill in embankments and/or formations ▸ Continue to investigate the viability of the material within the Project disturbance footprint for reuse as per the ARTC Earthworks Material Specification and the Earthworks and Material Management Framework, including extent of material that may need treatment (e.g. soil sampling and where applicable additional contaminated land surveys in accordance with relevant guidelines and procedures (refer Chapter 9: Land Resources)) ▸ Establish waste reduction targets for design and construction ▸ Undertake a waste reduction review to identify opportunities to meaningfully achieve the waste reduction targets through detailed design and construction of the Project. ▸ Consider alternative approaches to materials used, construction and operational techniques and maintenance of a process to achieve a less resource intensive and more efficient process, in accordance with relevant design standards. For example, material specifications will consider aspects such as use of prefabricated materials, percentage of recycled content and percentage of material rejection to reduce waste generation from the Project. Establish water quality objectives for the water treatment plant, along with the capacity of the treatment plant ,including waste storage areas and any proposed discharge points ▸ Establish waste reporting requirements for the pre-construction, construction phases of the Project and incorporated into the Waste Management Sub-plan
Pre-construction	Waste	A Waste Management Sub-plan will form part of the CEMP, which complies with the Project conditions of approval and relevant regulatory requirements, including: ▸ Waste targets (or waste reduction targets) to be achieved for the Project ▸ Waste reporting requirements. ▸ General protocols and performance objectives for keeping the work site clean and tidy ▸ Describe potential waste impacts, waste streams and estimated volumes ▸ Identify temporary waste storage areas and disposal locations on and off site (including stockpiles and landfilling) ▸ Ensure waste disposal is undertaken in line with NEPM criteria for disposal sites ▸ Requirements for waste segregation e.g. green waste, spoil, construction and demolition waste, general waste, regulated waste and recyclables ▸ Requirements for secure temporary storage, collection frequency and disposal/recycling requirements ▸ Effluent management for construction staff amenities ▸ Procedures and reporting/documentation requirements for ensuring waste transporters and receivers are appropriately licensed according to the type of waste ▸ Requirements for training, inspections, audits, corrective actions, notification and classification of environmental incidents, record keeping, monitoring and performance objectives for handover on completion of construction

Delivery Phase	Aspect	Proposed mitigation measures
Pre-construction [continued]	Hazardous waste	▸ A contaminated and hazardous material survey will be undertaken prior to the demolition of structures. In the event that asbestos or other hazardous materials are identified in these structures, a Contaminated and Hazardous Materials Management Plan will be developed and implemented as part of the Waste Management Sub-plan ▸ Where identified, asbestos-containing materials will be removed prior to the commencement of construction. Asbestos removal and handling will be conducted in accordance with: ▸ National Environmental Protection (Assessment of Site Contamination) Measure 2013 (National Environment Protection Council, 2013) ▸ Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia or equivalent ▸ *Model Code of Practice—How to Manage and Control Asbestos in the Workplace* (Safe Work Australia, 2018a) ▸ *Model Code of Practice—How to Safely Remove Asbestos* (Safe Work Australia, 2018b). ▸ If removal of more than 10 m^2 of asbestos is required, the necessary licence will be obtained from Workplace Health and Safety Queensland, as follows: ▸ A Class Licence—Removal of loose (friable) asbestos ▸ B Class Licence—Removal of bonded asbestos ▸ Asbestos-containing materials will be transported by a licensed service provider and disposed of at an appropriately licensed facility, in accordance with the requirements of the WRR Act, *Work Health and Safety Act 2011* (Qld) (WHS Act) and the EP Act.
Construction and commissioning	Waste	▸ Identify opportunities to achieve waste reduction targets appropriate to the scope of the construction works ▸ Avoid disposal of excavated material to landfill by implementing the spoil management hierarchy in Appendix T: Spoil Management Strategy ▸ All cut material of appropriate suitability for reuse will be stockpiled separately and reused on site where possible ▸ Careful specification of construction material requirements to avoid overestimation ▸ Source good quality construction materials, in accordance with relevant design standards ▸ Purchase construction materials in bulk to minimise packaging waste ▸ Develop and implement administrative controls on the transportation of waste materials from the Project, within the Project disturbance footprint and offsite ▸ Ensure plant and equipment used in the Project is appropriately maintained ▸ Maintenance activities, refuelling, concrete washout will be carried out at an appropriate distance (relative to task risk assessment) from riparian vegetation and waterways, with appropriate measures in place to reduce the potential for impacts to waterways, aquatic habitats, and groundwater ▸ Portable toilets and amenities will be serviced and maintained to ensure efficient operation and minimise environmental risks associated with their operation and decommissioning ▸ Contractors will adhere to the practices of the WRR Act waste and resource management hierarchy, which sets out an order of preference for options for managing waste from avoiding, to reusing, recovering, treating and disposing of waste ▸ Appropriate waste bins, facilitating segregation of waste, will be located at key site compounds to facilitate segregation and prevent cross contamination ▸ Comply with the waste reporting requirements established in the Waste Management Sub-plan
	Hazardous waste	▸ Contaminated waste will be classified and disposed in accordance with the Waste Management Sub-plan ▸ Hazardous or dangerous waste (e.g. asbestos, chemicals, oils) will be correctly stored, managed and disposed of by a licensed contractor or facility and in accordance with the relevant occupational health and safety legislative and regulatory obligations, including wastes generated as a result of demolition

Delivery Phase	Aspect	Proposed mitigation measures
Operation	Waste	▸ Operators will adhere to the practices of the WRR Act waste and resource management hierarchy, which sets out an order of preference for options for managing waste from avoiding, to reusing, recovering, treating and disposing of waste ▸ Waste management commitments in accordance with the WRR Act waste and resource management hierarchy and procedures will be developed for inclusion in the Operation and Maintenance Environmental Management Plan
	Hazardous waste	▸ Contaminated waste including oil and solvent spills will be classified and disposed in accordance with relevant legislative requirements ▸ The transportation of regulated wastes and contaminated soil or other materials will be conducted by appropriately licensed contractors for disposal at licensed facilities in accordance with the EP Act

TABLE 21.12: WASTE AND RESOURCE MANAGEMENT OPTIONS

Potential impact	Waste and resource stream	Classification	Avoid/reduce	Reuse/recycle	Disposal
Airspace consumption and material reduction of community access to landfill	Cleared vegetation	Green waste	Where practical minimise disturbance and clearing required	▸ Reuse logs, stumps and mulch in rehabilitation areas or deliver to a licensed facility for recycling ▸ Energy stored in green waste can be recovered as fuel	Not suggested
Airspace consumption and material reduction of community access to landfill Increase in greenhouse gas emissions arising from waste transportation activities	Concrete, timber, metal	Construction and demolition	Detailed design for infrastructure to carefully specify material requirements to avoid overestimation Source high-quality materials	▸ Reuse or repurpose for applications on-site Crushed concrete may be used as aggregate for fill, construction pads/laydown areas or road base ▸ Recover reusable metal, including stakes, drums and wire, and steel, where practical ▸ Segregate and store onsite in designated areas for removal by appropriately qualified personnel to licensed facility for recycling	No suggested
Excessive use of natural resources and dispose the excess as waste	Soil (topsoil)	Construction and demolition	Where practical minimise the permanent operational and temporary construction footprints	▸ Topsoil may be re-spread over batters/used for revegetation ▸ Direct placement of topsoil is preferred to stockpiling	Not suggested
Excessive use of natural resources and dispose the excess as waste	Spoil	Construction and demolition	Reduce the amount of spoil being generated through design and construction methodology	▸ Reuse in the Project above the rail formation to fill embankments for rail line and drainage ▸ Reuse for rehabilitation onsite ▸ Reuse as an embankment fill for other Inland Rail projects ▸ Reuse for land reclamation or remediation works for quarries and borrow pits ▸ Treat unsuitable materials to required reuse standards ▸ Investigate the option to retain excess spoil within the Project disturbance footprint, as noise bunds or visual barriers a permanent stockpile	Disposal of excess spoil as waste at an approved facility licensed to receive the material only if not suitable for reuse and recycling

Potential impact	Waste and resource stream	Classification	Avoid/reduce	Reuse/recycle	Disposal
Airspace consumption and material reduction of community access to landfill	Debris and litter	General waste	Buy in bulk to minimise packaging waste	▸ Reduce, reuse or recycle wastes where possible ▸ Provide separate recyclable materials receptacle near site offices ▸ Transportation of recyclable materials by appropriately qualified personnel to licensed facility for recycling	Only for materials that cannot be recycled or reused: ▸ Collection in covered bins/containers with appropriate signage ▸ Service regularly to avoid vermin and pests ▸ Transportation of waste by appropriately qualified personnel to licensed facility
Uncontrolled release of waste can cause contamination of land, surface waters and dependant ecosystems which can lead to vegetation dieback, reducing the quality of crops and affects animal husbandry	Hazardous substances (i.e. paint, solvents and chemicals) Waste oil, including absorbent materials, containers, filters and rags	Regulated waste	Avoid spills through implementation of standard operating procedures Ensure staff are trained for the correct use of equipment	▸ Collect in appropriately bunded and covered area, where practical	▸ Waste tracking systems to be maintained for the disposal of regulated waste. ▸ Transportation of waste by appropriately qualified personnel to licensed facility.

21.9.3 Impact assessment

In the assessment of potential impacts, the assessment methodology discussed in Chapter 4: Assessment Methodology for qualitative risk assessment for all potential environmental aspects was followed. The outcome of the assessment is in Table 21.13 where initial rating assumes design parameters in Table 21.10 have already been implemented and the residual risks are outcomes of the application of the proposed design objectives and additional mitigation measures in Table 21.11. The initial risk levels were then compared to the residual risk levels to assess the effectiveness of the mitigation measures.

TABLE 21.13: WASTE AND RESOURCE MANAGEMENT RISK ASSESSMENT

		Initial risk			Residual risk		
Potential impact	**Phase**	**Likelihood**	**Consequence**	**Risk**	**Likelihood**	**Consequence**	**Risk**
Excessive use of natural resources and dispose the excess as waste	Construction	Unlikely	Moderate	Low	Unlikely	Minor	Low
	Operation	Unlikely	Minor	Low	Unlikely	Not significant	Low
Airspace consumption and material reduction of community access to landfill	Construction	Unlikely	Minor	Low	Unlikely	Minor	Low
	Operation	Unlikely	Minor	Low	Unlikely	Minor	Low
Uncontrolled release of waste	Construction	Possible	Moderate	Medium	Unlikely	Minor	Low
	Operation	Unlikely	Moderate	Low	Unlikely	Minor	Low
Increase in greenhouse gas emissions arising from additional waste transportation activities	Construction	Almost certain	Minor	Medium	Likely	Not significant	Low
	Operation	Unlikely	Minor	Low	Unlikely	Not significant	Low
Decrease in air quality and visual amenity due to waste traffic increases	Construction	Likely	Minor	Medium	Possible	Minor	Low
	Operation	Unlikely	Minor	Low	Unlikely	Minor	Low

21.9.4 Performance requirement

Waste and resource management activities associated with the Project will be carried out strategically, in line with the waste and resource management hierarchy in the 2018 National Waste Policy and WRR Act for waste streams that present a significant impact. Mitigation measures are proposed to reduce adverse impacts from significant waste generation and resource use on environmental values and sensitive receptors. Waste streams deemed to be insignificant will be managed using business as usual waste management methods.

Mitigation measures to avoid and reduce potential impacts from waste on environmental, social and economic values of the Project been identified in Section 21.9. Mitigation measures have been developed in accordance with relevant legislation, including the EP Act and the WRR Act. They have also been prepared to align with the waste and resource management hierarchy (refer Figure 21.2). With the exception of spoil, no significant waste streams have been identified for the Project.

21.10 Cumulative impacts

The construction of the Project will generate a number of waste streams that will be managed by maximising opportunities to avoid or reduce, reuse and recycle using standard industry practice (refer Table 21.14); however, there will be waste streams for which this cannot be achieved, and these will be disposed of within appropriately licensed facilities.

Cumulative impacts arising from waste management activities on surrounding environmental values and sensitive receptors will largely be the product of waste disposal adversely affecting airspace consumption of local waste management infrastructure, thereby potentially reducing the local community's access to such services. Further details on the potential for cumulative impacts to arise as a result of the Project, in combination with others, is in Chapter 22: Cumulative Impacts. Details on the assessment methodology for cumulative impacts is in Chapter 4: Assessment Methodology.

The projects considered to have a potential for cumulative impacts relating to waste and resource management are those with an overlapping construction timeframe and potential for shared demand on existing waste management facilities. In this context, the projects that may result in cumulative impacts have been identified as:

- B2G (Inland Rail)
- H2C (Inland Rail)
- InterLinkSQ.

The time overlap of these projects can provide an opportunity to improve resource efficiency across all projects.

B2G and H2C projects are both Inland Rail projects and despite the potential for cumulative impacts on receiving waste management facilities, ARTC will liaise with the relevant operators to negotiate appropriate waste disposal arrangements across the three Inland Rail projects. There is an opportunity to consolidate supply material reuse across all Inland Rail projects. Spoil material and construction and demolition waste such as concrete from these projects can be crushed up and used as an aggregate or fill if determined to be geotechnically suitable which consequently will reduce the need to borrow material from quarries, thereby reducing the overall environmental impact of the Project.

As for InterLinkSQ, the construction period may extend to 2037 reducing the potential construction phase overlap with the construction timeframe of the Project. Therefore, the risk of cumulative impacts from the interaction of these projects is considered to be Low.

TABLE 21.14: ASSESSMENT OF WASTE MANAGEMENT CUMULATIVE IMPACT

Project	Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
NSW/Queensland Border to Gowrie (Inland Rail)	Airspace consumption of local waste management infrastructure, thereby reducing the local community's access to such services	Probability of the impact	2	5	Low
		Duration of the impact	1		
		Magnitude/intensity of the impact	1		
		Sensitivity of the receiving environment	1		
Helidon to Calvert (Inland Rail)	Impacts on the local environment and future projects from the potential use of explosives for tunnel construction.	Probability of the impact	1	5	Low
		Duration of the impact	1		
		Magnitude/intensity of the impact	2		
		Sensitivity of the receiving environment	1		
InterLinkSQ	Impacts on the local environment and future projects from the potential use of explosives for tunnel construction.	Probability of the impact	1	5	Low
		Duration of the impact	1		
		Magnitude/intensity of the impact	2		
		Sensitivity of the receiving environment	1		

21.11 Conclusion

The waste quantities and streams generated during the construction and operation phases of the Project will vary. The construction phase will produce the greatest quantity of waste mainly categorised as construction and demolition waste, which includes concrete, steel, timber and spoil in addition to the green waste generated as a result of clearing and grubbing activities. The waste generated during the operational phase will mainly include general waste, green waste and some construction and demolition and regulated waste arising from repair works.

The control measures proposed to manage the waste streams are aligned with the waste and resource management hierarchy to effectively mitigate the potential impact on environmental values and sensitive receptors, where avoidance is the priority and landfill disposal is the least preferred and last option. Any spoil that would not be reused as fill or for rehabilitation works within the Project will be stockpiled within the disturbance footprint at the western tunnel portal to be reused for other adjoining or future projects. Disposal facilities that accept soil material include a number of landfills in Toowoomba and Lockyer Valley LGAs with the Toowoomba Waste Management Centre identified as the major facility to receive spoil due to having greater capacity and proximity to the Project. The requirements of each facility to accept spoil will be determined at the time of construction in consultation with the relevant local council and/or operator. Consultation with the relevant councils and other stakeholder may also identify opportunities to repurpose clean fill for landfill closure or rehabilitation activities.

A range of potential impacts associated with waste arising from the execution of the Project have been identified and mitigation and management measures for those impacts throughout the life of the Project are proposed. Performance and monitoring requirements for the management of the generated waste streams has been identified. The mitigation measures and the monitoring requirements will be re-assessed during the detail design and construction phases to ensure their currency and applicability and will be used in the:

- Implementation of waste management strategies into the detail design and construction including establishing Project-specific waste reduction targets
- Development and implementation of the Waste Management Sub-plan within the CEMP
- Development and implementation of appropriate procedures for the storage, handling, treatment and transport of waste for all project phases
- Incorporation of the spoil management strategy into the CEMP.

In summary, all reasonable measures will be taken to reduce the impact of the generated waste streams on the environment which could occur during handling, treatment, storage and transport, by implementing the control measures throughout the lifecycle of the Project. This will include avoiding the generation of waste by optimising the design, followed by adopting sustainable procurement, and later during the Project delivery, by promoting reusing and recycling of generated waste material. With the implementation of the proposed control measures, the Project will not pose significant risk to the surrounding environment, community and ecosystems as a result of waste being generated from the Project.