24 Materials and Waste Management

Contents

Table of Acronyms

Acronym	Meaning
AER	Annual Environmental Report
C&D	Construction & Demolition
CIF	Construction Industry Federation
CIRIA	Construction Industry Research & Information Association
C&D	Construction and Demolition
C&D WMP	Construction and Demolition Waste Management Plan
CEMP	Outline Construction Environmental Management Plan
DCC	Dublin City Council
DP	Demolition Plan
EPB	Earth Pressure Balance
EIAR	Environmental Impact Assessment Report
EMR	Eastern-Midlands Region
EPA	Environmental Protection Agency
ESBN	Electricity Supply Board Networks Ltd.
EWC	European Waste Catalogue
FCC	Fingal County Council
GHG	Greenhouse Gases
GI	Ground investigations
IEMA	Institute of Environmental Management & Assessment
IT	Information Technology
LoW	List of Waste code
MSW	Municipal Solid Waste
NWCPO	National Waste Collection Permit Office
TII	Transport Infrastructure Ireland
TBM	Tunnel Boring Machine
WEEE	Waste Electrical and Electronic Equipment
WFD	Waste Framework Directive
WTF	Waste Transfer Forms

24. Materials & Waste Management

24.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) assesses the impact of the MetroLink Project (hereafter referred to as the proposed Project) on materials and waste management during the Construction Phase and Operational Phase.

This Chapter describes and assesses the likely direct and indirect significant effects of the proposed Project on materials and waste management, in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (i.e. the EIA Directive) (European Union, 2014a).

This Chapter should be read in conjunction with the following Chapters, and their Appendices, which present related impacts arising from the proposed Project and proposed mitigation measures to ameliorate the predicted impacts:

- Chapter 9 (Traffic & Transport);
- Chapter 10 (Human Health);
- Chapter 13 (Airborne Noise & Vibration);
- Chapter 16 (Air Quality);
- Chapter 17 (Climate);
- Chapter 18 (Hydrology);
- Chapter 19 (Hydrogeology); and
- Chapter 20 (Soils & Geology).

The assessment is based on identifying and describing the likely significant effects arising from the proposed Project as described in Chapters 4 to 6 of this EIAR. The proposed Project description is based on the design prepared to inform the planning stage of the project and to allow for a robust assessment as part of the Environmental Impact Assessment (EIA) Process.

Where it is required to make assumptions as the basis of the assessment presented here, these assumptions are based on advice from competent project designers and are clearly outlined within the Chapter.

24.2 Outline Project Description

A full description of the proposed Project is provided in the following Chapters of this EIAR:

- Chapter 4 (Description of the MetroLink Project);
- Chapter 5 (MetroLink Construction Phase); and
- Chapter 6 (MetroLink Operations & Maintenance).

Limits of deviation have been set for the proposed Project and this is addressed in the Wider Effects Report annexed at Appendix A5.19.

Table 24.1 presents an outline description of the key proposed Project elements which are appraised in this Chapter. Diagram 24.1 presents an outline of the main elements of the proposed Construction Phase that are appraised in this Chapter and Diagram 24.2 presents an outline of the main elements of the Operational Phase of the proposed Project that are appraised in this Chapter.

Table 24.1: Outline Description of the Principal Project Elements

Project Elements	Outline Description
Permanent Project Elements	
Tunnels	It is proposed to construct two geographically separate, single-bore tunnels, using a Tunnel Boring Machine (TBM). Each section of tunnel will have an 8.5m inside diameter and will contain both northbound and southbound rail lines within the same tunnel. These tunnels will be located as follows: ▪ The Airport Tunnel: running south from Dublin Airport North Portal (DANP) under Dublin Airport and surfacing south of the airport at Dublin Airport South Portal (DASP) and will be approximately 2.3km in length; and ▪ The City Tunnel: running for 9.4km from Northwood Portal and terminating underground south of Charlemont Station.
Cut Sections	The northern section of the alignment is characterised by a shallow excavated alignment whereby the alignment runs below the existing ground level. Part of the cut sections are open at the top, with fences along the alignment for safety and security. While other sections are "cut and cover", whereby the alignment is covered.
Tunnel Portals	The openings at the end of the tunnel are referred to as portals. They are concrete and steel structures designed to provide the commencement or termination of a tunnelled section of route and provide a transition to adjacent lengths of the route which may be in retained structures or at the surface. There are three proposed portals, which are: ▪ DANP; ▪ DASP; and ▪ Northwood Portal. There will be no portal at the southern end of the proposed Project, as the southern termination and turnback would be underground.
Stations	There are three types of stations: surface stations, retained cut stations and underground stations: ▪ Estuary Station will be built at surface level, known as a 'surface station'; ▪ Seatown, Swords Central, Fosterstown Stations and the proposed Dardistown Station will be in retained cutting, known as 'retained cut stations'; and ▪ Dublin Airport Station and all 10 stations along the City Tunnel will be 'underground stations'.
Intervention Shaft	An intervention shaft will be required at Albert College Park to provide adequate emergency egress from the City Tunnel and to support tunnel ventilation. Following the European Standard for safety in railway tunnels TSI 1303/2014: Technical Specification for Interoperability relating to 'safety in railway tunnels' of the rail system of the European Union, it has been recommended that the maximum spacing between emergency exits is 1,000m. As the distance between Collins Avenue and Griffith Park is 1,494m, this intervention shaft is proposed to safely support evacuation/emergency service access in the event of an incident. This shaft will also function to provide ventilation to the tunnel. The shaft will require two 23m long connection tunnels extending from the shaft, connecting to the main tunnel. At other locations, emergency access will be incorporated into the stations and portals or intervention tunnels will be utilised at locations where there is no available space for a shaft to be constructed and located where required (see below).
Intervention Tunnels	In addition to the two main 'running' tunnels, there are three shorter, smaller diameter tunnels. These are the evacuation and ventilation tunnels (known as Intervention Tunnels): ▪ Airport Intervention Tunnels: parallel to the Airport Tunnel, there will also be two smaller diameter tunnels; on the west side, an evacuation tunnel running northwards from DASP for about 315m, and on the east side, a ventilation tunnel connected to the main tunnel and extending about 600m from DASP underneath Dublin Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands.

Project Elements	Outline Description
	▪ Charlemont Intervention Tunnel: The City Tunnel will extend 320m south of Charlemont Station. A parallel evacuation and ventilation tunnel is required from the end of the City Tunnel back to Charlemont Station to support emergency evacuation of maintenance staff and ventilation for this section of tunnel.
Park and Ride Facility	The proposed Park and Ride Facility next to Estuary Station will include provision for up to 3,000 parking spaces.
Broadmeadow and Ward River Viaduct	A 260m long viaduct is proposed between Estuary and Seatown Stations, to cross the Broadmeadow and Ward Rivers and their floodplains.
ESBN Substation and Grid Connections	Grid connections will be provided via cable routes with the addition of new 110kV substations at DANP and Dardistown. (Approval for the proposed grid connections to be applied for separately, but are assessed in the EIAR).
Dardistown Depot	A maintenance depot will be located at Dardistown. It will include: ▪ Vehicle stabling; ▪ Maintenance workshops and pits; ▪ Automatic vehicle wash facilities; ▪ A test track; ▪ Sanding system for rolling stock; ▪ The Operations Control Centre for the proposed Project; ▪ A substation; ▪ A mast; and ▪ Other staff facilities and a carpark.
Operations Control Centre	The main Operations Control Centre (OCC) will be located at Dardistown Depot and a back-up OCC will be provided at Estuary.
M50 Crossing	A 100m long viaduct to carry the proposed Project across the M50 between the Dardistown Depot and Northwood Station.
Temporary Project Elements	
Construction Compounds	There will be 34 Construction Compounds including 20 main Construction Compounds, 14 Satellite Construction Compounds required during the Construction Phase of the proposed Project. The main Construction Compounds will be located at each of the proposed station locations, the portal locations and the Dardistown Depot Location (also covering the Dardistown Station) with satellite compounds located at other locations along the alignment. Outside of the Construction Compounds there will be works areas and sites associated with the construction of all elements of the proposed Project, including an easement strip along the surface sections.
Logistics Sites	The main logistics sites will be located at Estuary, near Pinnock Hill east of the R132 Swords Bypass and north of Saint Margaret's Road at the Northwood Compound (these areas are included within the 14 Satellite Construction Compounds).
Tunnel Boring Machine Launch Site	There will be two main tunnel boring machine (TBM) launch sites. One will be located at DASP which will serve the TBM boring the Airport Tunnel and the second will be located at the Northwood Construction Compound which will serve the TBM boring the City Tunnel.

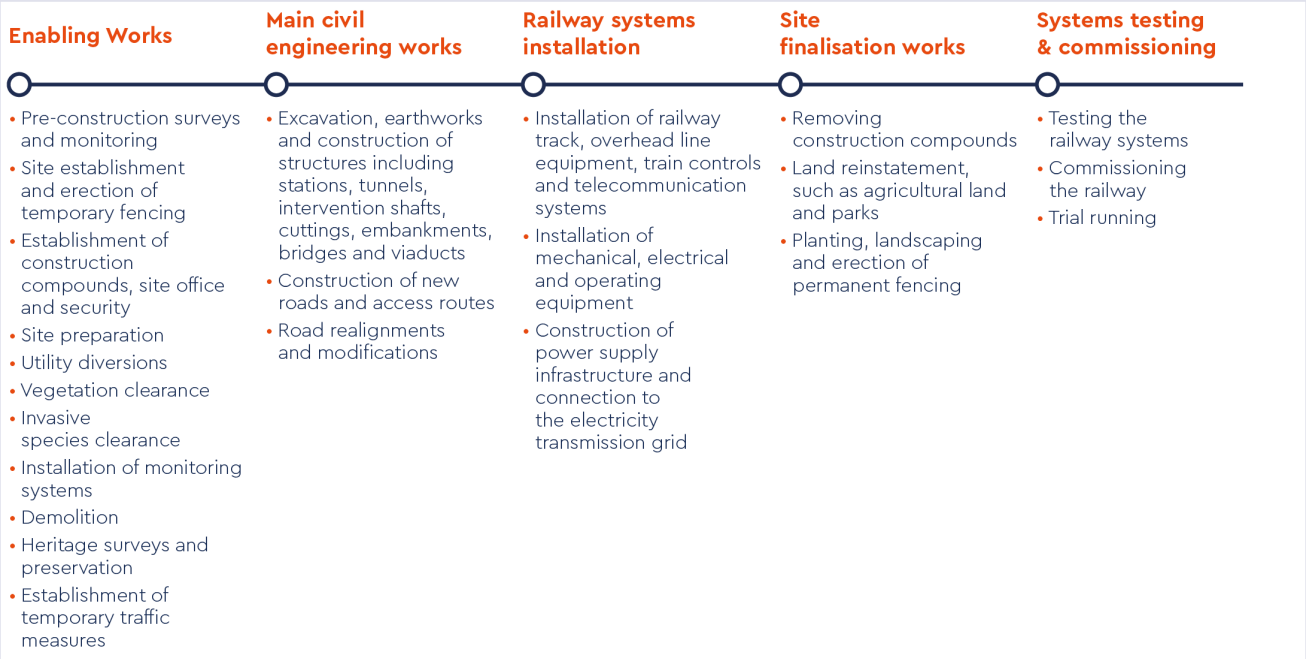

Diagram 24.1: Summary of Key Activities during the Construction Phase of the Proposed Project

Diagram 24.2 Summary of Key Activities during the Operation Phase of the Proposed Project

24.3 Methodology

24.3.1 Study Area

In accordance with the Institute of Environmental Management & Assessment (IEMA) guidance, the assessment of materials and waste has utilised two geographically different study areas to examine the use of materials and the generation and management of waste:

- The first study area comprises the proposed Project Boundary and any areas required for temporary access, site compounds, working platforms and other enabling activities. Where materials will be consumed, and materials/waste will be generated.

The second study area extends to the availability of construction materials and capacity of waste management licensed infrastructure and remaining landfill void likely to be suitable (permitted for waste volume and type) to accept arisings and/or waste generated by the proposed Project. This includes the Eastern Midlands Region (EMR) (regional) and Ireland (national) as a whole where applicable in order to capture potential impacts of recovering, recycling or disposal of the waste generated from the proposed Project at landfills located throughout the country. Disposal of Hazardous Waste going to other European Countries has also been appraised.

24.3.2 Relevant Guidelines, Policy and Legislation

The methodology used to assess the impacts associated with materials and waste is consistent with, and cognisant of, relevant guidance including, but not limited to:

- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2017);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EIAR) (EPA 2022);
- Draft Advice Notes for Preparing Environmental Impact Statements (EPA 2015);
- EIA Projects - Guidance on Scoping (EU 2017);
- EIA Projects - Guidance on the preparation of the EIAR (EU 2017);
- IEMA Guide to: Materials and Waste in Environmental Impact Assessment (IEMA 2020);
- Handling, Treatment and Disposal of Tunnel Spoil Materials – Working Groups 14 and 15 Underground Construction and the Environment and Mechanized Tunnelling (International Tunnelling and Underground Space Association (AITES) 2019);
- Guidelines for the Management of Waste from National Road Construction Projects (TII 2017);
- The Management of Waste from National Road Construction Projects (GE-ENV-01101) (TII 2017);
- Guidance on Soil and Stone By-products in the Context of Article 27 of the European Communities (Waste Directive) Regulations 2011 (EPA 2019);
- By-Product Guidance Note – A Guide to by-products and submitting a by-product notification under Article 27 of the European Communities (Waste Directive) Regulations 2011 (EPA, 2020).
- Guidance on waste acceptance criteria at authorised soil recovery facilities (EPA,2021).
- Best Practice Guidelines on the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects (EPA 2021);
- EU Pathway to a Healthy Planet for All EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' and associated waste targets for 2030 (European Commission, 2021);
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (TII 2008); and
- CIRIA Document 133 Waste Minimisation in Construction (CIRIA 1997).

As part of the compilation of this Chapter the following EU, national and local policy documents were reviewed with respect to waste management policies:

- EU Construction & Demolition Waste Management Protocol (EC 2016);
- A Waste Action Plan for a Circular Economy – Ireland's National Waste Policy 2020-2025; (Government of Ireland, 2020);
- Towards a Resource Efficient Ireland: A National Strategy to 2020 incorporating Ireland's National Waste Prevention Programme (2014);
- Circular Economy Action Plan – For a Cleaner and More Competitive Europe (EC 2020);
- National Hazardous Waste Management Plan 2021-2027 (EPA, 2021);
- A Resource Opportunity – Waste Management Policy in Ireland (Department of Environment, Community and Local Government1 2012);
- Construction & Demolition Waste: Soil and Stone Recovery / Disposal Capacity (RPS on behalf of DCC 2016);
- Review of Soil Waste Management in the Greater Dublin Area – Market Analysis Report (RPS on behalf of Construction Industry Federation (CIF) 2016);
- Eastern – Midlands Region Waste Management Plan 2015-2021; (EMRW Office, 2015);
- Fingal Development Plan 2017-2023;
- Draft Fingal Development Plan 2023 – 2029;
- Dublin City Development Plan 2016-2022; and
- Draft Dublin City Development Plan 2022 – 2028.

In addition, the following documents and legislation have been reviewed:

- The EIA Directive (2014/52/EU);
- The EU Waste Framework Directive (2018/851) (as amended);

[1] Now Department of Communications, Climate Action and Environment

- Waste Directive Regulations 2011 (S.I. No. 126 of 2011);
- The Waste Management Act 1996 (as amended);
- Circular Economy, Waste Management (Amendment) and Minerals Development (Amendment) Bill 2022;
- European Union (Waste Directive) Regulations 2020 (S.I. No. 323 of 2020) (as amended); and
- Waste Classification – List of Waste and Determining if Waste is Hazardous or Non-Hazardous (EPA 2015).

Some of the key policy documents as listed above are described in more detail in the following sections.

24.3.3 Key Guidelines, Policy and Legislation

The following section provides a summary of the key guidelines, policy and legislation that are applicable to the design, construction and assessment of the proposed Project and by reference to which the evaluation of the impacts on resources and waste management of the proposed Project has been carried out.

24.3.3.1 Directive 2008/98/EC on Waste (Waste Framework Directive)

The Waste Framework Directive (2008) sets out basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery. It also sets out basic waste management principles and it requires that waste be managed without endangering human health and harming the environment. In particular without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest.

The principles that the Waste Framework Directive introduces are "polluter pays principle", "extended producer responsibility" and the "waste management hierarchy". The Waste Framework Directive also requires that Member States adopt waste management plans and waste prevention programmes.

Furthermore, the Waste Framework Directive includes two recycling and recovery targets to be achieved by 2020:

- 50% of certain waste materials from households and other origins similar to households must be prepared for re-use and recycling; and
- 70% of construction and demolition waste must be prepared for re-use, recycling and other recovery

Using best practices, the proposed Project will surpass these targets with a 95% diversion of construction and demolition (inert and non-hazardous) waste target being proposed.

24.3.3.2 EU Construction & Demolition Waste Management Protocol

The European Commission introduced non-binding guidelines for the recycling and re-use of construction and demolition (C&D) waste in 2018, with the overall aim to increase confidence in the C&D waste management process and trust in the quality of C&D waste recycled materials. These guidelines are a part of the European Commission's drive towards a Circular Economy where the value of products and materials is maintained for as long as possible through reuse, with disposal of material and consumption of new resources being minimised. It aims to achieve this through:

- Improved waste identification, source separation and collection;
- Improved waste logistics;
- Improved waste processing;
- Quality management; and
- Appropriate policy and framework conditions.

This document, while not binding, provides an outline of the best practice for the management of C&D waste and is a useful guide on how to best manage waste from a construction project such as the proposed Project.

24.3.3.3 Circular Economy Action Plan – For a Cleaner and More Competitive Europe

The European Commission adopted the Circular Economy Action Plan (hereafter referred to as "the Action Plan" in March 2020 as part of the European Green Deal. This Action Plan announces initiatives along the entire life cycle of products and introduces legislative and non-legislative measures targeting seven key product value chains. One of these value chains is construction and buildings. In the Action Plan it states that the construction sector is responsible for 35% of the EU's total waste generation and an estimated 5% to 12% of total national greenhouse gas (GHG) emissions. Two of the circularity principles promoted by the Action Plan pertain to C&D waste and excavated soils as follows (EC 2020, p.11):

- 'considering a revision of material recovery targets set in EU legislation for construction and demolition waste and its material-specific fractions'; and
- 'promoting initiatives to reduce soil sealing, rehabilitate abandoned or contaminated brownfields and increase the safe, sustainable and circular use of excavated soils'.

24.3.3.4 A Waste Action Plan for a Circular Economy

A new national waste policy entitled 'A Waste Action Plan for a Circular Economy' was issued by the Irish Government in September 2020, outlining Ireland's updated goals, actions and policies to be implemented from 2020 - 2025. The new policy is structured around the framework provided in the EU's Second Circular Economy Action Plan launched in March 2020. The policy is intended to move Ireland toward a circular economy shifting away from waste disposal, favouring circularity and sustainability by identifying and maximising the value of material through improved design, durability, repair and recycling. The plan sets out the following:

- Project Ireland 2040 sets out the State's development goals over the next 20 years which allows for the opportunity to forecast large, specific waste streams with a focus on preventing or efficiently managing the waste from these areas.
- Prevention of soil arisings which are a significant financial burden on the sector are to progress by placing value on the used material where possible. There is a strong focus on Article 27 and the end of-waste decision making process. These processes are to be streamlined and detailed guidance will be developed for specific problematic materials.
- The use of recycled construction materials will be incentivised (potentially by introducing a levy on virgin aggregates).
- The plan looks to make national end-of-waste decisions for specific construction and demolition waste streams at the earliest possible stage.
- The 2021 Best Practice Guidelines for construction and demolition waste will be revised to improve the Preparation of Waste Management Plans for Construction and Demolition Waste Projects.

Regional waste planning and associated policy actions are currently implemented through the three regional waste management plans. The current regional plans will be replaced in 2021 with a National Management Plan for a Circular Economy. This will include targets for the construction sector based on EU legislation and policy changes.

The Circular Economy, Waste Management (Amendment) and Minerals Development (Amendment) Bill 2022, which passed All Stages in the Houses of the Oireachtas in July 2022 builds on the government's commitment to achieving a circular economy as set out above in the action plan.

24.3.3.5 National Hazardous Waste Management Plan (2021-2027)

The Environmental Protection Agency has prepared a revised National Hazardous Waste Management Plan for the Republic of Ireland covering a six-year period from the date of publication (2021-2027). It sets out the priorities to be pursued to improve the management of hazardous waste, taking into account the progress made since the previous plan and the waste policy and legislative changes that have occurred since the previous plan was published.

The objectives of the National Hazardous Waste Management Plan are to:

- Support and drive priority prevention actions by industry and the public to reduce the generation of hazardous waste;
- Support the identification of adequate and appropriate collection infrastructure for all hazardous wastes with a view to mitigating environmental and health impacts;
- Endorse the proximity principle such that hazardous wastes are treated as close to the point of production as possible – including within Ireland, where feasible
- Support effective regulation of the movement and disposal of hazardous wastes in line with national policy priorities; and
- Promotion of safe reuse and recycling pathways in support of the circular economy.

The revised National Hazardous Waste Management Plan makes 27 recommendations around prevention, collection, self-sufficiency, regulations, legacy issues, guidance and awareness and implementation.

The Plan sets out a set of recommendations to be actioned within its lifetime to strengthen protection of the environment and human health through best-practice management of hazardous wastes.

24.3.3.6 Eastern-Midlands Region (EMR) Waste Management Plan 2015-2021

The proposed Project falls within the EMR. A Waste Management Plan for the region was published in 2015, compiled by DCC on behalf of all Local Authorities in the EMR (DCC 2015). It commits to a large and varied number of waste management policies and objectives for the region. The EMR Waste Management Plan contains several policies and objectives aimed at generally improving waste management in the region. These include:

- Policy A.1 which calls for the region to 'Take measures to ensure the best overall outcome by applying the waste hierarchy to the management of waste streams' (DCC 2015, p.212).
- Policy A.3 which sets out the need to 'Contribute to the improvement of management performance across all waste streams through the implementation of policy actions and monitor progress towards national targets' (DCC 2015, p.213).
- Strategic Objective A states that 'The region will implement EU and national waste and related environmental policy, legislation, guidance and codes of practice to improve management of material resources and wastes' (DCC 2015, p.212).
- Strategic Objective G states that the region is to 'Apply the relevant environmental and planning legislation to waste activities in order to protect the environment, in particular European sites, and human health against adverse impacts of waste generated' (DCC 2015, p.225).

24.3.3.7 County/City Development Plans

The proposed Project will be located in the Local Authority areas of FCC and DCC. The Development Plans for these Local Authority areas are discussed in further detail below.

24.3.3.7.1 Fingal Development Plan

The current Fingal Development Plan 2017-2023 (FCC 2017) discusses waste management in Chapter 7 (Movement and Infrastructure), in which 26 waste management objectives are outlined. The most relevant to the proposed Project are:

- Objective WM03: '*Implement the provisions of the Eastern Midlands Region Waste Management Plan 2015-2021 or any subsequent Waste Management Plan applicable within the lifetime of the Development Plan. All prospective developments in the County will be expected to take account of the provisions of the Regional Waste Management Plan and adhere to the requirements of that Plan'* (FCC 2017, Section 7.5 p.293); and
- Objective WM18: '*Ensure that construction and demolition Waste Management Plans meet the relevant recycling / recovery targets for such waste in accordance with the national legislation and regional waste management policy'* (FCC 2017, Section 7.5 p.296).

The draft Fingal Development Plan 2023-2029 (FCC 2022) discusses waste management in Chapter 11 (Infrastructure and Utilities), in which 15 waste management objectives are outlined. The most relevant to the proposed Project are:

- Objective Policy IUP20: 'Support the implementation of existing waste management policy and promote education and awareness on all issues associated with waste management, both at industry and community level, including the promotion of waste reduction by encouraging reuse, recycling and recovery of waste. Fingal County Council will continue to promote and support the objectives of the Eastern and Midlands Region Waste Management Plan 2015–2021, or such plans as may be updated.' (FCC 2022, Section 11.6); and
- Objective Policy CAP25: 'Have regard to existing Best Practice Guidance on Waste Management Plans for Construction and Demolition Projects as well as any future updates to these Guidelines in order to ensure the consistent application of planning requirements.' (FCC 2022, Section 5.4.4).

24.3.3.7.2 Dublin City Development Plan

The current Dublin City Development Plan 2016-2022 (DCC 2016) outlines four waste-specific policies and five objectives. Of these the most relevant to the proposed Project are:

- Policy SI19: '*To support the principles of good waste management and the implementation of best international practice in relation to waste management in order for Dublin City and the region to become self-reliant in terms of waste management'* (DCC 2016, Section 9.5.5 p.153);
- Objective SIO17: '*To promote the re-use of building materials, recycling of demolition material and the use of materials from renewable sources. In all developments in excess of 10 housing units and commercial developments in excess of 1000 sq.m, a materials source and management plan showing type of materials/proportion of re-use/recycled materials to be used shall be implemented by the developer'* (DCC 2016, Section 9.5.5 p.154); and
- Objective SIO19: *'To implement the Eastern-Midlands Regional Waste Management Plan 2015-2021 and achieve the plan targets and objectives'* (DCC 2016, Section 9.5.5 p.154).

The Elected Members will make the Dublin City Development Plan 2022-2028 at the end of October (date to be confirmed). The Development Plan outlines four waste-specific policies and five objectives. Of these the most relevant to the proposed Project are:

- Policy SI27: 'To support the principles of the circular economy, good waste management and the implementation of best practice in relation to waste management in order for Dublin City and the Region to become self-sufficient in terms of resource and waste management and to provide a waste management infrastructure that supports this objective.' (DCC 2022, Section 9.5.5); and
- Objective SIO16: 'To support the implementation of the Eastern-Midlands Regional Waste Management Plan 2015–2021 and any subsequent plans in order to facilitate the transition from a waste management economy towards a circular economy.' (DCC 2022, Section 9.5.5).

24.3.3.8 Materials Exempted from Waste Categorisation

The Waste Framework Directive sets out the exclusions from the scope of the Directive which includes the following under Article 2(1):

'(b) land (in situ) including unexcavated contaminated soil and buildings permanently connected with land;

(c) uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated.'

Materials from the proposed Project which fall within this provision are therefore not subject to the requirements of EU and National waste legislation.

24.3.3.9 Materials Classified as By-Products

Article 27 of the European Communities (Waste Directive) Regulations 2011 (Article 5 of the Waste Framework Directive) allows an economic operator to decide, under certain circumstances, that material is a by-product and not a waste. The following conditions must be met in this case:

- *'Further use of the substance or object is certain;*
- *The substance or object can be used directly without any further processing other than normal industrial practice;*
- *The substance or object is produced as an integral part of a production process; and*
- *Further use is lawful in that the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts'.*

Classification of material as a by-product means that the material is approved for a use that is not regulated by waste management legislation, and therefore is not required to be managed as per that legislation. For construction projects, excavated soil and stone can be categorised under this exemption provided the material adheres to the conditions stipulated under Article 27.

According to the EPA's Waste Data Release on 22 September 2020 covering 2018 (the latest reference year), there were by-product notifications made to the EPA for 6,251,396 tonnes of C&D material. Of this quantity, the notifications for 2,605,878 tonnes were subsequently withdrawn and the EPA determined that 907,000 tonnes were by-product as notified, with no determination made for the remaining 2,738,518 tonnes to date (EPA 2020).

24.3.3.10 End-Of-Waste Materials

If material from the proposed Project is categorised as a waste as opposed to a by-product, Article 28 of the European Communities (Waste Directive) Regulations 2011 (Article 6 of the Waste Framework Directive) allows for waste materials to be given End-of-Waste status following recovery or recycling process, as long as it meets a set of criteria as outlined in the legislation. This means that the material is no longer classified as a waste but is rather a product and therefore no longer falls under the jurisdiction of any waste management legislation. The material can therefore re-enter the supply chain. Facilities that have 'end-of-waste' status for recovered waste materials are detailed in Table 24.11.

24.3.3.11 EPA Guidance on Waste Acceptance Criteria at Authorised Soil Recovery Facilities

The EPA issued guidance in January 2020, titled 'Guidance on waste acceptance criteria at authorised soil recovery facilities.' This guidance applies to licensed, permitted and registered facilities and provides guidance to facility operators for selecting maximum concentrations and/or trigger levels for relevant contaminants in soil and stone arising from non-greenfield sources.

24.3.4 Assessment Methodology

Materials and Waste Environmental Impact Assessment Guidance (2020) published by IEMA has been used as the basis for the assessment undertaken, with the approach slightly modified to have regard to Irish conditions. This is the first industry publication to offer guidance and recommendations for EIA practitioners and stakeholders concerned with the impacts and effects of materials and waste on the environment.

The assessment undertaken presents a comparative analysis between the predicted material and waste generation for the proposed Project and the available capacity to receive the identified material.

For comparison purposes against future landfill capacity the generation of construction and demolition waste has been predicted as an average over nine years of the Construction Phase for the proposed Project. Surplus excavated material that is destined for landfill or soil recovery facilities has been averaged over a five year period given the excavation activities would occur during a shorter period.

24.3.4.1 Estimation of Volumes of Construction Materials to be used during the Construction Phase

Construction material types and quantities required to construct the proposed Project were predicted so as to inform the impact assessment. The current materials estimate provided is based on the best available information in relation to the key materials forecast to be required during the construction of the proposed Project.

For the purposes of this assessment primary aggregates have been chosen to act as a proxy indicator for materials given that large quantities of aggregates are required for this proposed Project, e.g. for direct use in unbound bulk fill and sub-base, and for indirect use in bound applications such as concrete.

24.3.4.2 Identification of Licensed Materials and Waste Management Capacity

A review of existing and proposed waste management facilities was completed in the vicinity of the proposed Project. In the first instance, all licensed or permitted facilities within the Dublin area and surrounding counties were reviewed in terms of waste types authorised for acceptance and available capacity. Due to the estimated volumes of material to be managed, the review was then expanded further in order to provide a broader overview of waste management facilities within the EMR. This was carried out through online research, namely through review of Annual Environmental Reports (AERs), information contained in waste licences, permits or certificates, and/or capacity as set out in progress reports for the different waste regions.

The data used to predict the volume of waste to be generated nationally has been based on an average of the published available data and not based on a forecast. This is because the data are not available for all years leading up to 2018 therefore it has not been possible to forecast the volume of waste generated, using statistical trend analysis, to then compare it against the remaining inert and non-hazardous landfill void capacity.

There are no dedicated hazardous waste landfills in Ireland. Any hazardous waste produced in Ireland that requires disposal has to be exported for disposal. Hazardous waste from Ireland has historically been exported to a number of European countries including the UK, Netherlands, Germany and Belgium. However, following Brexit, it has not been possible to export hazardous waste material to the UK. Therefore, for this assessment and for comparison purposes the hazardous landfill capacity in a number of European countries has been used in the assessment as discussed in Sections 24.3.7.2 and 24.3.7.4 respectively.

24.3.4.3 Estimation of Volumes of Materials to be Generated during the Construction Phase

Material types and use and waste types and quantities arising from the construction of the proposed Project were predicted to inform the impact assessment.

The characterisation of excavated material generated by the proposed Project was based on an in-depth analysis of historical land use information and geochemical data supplemented by data from a number of Geotechnical Investigations which involved the use of geological data including borehole logs and cross section, to determine the excavated material properties and assign a preliminary waste classification. The characterisation of excavated material was undertaken for the proposed Project in order to:

- Quantify the volume of excavated material to be generated;
- Quantify the volume of rock and soil to be generated; and
- Quantify the level of any contamination present in order to determine the suitability of the material for re-use and for disposal having regard to whether it could be considered inert, non-hazardous or hazardous.

The Land Contamination Interpretive Report (Appendix A20.8) provides detail on the approach used to the quantification of excavated material quantities likely to be generated by the proposed Project.

24.3.4.4 Article 27 of the European Communities (Waste Directive) Regulations 2011

A notification under Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011), as amended (Waste Directive Regulations (2011)) (referred to as Article 27) has been made to the Environmental Protection Agency on behalf of TII to classify much of the inert material to be generated by the proposed Project as a by-product and not a waste. This will allow the material to be re-used. The Article 27 Notification is in process and as there has been no determination to date on the application, two separate scenarios are outlined in this EIAR to mitigate the impact of the materials generated during the construction phase and these are as follows:

- A scenario where a significant volume of material can be re-used as it has been determined to be a by-product under Article 27. Other non-hazardous material and hazardous material generated requires management.
- A scenario where the material has been determined not to be a by-product and as such the material needs to be managed through other mechanisms to allow for re-use and/or disposal. Oher non-hazardous material and hazardous material generated requires management.

Based on the available data a preliminary assessment has been undertaken of the likely waste classification of material likely to not be included within the Article 27 application assuming off-site disposal would be required. A second scenario has also been considered, in which Article 27 has not been successful and all the excavated material requires classification as waste.

Table 24.20 provides a summary of the predicted quantities of excavated materials classified under Article 27, the quantity of excavated material to be reused onsite and those materials that are classified as inert, non-hazardous and hazardous.

Whilst the current materials estimate provides a preliminary estimate of the key materials likely to be required during the construction of the proposed Project, it does not quantify all material and product types that would be required. Therefore, the estimated quantities presented in this assessment can only be taken as approximate and indicative. The assessment parameters which form the basis of the materials and waste forecasting, will inevitably be subject to some changes as the proposed Project evolves through the construction stages.

24.3.4.5 Operational Phase

Operational impacts associated with material and waste management have not been assessed, as they were considered not to be significant (by quantity) in the context of the proposed Project. Furthermore, IEMA guidance specifies that the environmental assessment should be assessed over the course of any one full year and justifiable representative year within the first three years of commissioning.

It has been assumed that no significant maintenance activities would occur during a year in the first three years, and therefore no significant materials consumption or waste generation is likely to be realised. Operational impacts associated with material and waste management at stations have also not been assessed, as they are predicted not to be significant from the proposed Project. Further details on the types of waste that are likely to be generated during the operational phase of the proposed Project and mitigation measures anticipated to be implemented are provided in Sections 24.5.5 and 24.6.8.

The assessment of any environmental impacts and effects associated with materials and waste during maintenance or any large-scale future renewal or improvement works, will be undertaken by the future Operator in accordance with all legal and other necessary requirements. The future Operator will be required to be accredited to ISO 14001 Environmental Management Systems (or similar) for the operation and maintenance of the proposed Project. In addition, the future Operator will be required to have a Sustainability Plan which will linked to the ISO 14001 accreditation (or similar).

24.3.4.6 Comparative Assessment between Available Capacity and Material and Waste Generation and available Capacity during the Construction Phase

Material types and waste quantities predicted to arise from the construction of the proposed Project were determined as outlined above and compared to available licensed capacity for receipt of the material so as to inform the impact assessment of material used and waste generated.

The assessment of waste management capacities and available facilities, as well as potential by-product use options within the EMR is estimated based on currently published information and consultation with relevant authorities. The analysis presented here is a comparison between the predicted materials and waste generation that will arise from the proposed Project and available capacity for receipt of material during the likely years of material and waste generation.

Where predicted impacts are identified, mitigation measures will be applied in accordance with the requirements of the Waste Management Act and best practice guidance.

24.3.5 Consultation

Consultation responses from key stakeholders, landowners and the public were reviewed and taken into account in compiling the Chapter. The consultation responses relevant to materials and waste are provided in Table 24.2. Further details on the consultation on the proposed Project and responses received are included in Chapter 8 (Consultation).

Table 24.2: Resource and Waste Issues Raised During Consultation

Consultee	Comment	Relevant EIAR Section
Construction Industry Federation Meeting	Meeting held regarding material management. Discussion around options for management of the surplus excavated material: ▪ Article 27 (by-product); ▪ Article 28 (end-of-waste); ▪ Consideration of several possible locations for material; and ▪ Consideration of quarries for material disposal – there are a number within close proximity to the M50 Motorway.	These issues are covered in the following sections: ▪ Section 24.4 ▪ Section 24.6
Eastern Midlands Region Waste Management Planning Lead Authority	Following consultation with Eastern Midlands Region Waste Management Planning Lead Authority: ▪ Significant quantity of potential spoil arising from the proposed Project; ▪ Lack of headroom within the current domestic market; ▪ Importance of characterisation of material as early as possible in order to identify management options; ▪ Identification of the five likely categories into which the spoil will fall; ▪ Highlighted the fact that non-hazardous landfills (Ballynagran, Knockharley and Drehid) also take municipal waste, which takes precedent over C&D waste; ▪ Recently there has been a need to export non-hazardous soils due to the lack of capacity within the domestic market, likely that this will be required for this proposed Project if the current circumstances continue; and ▪ Encourage TII to explore alternatives domestically and to adopt a Circular Economy approach.	These issues are covered throughout this Chapter, but are specifically addressed in the following sections: ▪ Section 24.4 ▪ Section 24.5 ▪ Section 24.6
Integrated Material Solutions	Discussing options for managing material and waste generated by the proposed Project.	These issues are covered throughout this Chapter but are

Consultee	Comment	Relevant EIAR Section
		mainly addressed in Section 24.4.
Roadstone	Discussing options for managing material and waste generated by the proposed Project.	These issues are covered throughout this Chapter but are mainly addressed in Section 24.4.
Hazardous waste facilities in Ireland	Discussing options for managing hazardous waste generated by the proposed Project. Indication that the hazardous waste generated by the proposed Project could be treated	
Irish Georgian Society	The Irish Georgian Society was not in a position to undertake scoping exercises for individual projects and proposals.	Acknowledged.
Department of Environment, Climate and Communications	▪ Prevention of waste – no mention of such measures. ▪ Opportunities to reuse material on site. ▪ Scoping recycling/recovery of the material off-site in advance. ▪ Measures to ensure uncontaminated/contaminated soils are segregated. ▪ Quantity of material and classification of material mentioned later in EIAR.	These comments have been taken on board and reflected in this chapterand Chapter 20 (Soils & Geology) of the EIAR for more information, which include measures to prevent or reduce waste and details on recycling and/or recovery of the material off-site, and measures on soil contamination.
Department of the Environment, Climate and Communications	Provided reference to the following specific policies and guidelines: ▪ A Resource Opportunity - Waste Management Policy in Ireland (DECLG 2012) https://www.gov.ie/en/publication/a9d98-a-resource-opportunity-waste-management-policy-in-ireland/ ▪ Towards a Resource Efficient Ireland (EPA 2012) https://www.epa.ie/waste/nwpp/ ▪ Construction and Demolition Web Resources & https://www.epa.ie/our-services/monitoring--assessment/circular-economy/construction--demolition/ Reference should also be made to the EU Construction and Demolition Waste Management Protocol (European Commission 2016) developed as part of the European Commission's Circular Economy Action Plan	These plans/guidelines have been taken on board and reflected in this chapter.
Department of Communications, Climate Action and Environment	With respect to waste, the Local Authority should consult directly with their respective Regional Waste Management Planning Office regarding the development of the final plans.	This comment has been taken on board. Further consultation has taken place with Eastern and Midlands Regional Waste Offices, Fingal County Council and Dublin City Council.
FCC	Consideration should be given to provide the exact locations for disposal of the waste.	Discussions have been ongoing with relevant stakeholders as to potential waste

Consultee	Comment	Relevant EIAR Section
		locations and is detailed inthis chapter.

24.3.6 Appraisal Method for the Assessment of Impacts

The impact assessment and identification of mitigation measures aims to manage proposed Project materials and waste more effectively in order to reduce the impacts associated with the acquiring of resources and materials, as well as reducing the amount of waste requiring final disposal during the Construction Phase. Any waste which is generated will be dealt with in adherence to the waste hierarchy (Refer to Diagram 24.3), with the main priority being to prevent waste from being generated in the first place, and to prevent any waste which is generated from requiring disposal at a landfill. Landfill is the least favoured option to deal with waste, and the quantity of waste being landfilled is being significantly reduced across Europe. According to the EPA National Waste Statistics, over the last decade the number of landfills accepting municipal waste in Ireland has fallen from 29 in 2007 to five in 2018.

Diagram 24.3: Waste Hierarchy (European Commission)

The types and quantities of construction materials required as well as waste to be generated through the construction of the proposed Project have been estimated, along with estimates of the quantities to be reused within the proposed Project and waste recycled/recovered off site. Materials import and waste export during the Construction Phase, of the proposed Project, has been assessed against the assessment criteria detailed within the IEMA Materials and Waste in Environmental Impact Assessment guidance (IEMA 2020). These criteria for determining the sensitivity of the receptor, magnitude of impact and significance of effect are provided in Section 24.3.7.

24.3.7 Impact Assessment Criteria

The IEMA assessment method focuses on determining the likely significant effects of constructing the proposed Project on the environment resulting from the consumption of materials and the generation of waste. The IEMA guidance sets out how to assess the significance of environmental effect based on the consideration of the sensitivity of the receptor in combination with the magnitude of the impact. It should be noted that the IEMA guidance assesses landfill void capacity for inert and non-hazardous

landfills collated together and hazardous landfills. However, an additional breakdown of impact on landfill void capacity for inert and non-hazardous landfills has been provided separately in Section 24.7.1.

24.3.7.1 Sensitivity of the Receptor - Materials

The sensitivity of the receptor relates to the availability and type of materials to be consumed by the proposed Project. The sensitivity of materials can be determined by identifying where one or more of the criteria from the thresholds detailed in Table 24.3 are met. Materials are considered to be a receptor as well as a source of effect.

Table 24.3: Sensitivity Criteria for Materials (IEMA 2020)

Value	Description
	On balance, the key materials required for construction of a development
Very High	Are known to be insufficient in terms of production, supply and/or stock; and/or Comprise no sustainable features and benefits compared to industry-standard materials.*
High	Are forecast (through trend analysis and other information) to suffer from known issues regarding supply and stock; and/or Comprise little or no sustainable features and benefits compared to industry-standard materials.*
Medium	Are forecast (through trend analysis and other information) to suffer from some potential issues regarding supply and stock; and/or Are available comprising some sustainable features and benefits compared to industry-standard materials.*
Low	Are forecast (through trend analysis and other information) to be generally free from known issues regarding supply and stock; and/or Are available comprising a high proportion of sustainable features and benefits compared to industry-standard materials.*
Negligible	Are forecast (through trend analysis and other information) to be free from known issues regarding supply and stock; and/or Are available comprising a very high proportion of sustainable features and benefits compared to industry-standard materials.*
*Subject to supporting evidence, sustainable features and benefits could include, for example, materials or products that: comprise reused, secondary or recycled content (including excavated and other arisings); support the drive to a circular economy; or in some other way reduce lifetime environmental impacts.	

24.3.7.2 Sensitivity of the Receptor - Waste

The sensitivity of waste relates to the availability of regional (and where appropriate national) landfill void capacity in the absence of the proposed Project. Landfill capacity is seen as unsustainable and increasingly scarce option for managing waste. The sensitivity of landfill void capacity is assessed by applying the following two step process:

- The volume of waste for disposal that is predicted to be generated within a defined first study area is calculated by analysing the available data and by providing justified forecasts over the Construction Phase of the proposed Project;
- The volume of forecast waste for disposal within the defined study area is then compared to the remaining landfill void capacity to identify predicted losses in that capacity over the Construction Phase of the proposed Project; and

- The sensitivity of landfill void capacity can be determined through the criteria thresholds detailed in Table 24.4.

Table 24.4: Sensitivity Criteria for Regional Inert, Non-Hazardous and Hazardous Landfill Void Capacity (IEMA 2020)

Value	Description	
	Inert and Non-Hazardous Landfill	Hazardous Landfill
	Across construction, the baseline/future baseline (i.e. without development) of regional (or where justified, national) inert, non-hazardous and hazardous landfill void is expected to...	
Very High	...reduce very considerably (by >10%); end during construction or operation; is already known to be unavailable; or, would require new capacity or infrastructure to be put in place to meet forecast demand.	...reduce very considerably (by >1%); end during construction or operation; is already known to be unavailable; or, would require new capacity or infrastructure to be put in place to meet forecast demand.
High	...reduce considerably: by 6% to 10% as a result of wastes forecast.	...reduce considerably: by 0.5% to 1% as a result of wastes forecast.
Medium	...reduce noticeably: by 1% to 5% as a result of wastes forecast	...reduce noticeably: by 0.1% to 0.5% as a result of wastes forecast.
Low	...reduce minimally: by <1% as a result of wastes forecast.	...reduce minimally: by <0.1% as a result of wastes forecast.
Negligible	...remain unchanged, or is expected to increase through a committed change in capacity	...remain unchanged or is expected to increase through a committed change in capacity.

24.3.7.3 Assessing Magnitude – Materials

The methodology for assessing the magnitude of impact from materials comprises a percentage-based approach that determines the influence of materials consumption on the baseline market capacity (production, stocks or sales), in construction. The approach for assessing the magnitude of impact for materials is detailed in Table 24.5.

Table 24.5: Assessing Magnitude for Materials (IEMA 2020)

Value	Description
	The assessment is made by determining whether through a development, the consumption of...
Major	...one or more materials is >10% by volume of the regional* baseline availability;
Moderate	...one or more materials is between 6% to 10% by volume of the regional* baseline availability;
Minor	...one or more materials is between 1% to 5% by volume of the regional* baseline availability
Negligible	...no individual material type is equal to or greater than 1% by volume of the regional* baseline availability.
No change	...no materials are required.
* or where justified, national.	

24.3.7.4 Assessing Magnitude – Waste

The magnitude of impact from waste is assessed by determining the percentage of the remaining landfill void capacity that will be depleted by waste produced during the construction of the proposed Project. This is the method that best suits the scale and nature of the proposed Project. The magnitude criteria for assessing the inert, non-hazardous and hazardous landfill capacity void are detailed in Table 24.6.

Table 24.6: Magnitude Criteria for Inert, Non-Hazardous and Hazardous Landfill Void Capacity (IEMA 2020)

Value	Description	
	Inert and Non-Hazardous Landfill	Hazardous Landfill
Major	Waste generated by the development will reduce national landfill void capacity baseline # by >10%.	Waste generated by the development will reduce national landfill void capacity baseline # by >1%.
Moderate	Waste generated by the development will reduce national landfill void capacity baseline # by 6% to 10%.	Waste generated by the development will reduce national landfill void capacity baseline # by <0.5% to 1%.
Minor	Waste generated by the development will reduce national landfill void capacity baseline # by 1% to 5%.	Waste generated by the development will reduce national landfill void capacity baseline # by <0.1% to 0.5%.
Negligible	Waste generated by the development will reduce national landfill void capacity baseline # by <1%.	Waste generated by the development will reduce national landfill void capacity baseline # by <0.1%.
No change	Zero waste generation and disposal from the development.	Zero waste generation and disposal from the development.
# Forecast as the worst-case scenario, during a defined construction and/or operational phase		

For this assessment national landfill void capacity has been used, the three inert landfills in the country are all located in the EMR. There are two non-hazardous landfill facilities in the EMR. Figure 24.1 shows the location of inert and non-hazardous landfills surrounding the proposed Project.

There is no dedicated hazardous waste landfill capacity in Ireland. Any hazardous waste produced in Ireland that requires disposal has to be exported for disposal. Hazardous waste is exported to UK, Netherlands, Germany and Belgium. Data from the EPA (2019) shows that between 2015 and 2019 the UK accepted the most hazardous waste from Ireland followed by Netherlands, Germany and Belgium. Given that a large quantity of hazardous waste generated in Ireland is exported and under current laws due to Brexit no hazardous waste can be exported to the UK, for this assessment and for comparison purposes the hazardous landfill capacity in Germany has been used to assess the likely impacts on hazardous waste landfill capacity.

24.3.7.5 Determining Significance

The potential for significant environmental effects is determined by considering the scale and nature of impacts within the context of the sensitivity of receptors affected as shown in Table 24.7.

Table 24.7: Determining Significance for Materials and Waste

Sensitivity (or Value) of Receptor	Magnitude of impact				
	No change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
High	Neutral	Slight	Sight or Moderate	Moderate or Large	Large or Very Large
Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Sight or Moderate
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

For both materials and waste for an environmental effect to be considered significant it must fall within the moderate, large or very large category. For an environmental effect to be considered not significant it must fall within either the neutral or slight category.

24.3.7.6 Mitigation Measures

Where predicted impacts are identified, mitigation measures will be applied in accordance with the requirements of the Waste Management Act and best practice guidance.

24.4 Baseline Environment

A desk-based assessment has been undertaken in order to establish, for the first and second study areas, the current and likely future conditions (in the absence of the proposed Project) for materials and waste. Baseline data has been collected at national and regional level, including: availability of construction aggregates; construction, demolition and excavation waste arisings; as well as information on regional and national waste transfer and treatment and disposal facilities capacity.

24.4.1 Materials

The 'Essential Aggregates: Providing for Ireland's needs to 2040' report (Irish Concrete Federation 2018) details that Ireland has abundant natural reserves of high-quality aggregates (stone, sand and gravel). The Irish quarrying industry comprises approximately 500 active quarries. These quarries produce aggregates from crushed rock, sand and gravel. Aggregates are also the basic raw materials for concrete products which are ubiquitous in Ireland's built environment.

Table 24.8 provides quantity information on the total aggregates production in Ireland between 2013 to 2018. There are approximately 220 ready mixed concrete plants and 20 large scale precast concrete plants located throughout Ireland. In addition, there are 40 plants producing bitumen bound road surfacing materials for Ireland's national road network. Table 24.9 provides quantity information on the total ready mixed concrete in Ireland between 2013 and 2018.

Table 24.8: Total Aggregates Production in Ireland 2013-2018

	2013	2014	2015	2016	2017	2018
Aggregates	Tonnes					
	25,000,000	26,000,000	28,000,000	33,000,000	32,000,000	36,000,000

Table 24.9: Total Ready Mixed Concrete in Ireland 2013-2018

	2013	2014	2015	2016	2017	2018
Ready mixed concrete	m^3					
	2,400,000	3,000,000	3,500,000	4,100,000	4,500,000	4,900,000

The proposed Project will source materials for construction, and it is best practice to use local suppliers and to re-use materials on site to minimise the attendant environmental impact and cost of waste transport and support the economic well-being of the local communities in line with the proximity principle.

Both secondary and recycled aggregates can be used as alternatives to primary aggregate and have a number of benefits, including the reuse of secondary and waste materials and reducing the impact of primary extraction. Secondary aggregates are typically by-products of industrial processes. These can be sub-divided into manufactured and natural aggregates, depending on their source and can include materials such as pulverised fuel ash, ground granulated blast furnace slag, incinerator bottom ash and recycled glass. Whereas recycled aggregates are typically derived from reprocessing inert materials previously used in construction (e.g. road planning's or crushed concrete).

24.4.2 Construction and Demolition Waste

The Waste Framework Directive requires that the majority of non-hazardous C&D waste (minimum of 70% (excluding natural soils and stone)) shall be prepared for re-use, recycled or subjected to other material recovery, including backfilling operations using waste to substitute other materials by 2020. According to the EPA's Progress to EU Targets (EPA 2021) Ireland has achieved this target, recovering 84% in 2019 (the last year for which statistics are currently available). According to the most recent EPA Waste Data Release on 21 November 2021, covering 2019 (the latest reference year):

- The quantity of C&D waste generated and collected in Ireland was 8.8 million tonnes, representing an increase of 2.6 million tonnes in 2018.
- In 2019 soil and stone waste accounted for over 85% of total C&D waste. In 2019, concrete, brick, tile and gypsum accounted for 8.6% of the total C&D waste, mixed C&D wastes were 4.5% and metals were responsible for 2.2%. The remaining 1.3% is made up of bituminous material and segregated wood, glass and plastic.
- 96% underwent final treatment in Ireland, with the remaining 4% being exported.
- 82% was recovered through backfilling2 (due to the high proportion of soil and stone), 7% was recycled and 10% was disposed of.

The proposed Project lies entirely within the EMR and is therefore governed by the requirements of the EMR Waste Management Plan 2015-2021. The following is a description of the current waste management baseline within this region and Ireland as a whole, including information on current waste management facilities and estimates of current capacity.

The C&D waste and excavated material generated by the proposed Project, will be primarily inert and non-hazardous waste. However, there is also predicted to be small volumes of hazardous waste. The Land Contamination Interpretive Report (Appendix A20.8) states that the majority of soils, subsoils and bedrock which will be excavated within the first study area is natural material which is free from contamination. The material with greatest potential to be hazardous is the top layer of made ground.

Within the EMR the majority of C&D waste is composed of soil and stone with approximately 77% of the C&D waste in the region falling into this category in 2018 as per the Construction and Demolition Waste – Soil and Stone Recovery/Disposal Capacity – updated report 2020 (RPS on behalf of DCC 2020). The remaining C&D waste in the region comprised other materials such as contaminated soil, rubble, metals, timber, plastic, glass and wood.

Within the EMR, 15 soil recovery facilities, operating under Waste Licence with backfilling capacity, were determined to be either active or within the application process at the end of 2018. Soil recovery facilities are generally worked out quarries which are being restored using uncontaminated soil to raise natural ground levels.

[2] Backfilling as defined in the Waste Framework Directive (WFD) 2008/98/EC means a recovery operation where suitable waste is used for reclamation purposes in excavated areas or for engineering purposes in landscaping and where the waste is a substitute for non-waste materials

The total annual capacity for the region at that time was 2,411,400 tonnes (RPS on behalf of DCC 2020). Licensed capacity is most prominent in the EMR which has a healthy supply of active capacity and substantial new capacity due to come on stream. The Region contains 80% of the active national capacity. New licensed facilities are also due to come on stream. Future capacities (new applications and un-commenced operations) exceed 2.1 million tonnes nationally, with 73% of this capacity planned for the EMR.

As detailed in the EPA's (2020) Guidance on Waste Acceptance Criteria at Authorised Soil Recovery Facilities, the Geological Survey Ireland have set boundaries of geological domains, within these domains' maximum concentrations and/or soil trigger levels that should be adopted for authorised soil recovery facilities when accepting material. Diagram 24.4 shows a map of the geographical domains. The proposed Project falls within Domain 2.

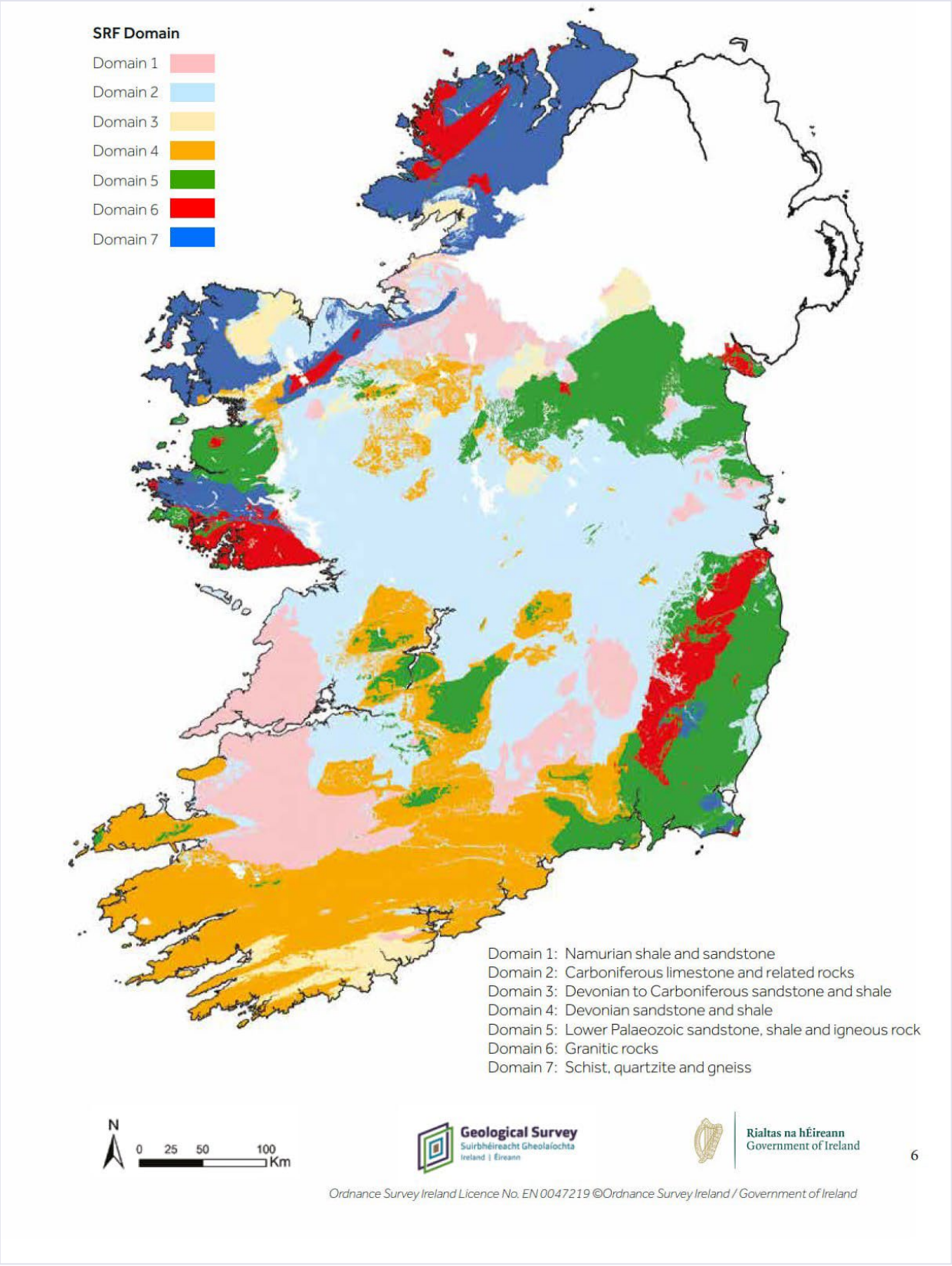

Diagram 24.4: A Map of the Geographical Domains

Table 24.10 summarises the available annual and remaining capacity and the expected year of closure of the soil recovery licensed facilities in the counties surrounding the proposed Project. It should be noted that the capacities provided are total capacities, and the potential proportion of that capacity available to the proposed Project in the future will be less than that when other potential construction projects

and other waste streams including municipal waste is accounted for. Figure 24.2 shows the location of the soil recovery facilities surrounding the proposed Project.

Table 24.10: Soil Recovery Licensed Capacities in Counties Surrounding the Proposed Project (Source: RPS 2020 and/or EPA Licence Search Website, October 2021)

Facility Name	Licence Number & Facility Type	Status	Annual Soil Authorised Intake (Tonnes)	Remaining Capacity (Tonnes)	Year of Expected Closure	Source of Information
County Dublin						
GLV Bay Lane Limited	W0301-01	Application	532,833 (inert soils and stones – 17 05 04 and 20 02 02)	1,332,084	2023	RPS 2020 & EPA Website
Huntstown Inert Clay Facility (Roadstone)[3]	W0277-03	Active	1,500,000 (soil & stones and dredging spoil 17 05 04 and 20 02 02)	2,555,600	2051	RPS 2020 & EPA Website
Milverton Waste Recovery (Roadstone)	W0272-01	Active	400,000 (inert soils and stones – 17 05 04 and 20 02 02)	1,886,795	2025	RPS 2020 & EPA Website
County Meath						
Clashford Recovery	W0265-01	Authorised (September 2019) Not yet commenced	170,000 (inert soils, stones and dredging material – 17 05 04 and 17 05 06)	805,200	Unknown – approx. 4-6 years from commence ment	RPS 2020 & EPA Website
Mullaghcrone Quarry	W0278-01	Authorised (April 2017) Not yet commenced	100,000 (inert soils, stones and dredging material – 17 05 04 and 17 05 06)	1,800,000	Unknown	RPS 2020 & EPA Website
Tullykane - Kilsaran Concrete, Kilmessan	W0296-01 Materials Recovery	Active	400,000 (inert soils and stones – 17 05 04)	5,600,000	2033	RPS 2020 & EPA Website
Kiernan Sand & Gravel	W0262-01	Active	167,400 (inert soils, stones and dredging material – 17 05 04 and 17 05 06)	938,100	2027	RPS 2020
County Kildare						
Blackhall Soil Recovery (Behans Land Restoration Ltd.)	W0247-01	Active	344,000 (inert soils and stones 17 05 04)	122,400	2022	RPS 2020 & EPA Website

[4] Total does not include capacity for Balleally Landfill as the remaining capacity is unknown

Facility Name	Licence Number & Facility Type	Status	Annual Soil Authorised Intake (Tonnes)	Remaining Capacity (Tonnes)	Year of Expected Closure	Source of Information
N&C Enterprises Ltd	W0292-01	Active	345,000 (inert soils and stones 17 05 04)	1,500,000	2031	RPS 2020 & EPA Website
Kildare Sand & Gravel Ltd	W0295-01	Active	225,000 (inert soils and stones 17 05 04)	1,500,000	Unknown – approx. 8-10 years from commence ment	EPA Website
County Wicklow						
Calary Quarry (Roadstone Ltd)	W0293-01	Authorised (November 2019) Not yet commenced	300,000 (inert soils, stones and dredging material – 17 05 04 and 17 05 06)	3,280,000	2040	RPS 2020 & EPA Website
Potential total annual licensed soil recovery intake in the counties surrounding the proposed Project			**3,600,000 to 4,485,000 (Equivalent to approx. 2,005,000 to 2,500,000m³)**	-	-	-
Estimated potential remaining licensed soil recovery capacity in the counties surrounding the proposed Project.				**19,865,000 to 21,320,000 (Equivalent to approx. 11,000,000 to 11,854,000m³)**	-	-

The declassification of recycled aggregates and crushed concrete as wastes under Article 28 is a mechanism facilitating the reduction of C&D waste. In addition to estimated capacity at EPA licensed soil recovery facilities and landfills as outlined in Table 24.10, there are, as of September 2020, two approved applications for recycled aggregate under Article 28, one from Integrated Materials Solutions Limited Partnership (IMS) and one from Panda Greenstar. Details on the facilities are provided in Table 24.11.

Table 24.11: Recycled Aggregate Processing Sites Approved under Article 28

Facility Name	Decision date for Article 28 application	Authorised Waste Codes	End of Waste for Recycled Aggregates Uses
Integrated Materials Solutions Ltd	16 July 2019:	17 01 01: concrete	Uses are restricted to roadway construction
Panda Greenstar	13 August 2019	17 01 01: concrete 17 01 02: brick 17 01 03: tiles and ceramics 17 01 07: mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06 17 05 04: soil and stone 17 09 04: mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03. 19 12 12: other wastes	Use is restricted to the construction of temporary haul roads at the Boliden Tara Mines Tailing Management Facility

Facility Name	Decision date for Article 28 application	Authorised Waste Codes	End of Waste for Recycled Aggregates Uses
		(including mixtures of materials) from mechanical treatment of waste other than those mentioned in 19 12 11. 19 12 12 wastes shall be restricted to those originating from the processing of 17 01 01, 17 01 02, 17 01 03, 17 01 07, 17 05 04 or 17 09 04.	

There are also a number of waste transfer stations throughout the country which accept C&D waste. Transfer stations are buildings or processing sites where wastes can be temporarily deposited. Transfer stations can reduce the cost and traffic impact of transporting waste as the transfer station facilitates the bulk haulage of the waste in larger vehicles to the final destination as opposed to a number of smaller vehicles transporting the same volume of waste to the same final destination. All relevant transfer stations which are currently operational in the counties surrounding the proposed Project are summarised in Table 24.12.

Table 24.12: Licensed Waste Transfer Stations and their permitted C&D intake per annum (Source: RPS 2016 and/or EPA Licence Search Website October 2021)

Location	Facility	Licence Number	Annual Intake (Tonnes)
County Dublin	Starrus Eco Holdings Ltd.	W0039-02	150,000 (total including all waste types)
	Paidraig Thornton Waste Disposal Ltd.	W0044-02	30,000 (maximum C&D waste per annum)
	Key Waste Management Ltd.	W0045-01	200,000 (maximum C&D waste per annum)
	Starrus Eco Holdings Ltd.	W0183-01	24,000-30,000 (maximum C&D waste per annum)
	Starrus Eco Holdings Ltd.	W0188-01	5,000 (maximum C&D waste per annum)
	Rilta Environmental Ltd.	W0192-03	500 (maximum non-hazardous C&D waste per annum) 68,000 (maximum hazardous C&D waste per annum)
	Oxigen Environmental	W0152-01	10,200 (maximum C&D waste per annum)
	Advanced Environmental Solutions Ltd.	W0222-01	29,000 (maximum C&D waste per annum)
	Paidraig Thornton Waste Disposal Ltd.	W0277-01	20,000 (maximum C&D waste per annum)
	Irish Packaging Recycling Ltd.	W0263-01	50,000 (maximum C&D waste per annum)
County Meath	Advanced Environmental Solutions Ltd.	W0131-02	23,750 (maximum C&D waste per annum)
	Mulleadys Ltd.	W0197-02	8,000 (maximum C&D waste per annum)

In addition to the EPA licensed facilities, there are currently a number of facilities in the counties surrounding the proposed Project in possession of a Waste Facility Permit or Certificate of Registration from the applicable Local Authorities which accept soils and inert waste from C&D works. These facilities are all permitted or certified to operate Class 5 (recovery of excavation or dredge spoil), Class 6 (recovery of inert waste (other than excavations or dredging comprising natural materials)), and/or Class 7 (recovery of inert waste arising from C&D activity) waste activities as described in the Third Schedule of the Waste Management (Facility Permit and Registration) Regulations 2007 (S.I. No. 821/2007). In the case of Certificates of Registration, maximum allowable quantities vary from that outlined above as follows; Class 5 - the total quantity of waste recovered at the facility shall not exceed 25,000 tonnes; Class 6 - the total waste recovered shall not exceed 10,000 tonnes; and Class 7 - the annual intake limit is

10,000 tonnes and the limit to the amount of waste leaving the facility is capped at 1,500 tonnes per annum.

Table 24.13 summarises the remaining capacity and the expected year of closure of the licensed landfill facilities in Ireland. It should be noted that the capacities provided are total capacities, and the potential proportion of that capacity available to the proposed Project in the future will be less than that when other potential construction projects and other waste streams including municipal waste is accounted for.

Table 24.13: Inert Landfill Licensed Capacities in the Eastern and Midland Region (Source: RPS 2020 and/or EPA Licence Search Website, October 2021)

Facility Name	Licence Number & Facility Type	Status	Annual Authorised Intake (Tonnes)	Remaining Capacity (Tonnes)	Year of Expected Closure	Source of Information
County Dublin						
Integrated Materials Solutions Ltd	W0129-02 Inert Landfill	Active	500,000 tonnes (inert C&D waste and inert dredging spoil)	3,874,316 tonnes	2028	RPS 2020 and EPA Website
County Kildare						
Walshestown Restoration Ltd	W0254-01 Inert Landfill	Active	330,000 tonnes (total including soils & stones and other waste)	2,105,239 tonnes	2026/2027	RPS 2020 & EPA Website
County Laois						
Kyletalesha Landfill	W0026-03	Active	28,596 tonnes inert material recovered in 2020	95,400 tonnes	Unlikely to still be accepting material in 2025 based on remaining capacity	RPS 2020 & EPA Website
Potential total annual licensed soil / C&D waste capacity in the counties surrounding the proposed Project			**830,000 tonnes**	-	-	-
Estimated potential remaining licensed soil / C&D waste capacity in the counties surrounding the proposed Project				**6,074,955 tonnes**	-	-

Table 24.14 summarises the remaining capacity and the expected year of closure of the non-hazardous licensed landfill facilities in Ireland. It should be noted that the capacities provided are total capacities, and the potential proportion of that capacity available to the proposed Project in the future will be less than that when other potential construction projects and other waste streams including municipal waste are accounted for.

Table 24.14: Non-Hazardous Landfill Licensed Capacities in the Eastern and Midland Region (Source: RPS 2020 and/or EPA Licence Search Website, October 2021)

Facility Name	Licence Number & Facility Type	Status	Annual Authorised Intake (Tonnes)	Remaining Capacity (Tonnes)	Year of Expected Closure	Source of Information
County Meath						
Knockharley Landfill	W0146-02 (W0146-04 in application) Non-hazardous Landfill	Active (application for increase in permitted annual intake and site changes)	25,000 (C&D for recovery) 70,000 (inert waste for recovery) (application for increase in total annual authorised intake from 200,000 to 440,000 tonnes)	2,846,228 tonnes (based on 1,581,238m^3)	Unknown	EPA Website
County Wicklow						
Ballynagran Residual Landfill (Greenstar Holdings Ltd)	W0165-02 Non-hazardous Landfill	Active	28,000 (C&D waste)	Research has found that there is 630,000 tonnes (350,000m^3) remaining capacity However new planning application states 8 of 21 cells still to be developed.	2026	EPA Website
Total Annual authorised intake			**53,000 tonnes**	-	-	-
Total Remaining Capacity[4]				**3,476,228 tonnes**	-	-

The facilities listed in Table 24.10 to Table 24.14 are all of the facilities currently available to take waste likely to be generated during the Construction Phase of the proposed Project. For those sites where their expected closure date is during the construction of the proposed Project, these sites could decide to extend/vary their permits if they wish to do so. At this stage the final destinations cannot be stipulated and the decision on the destination of waste will be based on a number of factors, including the Contractor(s), using up-to-date information on the available facilities and their capacities during the Construction Phase of the proposed Project.

24.4.3 Hazardous waste

In Ireland, approximately 80% of the 580,977 tonnes of hazardous waste was generated from industrial activities, 18% was from the construction sector and 2% was from municipal sources, such as households, small businesses, educational facilities in 2019.

Hazardous waste generation in Ireland has been increasing since 2015, due to the increases in incinerator ash and contaminated soils. There has also been an increase in the treatment of hazardous waste in

[4] Total does not include capacity for Balleally Landfill as the remaining capacity is unknown

Ireland; however, the majority of Ireland's hazardous waste was exported to other EU member states for treatment in 2019, amounting to 379,386 tonnes.

Irish hazardous waste treatment facilities treated 146,309 tonnes of hazardous waste to non-hazardous status in 2019. This equates to 25% of hazardous waste being treated at facilities located within Ireland. Waste types treated included used motor oil, healthcare wastes, sludges, filter cakes, absorbents, laboratory and chemical waste and household hazardous waste from civic amenity sites. This waste is treated until it is non-hazardous; the non-hazardous wastes that result are then further treated either in Ireland or exported. 55,282 tonnes of hazardous waste in 2019 was treated on site.

There are two sites within Ireland that are able to accept asbestos waste. Details of these sites are provided in Table 24.15.

Table 24.15: Existing Waste Facility Permit able to accept Asbestos in Ireland (Source: EPA website May 2021)

Facility Name	Licence Number & Facility Type	Status	Annual Authorised Intake (Tonnes)	Source of Information
Veolia Environmental Services Technical Solutions Limited	W0050-02	Licensed	3,000 tonnes of hazardous C&D waste	EPA Website
Rilta Environmental Limited	W0192-03	Licensed	8,100 tonnes per annum of specifically C&D materials containing asbestos 17 06 01* & 17 06 05*	EPA Website

In 2019 the total amount of contaminated soil generated in Ireland was just over 90,000 tonnes, of that approximately 75,000 tonnes of contaminated soils were treated within and outside of Ireland. This equates to the treatment of 83% of contaminated soils classified as hazardous thus indicating that contaminated soils generated by the proposed Project could be treated and avoid being sent to landfill for disposal.

There are a number of registered brokers that are exporting hazardous waste and excavated materials to EU countries from Ireland. In 2020, hazardous excavated material was exported from Ireland to Germany and Norway.

If hazardous waste was to be exported from Ireland it would be dependent on the broker, the market and a number other of factors when determining which country, the hazardous waste would be exported to. However, the information detailed on Eurostat (2022) demonstrates that export of waste from Ireland has been happening for a number of years to multiple EU countries.

Given that a large quantity of hazardous waste generated in Ireland is exported and under current laws due to BREXIT no hazardous waste can be exported to the UK, for this assessment and for comparison purposes the hazardous landfill capacity in Germany has been used to assess the likely impacts on hazardous waste landfill capacity.

Table 24.16 provides details on the remaining hazardous landfill capacity in Germany which has been obtained from the Eurostat (2022) for two-year periods from 2010 to 2018. The volumes have been converted into tonnes using a conversion factor of 1.8t/m3 and presented in Table 24.16. It shows that there were approximately 51 million tonnes of hazardous waste landfill capacity in 2018.

Table 24.16: Remaining Hazardous Landfill Capacity in Germany

Year	Remaining Hazardous Landfill Capacity (m^3)	Remaining Hazardous Landfill Capacity (tonnes)
2010	57,009,666	102,617,399
2012	60,711,359	109,280,446
2014	39,178,743	70,521,737

Year	Remaining Hazardous Landfill Capacity (m^3)	Remaining Hazardous Landfill Capacity (tonnes)
2016	33,637,300	60,547,140
2018	28,814,125	51,865,425

24.4.4 Future Forecast Inert, Non-hazardous and Hazardous Landfill Capacity Baseline

Future baseline information has been based on data for 2018 as this is the most recent data available on current landfill capacity in Ireland. Landfill demand has continued to decline with new alternative waste management options becoming available. However, landfill capacity continues to reduce with very few new landfills coming online. Projected future landfill capacity values have been estimated and illustrated in Table 24.17 and are based on the average across Germany. Average landfill capacity across all waste types reduced by 14% between 2014 and 2018. between 2014 and 2018. Projected future landfill capacity values have been estimated for Germany and illustrated in Table 24.17.

Table 24.17: Permitted and Remaining Capacity of Operational Hazardous Landfills in Germany

Timeline	Historic Baseline Capacity (tonnes)	Forecast Future Baseline Capacity (tonnes)
2018	51,865,425	N/A
2019	N/A	44,604,266
2020	N/A	38,359,668
2021	N/A	32,989,315
2022	N/A	28,370,811
2023	N/A	24,398,897
2024	N/A	20,983,052
2025	N/A	18,045,424
2026	N/A	15,519,065
2027	N/A	13,346,396
2028	N/A	11,477,900
2029	N/A	9,870,994
2030	N/A	8,489,055
2031	N/A	7,300,587
2032		6,278,505
2033		5,399,514
2034		4,643,582

As with inert and non-hazardous waste landfill capacity in Ireland, there is a reducing trend for hazardous waste landfill disposal in Germany, however the forecast future baseline hazardous landfill capacity suggests that there is likely to be adequate hazardous landfill capacity available in Germany to support the construction of the proposed Project. It should be noted that capacity also exists in a number of other European counties

Where wastes are accepted at landfill, some are subject to their properties and further assessment by the landfill operators, used for reuse, recycling or recovery within landfill cover or other engineering rather than subject to and accounted as disposal. Any landfills that have ceased infilling, at the time of construction, and are no longer accepting waste may also still require inert and non-hazardous materials for capping and restoration purposes, and therefore may be amenable to accepting any suitable surplus materials arising from construction subject to waste regulatory controls.

24.5 Predicted Impacts

The following is an evaluation of the likely impacts as a result of the anticipated materials consumption and waste generation during the demolition, excavation and Construction Phases of the proposed Project.

24.5.1 Do Nothing Scenario

The Do Nothing Scenario is the scenario in which the proposed Project does not proceed as planned and no development occurs. Under this scenario, there will be no effects as there will be no construction phase or operational phase occurring to use materials or generate waste.

24.5.2 Construction Phase

24.5.2.1 Demolition

In order to provide the sufficient space for the construction of the proposed Project, a certain amount of land-take will be required, resulting in a number of buildings and structures requiring demolition including footbridges, and buildings. Chapter 5 (MetroLink Construction Phase) and Appendix A5.8 provide further details on the general approach to demolition for the proposed Project and lists the properties to be demolished in advance of the main construction works.

The quantities of demolition waste arisings have been forecast by the construction design team. Approximately 98% of the waste which is predicted to arise as a result of demolition will be classified as either inert or non-hazardous wastes including concrete, bricks, glass and metals. However, hazardous waste is also predicted to arise when demolishing existing buildings, structures and infrastructure. Such hazardous wastes are predicted to include asbestos containing materials, bituminous, oils, chemicals and waste electrical and electronic equipment (WEEE).

Table 24.18 provides an estimate of demolition waste anticipated to be generated from the demolition of all the buildings and structures. A 95% recycling/recovery rate has been assumed for all inert and non-hazardous demolition wastes.

Table 24.18: Summary of Predicted Key Demolition Waste Generated from the proposed Project

Waste Type	Indicative Waste Classification	Total Tonnage	Quantity of demolition waste to be reused, recycled, recovered (tonnes)	Quantity of demolition waste to be sent for disposal (tonnes)	Indicative management option(s)
Concrete	Inert	36,854	35,011	1,843	Where it is not possible to reuse concrete in its current form, crushing concrete for use on or off site as a fully recovered aggregate would be carried out, or as a waste aggregate if not conforming to the relevant specification
Brick	Inert	10,227	9,716	511	Tiles, bricks and ceramics will be reused on site where possible; or crushing of these materials will be carried out for use on or off site as a fully recovered aggregate, or as a waste aggregate if not conforming to the relevant specification.
Tiles	Inert	91	87	5	
Ceramics	Inert	90	85	4	
Steel	Non-hazardous	6,373	6,055	319	Steel wastes will be segregated and sent for off-site recycling.

Waste Type	Indicative Waste Classification	Total Tonnage	Quantity of demolition waste to be reused, recycled, recovered (tonnes)	Quantity of demolition waste to be sent for disposal (tonnes)	Indicative management option(s)
Timber	Non-hazardous	1,785	1,696	89	Reuse of timber on site as formwork and hoarding. Reuse on site of intact or recycled chipped timber, for habitat creation, landscaping or other genuine and appropriate on-site construction uses. Used as biomass in off-site energy production
Glass	Inert	11	11	1	Glass wastes will be segregated and sent for off-site recycling
Plasterboard	Non-hazardous	169	160	8	Plasterboard wastes will be segregated and sent for off-site recycling
Asbestos	Hazardous	943	0	943	Asbestos waste will be sent for off-site disposal
Total		**56,543**	**52,821**	**3,723**	-
% recycled/recovered/landfilled			**95%***	**5%***	

*This figure excludes hazardous waste.

24.5.3 Excavation Phase

Tunnelling will take place under Dublin Airport and under Dublin City from Northwood to just south of Charlemont and this will result in large quantities of excavation material being generated. In addition, excavation of station boxes, open cut, and cut and cover sections of the proposed Project will result in large quantities of excavated soil, stone and made ground. For further details on excavation activities refer to Chapter 5 (MetroLink Construction Phase). There will also be significant quantities of excavated material generated during the construction of the proposed Project. The predicted excavation material quantities are based on the design and the vertical alignment determined for both the tunnelling and surface works. At O'Connell Street Station there are two potential construction scenarios due to the potential over site development at this location. However, for the MetroLink project the quantities of material excavated by MetroLink would be the same for both scenarios. Once tunnelling activities have stopped, the main drive TBM (used to excavate the City Tunnel) will be driven off-line south of Charlemont Station and buried. Table 24.19 provides the forecast quantities of excavated material likely to be generated by the proposed Project.

Table 24.19: Estimated Quantity of Excavated Material

Section	Estimate of Excavated Material Quantities (m^3)			
	Soil	Mixed	Rock	Total
Start of route to Seatown Station	108,790	-	2,941	111,731
Seatown Station to Malahide Roundabout	102,896	-	13,250	116,146
Malahide Roundabout to Pinnock Hill Roundabout	121,625	-	3,821	125,446
Pinnock Hill Roundabout to North Portal	161,590	-	4,055	165,645

Section	Estimate of Excavated Material Quantities (m^3)			
	Soil	**Mixed**	**Rock**	**Total**
Central Section Surface Works	281,818	-	7,950	289,768
Dardistown Station	incl above	-	incl above	-
Dardistown Depot	280,677	-	-	280,677
Bridges, Viaducts	6,404	-	-	6,404
Northwood Station	48,522	1,500	26,521	76,543
Ballymun Station	48,372	1,500	27,157	77,029
Collins Avenue Station	37,806	1,500	37,201	76,507
Griffith Park Station	33,011	1,500	55,137	89,648
Glasnevin Station	120,682	1,500	18,448	140,630
Mater Station	58,724	1,500	24,310	84,534
O'Connell Street Station	98,506	1,500	20,966	120,972
Tara Station	11,107	1,500	60,343	72,950
St Stephen's Green Station	19,600	1,500	65,763	86,863
Charlemont Station	36,151	1,500	47,944	85,595
Dublin Airport Station	6,530	1,500	67,730	75,760
TBM Tunnels	204,121	138,802	473,561	816,484
Northwood Portal	12,597	-	10,800	23,397
Dublin Airport North Portal	11,353	-	139	11,492
Dublin Airport South Portal	40,743	-	-	40,743
Albert College Park Shaft	17,031	-	4,607	21,638
South of Charlemont Shaft	2,530	-	879	3,409
Park & Ride	24,530	-	1,047	25,577
Total Excavated Material	**1,895,716**	**155,302**	**974,570**	**3,025,588**
Backfill required (Dardistown Depot), plus assumed material kept on site for bunds, landscaping and the like at Park & Ride	-	-	-	**99,931**
Total Surplus Excavated Material	-	-	-	**2,925,657**

Table 24.19 above summarises the predicted excavated material quantities. It is predicted that 89.6% of the 3 million m^3 would be classified under Article 27 which is approximately 2.7 million m3 (4,887,488 tonnes); and 10.4% would be classified as waste which is approximately 310,317m3 (558,571 tonnes). However, with approximately 99,931m^3 (176,876 tonnes) being used for backfilling and landscaping purposes on the proposed Project, this leaves a remaining 210,386m^3 (378,695 tonnes) that would be managed as a waste.

Table 24.20 provides a summary of the predicted quantities of excavated materials classified under Article 27, the quantity of excavated material to be reused onsite and those materials that are classified as inert, non-hazardous and hazardous. It has been predicted that approximately 94,775m^3 (170,595 tonnes) of the

excavated material would be considered contaminated (this equates to 3% of the overall total of excavated material).

Table 24.20: Summary of Predicted Quantities of Excavated Materials, Article 27 Compliant and Non-Compliant Material and Classification of Article 27 Non-Compliant Material from the proposed Project (Jacobs, 2022)

Excavated Materials		Volume (m^3)	Tonnage
Total excavated material volume		3,025,588	5,446,058
Excavated material to be reused on site		99,931	179,876
Total surplus excavated material		2,925,657	5,266,183
Material for re-use as a by-product (Article 27)		2,715,271	4,887,488
Classification of A27 non-compliant surplus as waste	Hazardous	94,775	170,595
	Non-hazardous	155,481	279,866
	Increased Inert	49,093	88,367
	Inert	10,968	19,742
*There is a requirement for 99,931m^3 of material for backfill on the Project. This has been taken from the figures above.			

Table 24.21 provides a further breakdown of the excavated material classified as waste generated over the construction period. It should be noted that the quantities detailed in Table 24.21 do not include the excavated material that has been classified as inert which is going to be reused on the proposed Project.

Table 24.21: A Breakdown of Excavated Material (Non-Compliant Article 27) classified as Waste Generated over the Construction Period of the proposed Project

Year	Non-hazardous (tonnes)	Hazardous (tonnes)
Year 1 of Construction	-	-
Year 2 of Construction		-
Year 3 of Construction	24,972	
Year 4 of Construction	49,944	85,298
Year 5 of Construction	62,430	85,298
Year 6 of Construction	43,701	-
Year 7 of Construction	27,053	-
Year 8 of Construction	-	-
Year 9 of Construction	-	-
Year 10 of Construction	-	-
Total	**208,100**	**170,595**

Table 24.22 shows that excavation activities would occur over five years for non-hazardous material with a peak production year in Year 5 and the production of hazardous material has been anticipated to be generated over two years. The table shows a peak generation of non-hazardous excavated material of approximately 62,450 tonnes in Year 5.

For further detail on the locations and extent of contaminated land refer to Chapter 20 (Soils & Geology) and The Land Contamination Interpretive Report (Appendix A20.8). For further information on the impacts on water and groundwater associated with contaminated land refer to Chapter 18 (Hydrology) and Chapter 19 (Hydrogeology).

24.5.4 Construction Activities

As is typical of any construction activities, materials will be required in order to construct the proposed Project. Such construction materials include soil, aggregates, asphalt, concrete, steel, plant, fuel, oils, material finishes, glass and wood.

There will be impacts associated with the generation of waste, an inevitable output of any construction project, no matter the scale. Such waste includes surplus materials which can arise from over-ordering or mishandling of construction materials, packaging waste, as well as mixed municipal waste and food waste associated with the construction staff working on the sites. There will also be hazardous wastes generated which are associated with the maintenance of construction machinery or with chemicals required as part of the construction processes. These hazardous wastes will be managed and disposed of in an environmentally friendly manner.

Reference should be made to Chapter 9 (Traffic & Transport), Chapter 13 (Airborne Noise & Vibration), Chapter 16 (Air Quality) and Chapter 17 (Climate) for information on the impacts associated with the transportation of materials and waste as part of the Construction Phase of the proposed Project.

24.5.4.1 Consumption of Materials during Construction

The quantities of key materials likely to be consumed during the following activities associated with construction of the proposed Project are estimated in Table 24.22:

- Construction of tunnels, subsurface and surface stations and depot;
- Construction of Park and Ride Facility; and
- Construction of rail track and roads.

Table 24.22: Summary of Estimated Materials Consumption

Material Type	Tonnage
Concrete	3,386,700
Shot concrete	6,600
Asphalt	331,700
Steel	4,500

The choice of whether to use primary or secondary or recycled aggregates, or a combination of both, will ultimately be made by the Contractor(s) after considering a combination of factors, such as sources, specification, production and transport of available materials. However, during construction the proposed Project has a commitment to source at least 20% (by weight, volume, value) of materials from re-used or recycled sources.

24.5.4.2 Construction Waste Generation and Management

The following section outlines the estimated types and quantities of waste to be generated during the Construction Phase of the proposed Project.

As mentioned in Section 24.4.2, the EU Waste Framework Directive sets a target of preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of 70% by weight of non-hazardous C&D waste by 2020 (N.B. this excludes naturally occurring soil and stone material falling within code 17 05 04 in the European Waste Catalogue). Currently Ireland is achieving 77% recovery rate for C&D waste however it is anticipated that the proposed Project will be able to achieve a recovery rate of at least 95% given the potential for reuse and recycling opportunities.

Construction waste arisings have also been modelled through a number of methods, including reference to actual quantities predicted by the design team, the application of material specific wastage rates, at good practice levels provided in the WRAP (2008) Net Waste Tool Dataset and applying a 95%

recycling/recovery rate which is based on achievements of other large infrastructure projects and discussions with the project and construction team.

The quantities of key C&D waste (it does not quantify all waste types that would be required) which are predicted will be generated during the following activities associated with construction main works of the proposed Project as described below are set out in Table 24.23:

- Park and Ride Facility;
- Earthworks and Roadworks;
- Surface Station;
- M50 Viaduct;
- Piling;
- Underground Stations;
- Retained Cut Stations;
- Retained Cut Alignment;
- Cut and cover Tunnels;
- Bored Tunnels;
- Portals;
- Intervention and Escape Shafts;
- Viaducts;
- ESBN Grid Connection (consent for which is being brought forward under a separate consent application);
- Electricity Substations;
- Overhead Catenary System;
- Track and Railway Systems Installation;
- Track;
- Building Works and Fit Out; and
- Material Management.

Table 24.23 sets out the quantities of construction waste which are predicted will be generated from the proposed Project based on the forecast 95% recycling/recovery rate. It should be noted that it has been assumed that all of the drilling mud generated from the dewatering and grouting processes can be recycled and that all the bentonite waste will be disposed of.

Table 24.23: Summary of Estimated Key Construction Waste Generated from the proposed Project

Waste Type	Indicative Waste Classification	Total Tonnage	Waste recovery rate (%)	Quantity of construction waste reused, recycled, recovered (tonnes)	Quantity of construction waste sent for disposal (tonnes)	Indicative management option(s)
Concrete	Inert	84,667	95%	80,433	4,233	Consideration would be given to reusing / recycling fresh ready-mixed concrete, as well as any wash out water, in the batching of new concrete. Consideration would be given to crushing hardened concrete on-site for use as a fully recovered aggregate on or off-site where it is not possible to use it in its current form, or as a waste aggregate if not conforming to the relevant specification.
Shotcrete	Inert	329	95%	313	16	
Asphalt	Non-hazardous	16,584	95%	15,755	829	Consideration would be given to reusing fully recovered aggregate as a non-waste in capping, subbase, basic running surfaces and use as a feedstock in the manufacture of new road surfacing materials either on or off site.
Mixed construction and demolition waste	Non-hazardous	32,508	95%	30,883	1,625	The mixed construction and demolition wastes would be segregated and sent for off-site recycling.
Drilling mud for dewatering and grouting processes	Non-hazardous	7,041	100%	7,041	0	All drilling mud would be recycled and reused off-site
Grout from drilling and TBM operations	Non-hazardous	4,443	95%	4,221	222	The grout waste would be segregated and sent off-site recycling then reuse.
Packaging	Non-hazardous	30,965	95%	29,417	1,548	Consider cleaning or washing packaging or containers so that they can be reused where suitable. Investigation would be undertaken to establish whether take-back schemes are available for waste packaging with suppliers. Alternatively, packaging wastes should be segregated and sent for off-site recycling.
Bentonite waste	Non-hazardous	52,443	0%	0	52,443	The only option for the bentonite waste is disposal

Waste Type	Indicative Waste Classification	Total Tonnage	Waste recovery rate (%)	Quantity of construction waste reused, recycled, recovered (tonnes)	Quantity of construction waste sent for disposal (tonnes)	Indicative management option(s)
Contaminated land	Hazardous	170,595	83%	141,594	29,001	Consideration would be given to the treatment of contaminated soils. However, it is likely that some the contaminated soils would require off-site disposal.
Miscellaneous hazardous construction waste	Hazardous	1,889	25%	475	1,425	Consideration would be given to recycling/recovery hazardous waste. However likely that the majority of the hazardous waste would need to be sent for off-site disposal.
Total		**401,474**	**-**	**310,131**	**91,343**	**-**

24.5.4.2.1 Hazardous Waste

Construction activities tend to produce some hazardous waste. This waste largely consists of waste from plant maintenance activities such as oils and grease from equipment maintenance, batteries, waste paint and solvents, as well as contaminated soils and stones as discussed with respect to excavated material. There may also be residues left in drums or containers utilised for certain construction processes, for example paint cans, solvent containers and empty fuel cans.

The hazardous waste which will potentially be generated during the Construction Phase of the proposed Project will comprise a relatively small proportion of the total construction waste. The majority of these hazardous wastes will arise from contaminated soils and stones.

Based on industry benchmarking data, as reported by WRAP BRE SmartWaste tool (2012), it has been assumed that 2% of C&D waste generated by the proposed Project would be classified as hazardous. With regards to excavated material, one potential source of contamination across the whole proposed Project alignment is from made ground. Analysis of the ground investigation data has been carried out to estimate the proportion of made ground that is likely to be considered hazardous. Table 24.24 provides the estimated quantities for hazardous C&D waste and contaminated made ground considered hazardous.

As there are no hazardous waste landfills located in Ireland, any hazardous waste sent for disposal will need to be exported. As detailed by the EPA Waste Statistics in 2019 in Ireland approximately 83% of contaminated soils were sent for treatment and approximately 25% of hazardous wastes (excluding soils) were treated either on or off site. Based on the above and in consultation with hazardous waste companies it is considered that the majority of contaminated soils will be treated. For the purposes of this assessment, it has been assumed that approximately 25% of the hazardous waste (excluding soils) and approximately 83% of contaminated soils generated by the proposed Project will be treated with remaining material exported. All asbestos waste will be sent for off-site disposal.

Table 24.24: Summary of Estimated Hazardous Waste Generated from the proposed Project

Waste Type	Indicative Waste Classification	Total Tonnage	Waste Recovery rate (%)	Quantity of hazardous waste for treatment (tonnes)	Quantity of hazardous waste for disposal (tonnes)	Indicative management option(s)
Contaminated soils*	Hazardous	170,595	83%	141,594	29,001	In 2019 in Ireland the EPA reported that approximately 83% of contaminated soils classified as hazardous were sent for treatment.
Miscellaneous hazardous construction waste	Hazardous	1,899	25%	475	1,425	In 2019 in Ireland the EPA reported that approximately 25% of the hazardous waste (excluding soils) waste was treated. Ireland's hazardous waste is treated either on-site at the industrial facility where the waste was generated (under conditions of EPA licence), offsite at hazardous waste treatment facilities in

Waste Type	Indicative Waste Classification	Total Tonnage	Waste Recovery rate (%)	Quantity of hazardous waste for treatment (tonnes)	Quantity of hazardous waste for disposal (tonnes)	Indicative management option(s)
						Ireland, or at facilities in other countries.
Asbestos	Hazardous	943	0%	-	943	Specialist contractors would be appointed to remove asbestos from the sites. There are two sites in Ireland that are able to accept asbestos. It is also likely that asbestos waste could be exported for disposal outside of Ireland.
Locations of areas of contaminated soils are detailed in Chapter 20 (Soils & Geology)						

24.5.4.2.2 Tunnel Boring Activities

In addition to the soil and stone arising from the tunnel boring process, there will be additional waste arising in the form of additives required to facilitate the efficient operation of the Tunnel Boring Machine (TBM). The additives are required to help regulate pressure at the head of the TBM, facilitate breakdown of sticky clays and other materials, reduce the wear on cutting tools, and help to transport the muck-soil from the cutting head of the TBM. It is proposed to use a Variable Density TBM due to the variable nature of the ground conditions through which it will need to bore. Depending on the type of operational mode selected for the TBM as it tunnels through the various types of ground, these additives will either be a bentonite slurry (Slurry TBM mode) or a foam conditioner (Earth Pressure Balance (EPB) TBM mode).

A Slurry TBM utilises a mix of bentonite and water in order to ensure the correct pressure across the cutting head. The excavated material which is brought to the surface during tunnelling will therefore contain bentonite as well as the excavated soil and stone material. The bentonite is reused within the tunnelling operations. Any bentonite which is no longer required will require separate disposal as a non-hazardous waste. In the case of the EPB TBM, the foam conditioner additive can be left mixed within the excavated material as it is highly biodegradable and will breakdown by 95% within 28 days, requiring no separate disposal.

The amount of excavated material containing bentonite that is predicted to be generated is approximately 52,445 tonnes, this takes into account losses into the ground and soil during the boring process. On completion of all tunnelling works this excavated material containing bentonite will be classified as non-hazardous waste and require disposal at an appropriately licensed waste facility.

24.5.4.2.3 Other Waste Types

Surplus material and waste (excluding excess excavated materials) may occur where material supply exceeds material demand. While some surplus materials have reuse potential, other materials will be considered a waste and fall under relevant regulatory controls. Materials brought to site but not fully utilised for their original purpose can also result in other waste such as damages, off-cuts and surplus products. Waste packaging from the construction materials will also be generated on-site during construction.

There will also be Municipal Solid Waste (MSW) generated by construction workers e.g. canteen, office and staff welfare waste that will need to be managed. However, the amounts predicted to be generated are Negligible and their impact will be imperceptible. These wastes will be managed in accordance with the waste hierarchy.

It is anticipated that small quantities of waste would be generated through the Electricity Supply Board Networks Ltd (ESBN) works. During the excavation of the trench excavated material would be stockpiled and reused to backfill the trench.

If Japanese Knotweed and/or other invasive species are identified on site, they will be removed in accordance with relevant legislation and guidance. An Invasive Species Management Plan will be developed and provide details on the method of eradication, control and containment together with the risk and method to prevent re-infestation and spread. The Invasive Species Management Plan will include an implementation schedule to facilitate record keeping of treatments, the options for disposal and the disposal locations for these materials. Further details are provided in Chapter 5 (MetroLink Construction Phase) and Appendix A5.1 outline Construction Environmental Management Plan (CEMP).

24.5.5 Operational Phase Materials and Waste

As detailed in Section 24.3.4.5, it is unlikely that waste generated during the Operational Phase of the proposed Project would be considered significant. However, it is acknowledged that operational waste would be generated from the station, depot and other areas associated with the proposed Project.

Municipal Solid Waste (MSW) would be generated at the depot, stations and offices e.g. canteen, office and staff welfare waste that will need to be managed. There are limited shops and eateries and no facilities on the trains therefore the amounts predicted to be generated are Negligible.

Maintenance wastes are likely to be generated from the depot, maintenance yards which would include waste oils and greases, paints, chemicals. There will be small amounts of dust, grit, sand and litter waste generated through tunnel cleaning and maintenance. Waste electrical electronic equipment (WEEE) such as Information Technology (IT) and telecommunications equipment, appliances, lighting equipment, electrically powered tools and batteries will be generated during the operation of the proposed Project. As with MSW waste the amounts of maintenance waste predicted to be generated are Negligible and their impact will be imperceptible.

24.5.6 Summary of Significant Effects

The significance of potential effects, prior to the application of mitigation measures, have been assessed and are summarised in Table 24.25.

Table 24.25: Summary of Significant Effects Prior to Mitigation

Element	Description of Potential Sensitivity of Receptors / Magnitude of Impacts	Significance Criteria	Assessment Summary	Significance of Effect
Materials	The sensitivity of materials relates to the availability of using materials comprising of some sustainable features and benefits. The proposed Project has committed to at least 20% (by weight, volume, value) (with scope to increase) of materials to be sourced from re-used or recycled sources during construction. Some degree of re-used / recycled content is anticipated given that this is standard practice in construction, and WRAP (2009) 'Construction Procurement Guidance' suggests that infrastructure projects typically exceed 10% even without explicitly trying to increase recycled content. WRAP (2009) reports that the recycled content as a percentage of the total material cost for an infrastructure project was found to be in the region of 8% to 36% using standard practice products, with this rising to 25% to 49% when applying cost-neutral good practice. Reference to WRAP (2011) Resource Efficiency Benchmarks for Construction Projects reports that the proportion of recycled content (RC) by total aggregates weight, for the completed infrastructure projects within its dataset, was 27% RC / tonne at the 50th percentile (median) level. Reference to the Mineral Products Association (2021) 'Profile of the UK Mineral Products Industry 2020 Edition' confirms that in 2018 the share of recycled and secondary aggregate materials as a proportion of total GB aggregates sales was approximately 30%.	**Sensitivity of Receptor**		**Significance of effect: Slight** **Significant for the purposes of EIAR: No**
		The key materials required for construction of the proposed Project are available comprising some sustainable features and benefits compared to industry-standard materials.	**Sensitivity of the receptor: Medium**	
	The method for assessing the magnitude of impact from materials comprises a percentage-based approach that determines the influence of materials consumption on the baseline market capacity. Aggregates comprise as much as 60% to 80% of a typical concrete mix, therefore of the aggregates which will be used on the proposed Project is it predicted that between 929,000m^3 and 1,130,000m^3 aggregates will be required. When these figures are compared to the aggregate annual production in Ireland (based on 2018 data), it equates to 3% to 4% of the national baseline availability.	**Magnitude of Impact**		
		The assessment is made by determining whether through the proposed Project, the consumption of one or more materials is between 1% to 5% by volume of the regional baseline availability.	**Magnitude of impact: Minor**	

Element	Description of Potential Sensitivity of Receptors / Magnitude of Impacts	Significance Criteria	Assessment Summary	Significance of Effect
Element	**Description of Potential Sensitivity of Receptors / Magnitude of Impacts**	**Significance Criteria**	**Assessment Summary**	**Significance of Effect**
Inert and Non-Hazardous Waste	The sensitivity of waste relates to the availability of national landfill void capacity. The average volume of waste predicted to be generated nationally has been compared to the remaining inert and non-hazardous landfill void capacity. The future landfill capacity has been calculated and detailed in Section 24.4.4, analysing the available data from the EPA. Based on the construction years it has been modelled on average over the nine year construction period that the inert and non-hazardous landfill void capacity is expected to reduce by over 10% as a result of the waste forecast (without the proposed Project).	**Sensitivity of Receptor** Across the Construction Phase the baseline/future baseline (without the proposed Project) of national inert and non-hazardous waste landfill void capacity is expected to reduce very considerably (by >10%).	**Sensitivity of the receptor: Very High**	**Significance of effect: Very large** **Significant for the purposes of EIAR: Yes**
	The magnitude of impact from waste has been assessed by determining the percentage of the remaining landfill void capacity that will be depleted by the predicted waste during the construction of the proposed Project. Table 24.23: Summary of Estimated Key Construction Waste Generated from the proposed Project provides the quantities of C&D wastes anticipated to be generated by the proposed Project. Under the worst-case scenario if all this C&D waste generated by the proposed Project (458,017 tonnes) in addition to the 2.9 million m^3 (5,446,058 tonnes) of excavated material was to be classified as waste and disposed of to landfill then it is likely to reduce national landfill capacity void in Ireland by 24%.	**Magnitude of Impact** Waste generated by the proposed Project will reduce national landfill void capacity baseline by >10%.	**Magnitude of impact: Major**	
Hazardous Waste	The sensitivity of waste relates to the availability of national hazardous landfill void capacity. There are no commercial hazardous waste landfills in Ireland, thus, any hazardous waste generated in Ireland destined for landfill is exported. Therefore, the assessment has been made on the basis of capacity in Germany as it is one of the countries that currently accepts hazardous waste generated in Ireland destined for landfill. The future hazardous landfill capacity has been calculated and detailed in Section 24.4.4, analysing the available data Eurostat. Based on the construction years it is has been estimated on average over the nine year construction period that the hazardous landfill void capacity is expected to reduce by over 10% as a result of the waste forecast.	**Sensitivity of Receptor** Across the Construction Phase the baseline/future baseline (without the proposed Project) of national hazardous waste landfill void capacity is expected to reduce very considerably (by >1%).	**Sensitivity of the receptor: Very High**	**Significance of effect: Moderate or Large** **Significant for the purposes of EIAR: Yes**
	The magnitude of impact from waste has been assessed by determining the percentage of the remaining landfill void capacity that will be depleted by the anticipated waste during the construction of the proposed Project. However, there are no commercial hazardous waste landfill capacity in Ireland and a large percentage of hazardous waste is exported to Germany. It is also unlikely that Ireland will gain new hazardous waste landfill capacity. On this basis the	**Magnitude of Impact** Waste generated by the proposed Project will reduce national hazardous waste landfill void capacity baseline by <0.1% to 0.5%.	**Magnitude of impact: Minor**	

Element	Description of Potential Sensitivity of Receptors / Magnitude of Impacts	Significance Criteria	Assessment Summary	Significance of Effect
	magnitude has been assessed based on hazardous landfill capacity in Germany rather than Ireland. If a worst-case scenario is assumed that all the contaminated excavated material and approximately 2% of the C&D waste requiring disposal was considered hazardous then approximately 173,437 tonnes of hazardous waste is anticipated to be generated. Based on these figures, hazardous landfill void capacity in Germany is expected to reduce by 0.17% as a result of the hazardous waste forecast from the proposed Project.			

24.6 Mitigation Measures

Mitigation measures, as set out in the following sections, aim to minimise the impact to the environment of the proposed Project through good material resource efficiency practices. All materials consumed and waste generated by the proposed Project will be managed in accordance with circular economy principles and the waste hierarchy, with prevention, reuse, recycling, and other recovery methods favoured over disposal.

24.6.1 Designing for Circular Economy (Mitigation Item RWM1)

The proposed Project will be constructed to be resource efficient, minimising the use of materials, energy and other resources in order to reduce environmental impacts and costs; and implement a circular approach to the use of materials. A circular economy is an alternative to a traditional linear economy (of make, use, dispose) in which resources are kept in use for as long as possible; maximum value is extracted from these resources while in use; and where assets, elements, products, components and materials are recovered and regenerated at the end of each service life. Throughout the construction of the proposed Project, solutions will be implemented to minimise the consumption of materials and the generation of waste throughout the lifecycle of the proposed Project.

There are five construction principles that will be implemented throughout the construction of the proposed Project to ensure that consumption of materials and the generation of waste is minimised throughout the lifecycle of the proposed Project.

The five key principles are:

- Design for reuse and recovery: identifying, securing and using materials that already exist on-site, or can be sourced from other projects (e.g. by considering reusing materials where possible). The proposed Project will recycle/ recover at least 95% of construction and demolition waste;
- Design for materials optimisation: simplifying layout and form to minimise material use, using standard design parameters, balancing cut and fill, maximising the use of renewable materials and materials with recycled content (e.g. using material from low-carbon or sustainable sources);
- Design for off-site construction: maximising the use of prefabricated structure and components, encouraging a process of assembly rather than construction;
- Design for waste efficient procurement: identifying and specifying materials that can be acquired responsibly, in accordance with a recognised industry standard (e.g. consider opportunities for materials to be returned to the supplier for future reuse (e.g. steel and concrete elements); and
- Design for the future (deconstruction and flexibility): identifying how materials can be designed to be more easily adapted over an asset lifetime and how deconstruction and demounting of elements can be maximised at end of first life.

24.6.2 Applying the Waste Hierarchy as a Priority Order to the Management of Waste (Mitigation Item RWM2)

All waste will be managed in accordance with the waste hierarchy (see Diagram 24.3), as set out in the Waste Framework Directive (2008/98/EC), in such a way as to prevent harm to human health, amenity and the environment.

The primary objective in the construction of the proposed Project will be at the top of the waste hierarchy on zero avoidable waste, i.e. preventing waste and reusing waste wherever possible. As such the aim will be not to focus on lower value recycling and other recovery, and in any case most construction and demolition waste is already 'recovered' in some form.

The waste hierarchy will require to be departed from for particular types of waste, where justified, in order to ensure minimal environmental impact. It is important to understand any potential wider implications and thus any unintended consequences of managing waste. For example, there will be instances where avoiding waste in the first instance would create greater environmental impact. Consideration therefore will be given by the Contractor(s) to the relationship with other factors such as

materials consumption, energy usage and the emission of carbon. The general measures detailed in Table 24.26 will be undertaken during the Construction Phase to ensure waste is managed in accordance with the waste hierarchy.

Table 24.26: Waste Management Best Practice Actions to be Adopted During the Construction Phase

Stage in Hierarchy	Action
Prevention	Standard sizes for most items will be used to avoid specials and cutting on-site. Materials will be ordered to size with minimum waste (BRE 2012).
Prevention	Off-site construction, prefabricated products / modules and pre-cast units will be used where possible (BRE 2012; EPA 2015b).
Prevention	Take-back scheme arrangement with suppliers will be used. All packaging, cable drums and pallets will be collected by suppliers and not broken up (BRE 2012).
Prevention / Preparation for Reuse	Materials will be reused (i.e. all excavated materials) on-site where possible. (BRE 2012).
Prevention	Main Contractors will work with all sub-contractors to identify waste minimisation and encourage all sub-contractors to reuse or recycle their own waste materials in particular packaging (BRE 2012).
Reduction and Recycling	Packaging requirements in materials procurement will be reduced and recycled content specified (EPA 2015b).
Prevention	Hoarding posts will be reused and shuttering systems used where these are required (EPA 2015b).

24.6.3 Demolition Plan (Mitigation Item RWM3)

A pre-demolition audit will be undertaken in order to facilitate selective demolition. Selective demolition will be undertaken in order to enable removal and safe handling of hazardous substances and to facilitate reuse and high-quality recycling. The EU Construction and Demolition Waste Protocol and Guidelines (European Commission 2018) provides guidance on best practice for the assessment of C&D waste streams prior to demolition or renovation of buildings and infrastructures, called a 'waste audit'. The aim of the guidance is to facilitate and maximise recovery of materials and components from demolition or renovation of buildings and infrastructures for beneficial reuse and recycling, without compromising the safety measures and practices outlined in the European Construction and Demolition Waste Protocol. This guidance will be used to inform the demolition audit of the proposed Project.

A Demolition Plan (DP) will be prepared for each building and structure to be demolished which will include the following information:

- The location of the building to be demolished and a detailed topography of the site and its surrounds together with ground level contours and sections of the slopes and ground supported by the building where appropriate;
- Details of ground removal and/or backfilling;
- The distances from the building to be demolished to its adjacent buildings, street, structures and significant street furniture;
- Layout of all floors of the building to be demolished, details of the principal materials of construction and the building condition;
- The procedures for the demolition of the building, with a detailed sequence of demolition;
- Protection and control measures; and
- Methods for the handling and disposal of waste such as the means of transport of waste material from the site, time and frequency of waste material movement offsite and a methodology for recording the materials generated and disposed of.

The DP will stipulate the procedure for the demolition of the building; detailing sequence and method of demolition to be adopted including any restrictions. The plan will specify all precautionary measures to be applied for the protection of the public including hoardings, covered walkways, catch platforms,

catch-fans, scaffolding, protective screens and safety nets. The DP will also set out requirements for the handling of debris and method of waste disposal to a licensed facility.

24.6.4 Construction Environmental Management Plan (Mitigation Item RWM4)

During the Construction Phase of the proposed Project the Contractor(s) will ensure the compliant management of all waste generated by the construction activities. Circular economy principles will be incorporated within the management of materials during the Construction Phase in order to reduce the amount of materials used and waste generated by the proposed Project.

An Outline CEMP has been prepared as part of this EIAR and can be found in Appendix A5.1. The Contractor(s) will prepare and finalise the CEMP and specific method statements based on the outline CEMP adopted to take account of the conditions of any RO granted. The Contractor(s) will prepare and implement a CEMP, identifying construction methodologies for the proposed Project and standard operating procedures that will be implemented to minimise the impact. The CEMP will include all mitigation measures as outlined in the EIAR. The Contractor(s) will ensure that any facilities to which waste is brought are licensed / permitted / registered in compliance with waste management legislation. Similarly, the transportation of waste away from any of the construction sites or compounds will be carried out by vehicles in possession of Waste Collection Permits in compliance with legislation. The Contractor(s) will also be responsible for management of the ordering of supplies, ensuring that supplies are ordered as needed to avoid over-ordering or the requirement for long-term storage of materials, thus reducing the potential for damage or expiration of supplies while being stored on site.

The outline CEMP (Appendix A5.1) also details the requirement for the Contractor(s) to develop a Construction and Demolition Waste Management Plan (C&D WMP) (Mitigation RWM5), which incorporates all of the measures outlined in this Chapter, Chapter 20 (Soils & Geology) and the Excavated Material Management Strategy (Appendix A24.1). The C&D WMP will identify how waste arisings are to be controlled and managed during the course of the proposed Project, in particular how waste prevention principles will be applied and how on-site waste will be minimised. The C&D WMP will be written in accordance with the best practice guidance (DoEHLG 2006).

The C&D WMP will include:

- Roles and responsibilities with regards to waste management;
- An analysis of the likely waste arisings;
- Specific waste management objectives for the proposed Project;
- Methods proposed for recycling / reuse of waste;
- Material handling procedures;
- Procedures for keeping records of all waste and materials which are removed from site; and
- Proposals for training of the workforce in waste management procedures and requirements.

A number of waste management practices will be implemented by the Contractor(s) in order to manage waste arisings in an orderly fashion to minimise the impact in so far as is possible.

- A regular programme of site tidying will be established to ensure a safe and orderly site;
- Debris netting will be erected to prevent materials being scattered by the wind;
- Food waste will be strictly controlled on all parts of the site in order to minimise the attraction of vermin and other pests;
- In the event of any litter or debris escaping the site, it will be collected immediately and removed to storage on site, and subsequently recovered / disposed of in the normal manner;
- Waste receptacles such as skips will be secured so as to minimise impact from fly-tipping; and
- Waste will be collected in a timely fashion so as to prevent overly large volumes of waste accumulating.

As outlined in Section 24.5.2, waste arising from the demolition of buildings and structures will be a mixture of different materials. This material shall be sorted and segregated on site in so far as is practical. The majority of the demolition waste will be concrete and mixed C&D waste. It is anticipated that where possible a soft strip approach to demolition activities would be undertaken which means demolition

waste such as concrete, steel and bricks would have a higher potential to be recycled and that any wood generated through demolition activities would be recoverable for use as fuel.

If material from the proposed Project is categorised as a waste as opposed to a by-product, Article 28 of the European Communities (Waste Directive) Regulations 2011 (Article 6 of the WFD) allows for waste materials to be given End-of-Waste status following recovery or recycling process, as long as it meets a set of criteria as outlined in the legislation. This means that the material is no longer classified as a waste but is rather a product and therefore no longer falls under the jurisdiction of any waste management legislation. The material can therefore re-enter the supply chain

Following consultations with a number of waste management facilities, Integrated Materials Solutions located in north County Dublin, approximately 25km from the Northwood Portal site, has been identified as a potential location for management and disposal of the bulk of the demolition waste (there is currently no contractual arrangements in place). Integrated Materials Solutions operate under Waste Licence W0129-02 and are licensed to accept 500,000 tonnes of inert C&D waste per annum.

Should there be issues with using the Integrated Materials Solutions facility when construction commences, a suitable alternative facility will be identified. Any facility to be used for the disposal of demolition waste shall be suitably licensed, permitted or certified to accept such waste, and will be transported by vehicles operating under a valid Waste Collection Permit. All demolition waste will be properly managed while on site and in accordance with the Contractor's C&D WMP in order to ensure that the site is kept tidy and safe, and that cross contamination of waste streams is prevented. Any hazardous waste arising from demolition activities shall be managed in accordance with the measures as outlined in Section 24.5.2.1.

24.6.5 Hazardous Waste

Table 24.24 provides details on the quantities of hazardous waste anticipated to arise as a result of the construction of the proposed Project which will be managed as per the Waste Management (Hazardous Waste) Regulations (S.I. No. 163 of 1998) as amended and other applicable legislation. Any hazardous waste will be stored separately to non-hazardous waste, with individual hazardous waste streams segregated from each other. Appropriate signage will be put in place to denote any hazardous waste storage locations. Refer to Chapter 18 (Hydrogeology) for further information on the impacts on water and groundwater associated with waste storage.

As detailed in Section 24.4.3 large quantities of hazardous waste generated in Ireland are treated either on-site at the industrial facilities where the waste was generated, offsite at hazardous waste treatment facilities in Ireland, or at facilities in other countries.

As fuels and oils are classed as hazardous materials, if there is any onsite storage of fuel/oil, all oil/fuel storage tanks will be bunded and located in a dedicated, secure area of the site. Provided that these requirements are adhered to, and the site Contractor(s) are trained in the appropriate techniques, no fuel/oil wastage is predicted during construction.

Paints, glues, adhesives and other known hazardous substances will be stored in designated areas. They will generally be present in small volumes only and associated waste volumes generated will be kept to a minimum. Wastes will be stored in appropriate receptacles pending collection by an authorised waste contractor. In addition, small volumes of WEEE (containing hazardous components), printer toner/cartridges, batteries (Lead, Nickel-Cadmium or Mercury) and/or fluorescent tubes and other mercury containing waste will be generated during C&D activities or temporary site offices. These wastes will be stored in appropriate receptacles in designated areas of the site pending collection by an authorised waste contractor for recycling or disposal if recycling is not possible.

The above wastes are typically unsuitable for disposal to landfill and will instead be managed in a closed-loop system, where suppliers will typically take back the materials they supply for recycling or special disposal.

Hazardous waste including asbestos will be disposed of through a suitably permitted waste contractor for disposal or processing at a suitably licensed/permitted/ registered facility which can accept the type of hazardous waste being managed. As per legislative requirements, records of all hazardous waste generated and removed from site will be retained for a minimum period of three years by the Contractor(s). This includes documentation such as waste transfer forms (WTF), any applicable transfrontier shipment records in the event that waste has to be exported, and any records on the treatment and ultimate disposal of the hazardous waste.

Export of hazardous waste from the proposed Project outside of the State is subject to a Europe-wide control system founded on Regulation (EC) No. 1013/2006 of the European Parliament and of the Council of 14 June 2006 on Shipments of Waste (hereafter referred to as the Transfrontier Shipment Regulations). This legislation is supplemented by S.I. No. 419/2007 - Waste Management (Shipments of Waste) Regulations 2007, as amended, which makes Dublin City Council responsible for the enforcement of this regulatory system throughout Ireland. Export of hazardous waste from the site outside of Ireland will comply with the procedures set out in this legislation.

24.6.6 Excavated Materials Management Strategy (Mitigation RWM6)

An Excavated Materials Management Strategy has been prepared for the proposed Project and included within this EIAR as Appendix A24.1. The overall objective of the Excavated Materials Management Strategy is to provide an initial summary of excavated material arisings that will be generated during the proposed Project and highlight the methods and sites for reuse, recovery, recycling and disposal of the excavated material to ensure that the amount of that material that is disposed of as waste is minimised. This Excavated Material Management Strategy is to be used by the Contractor(s) to develop an Excavated Materials Management Plan to be followed during the excavation phases of the proposed Project.

Nearly 3 million m^3 of excavated material is forecast to be generated by the proposed Project. Of that approximately 99,931m^3 of excavated material will be reused within the proposed Project for the construction of embankments, in backfill, and for bunding and landscaping requirements. The remaining approximately 2.9 million m^3 of surplus excavated material will not be reusable within the proposed Project. This material will therefore require management off site, either as a by-product or as a waste. In accordance with the waste hierarchy, finding a beneficial reuse for as much of the surplus excavated material as possible, and therefore preventing the material from being categorised as a waste, will be the preferred choice for management of the excavated material. Approximately 94,775m^3 (170,595 tonnes) of the total excavated material is predicted to be contaminated (this equates to 3% of the overall total of excavated material) and thus classified as hazardous. If required, the construction compound site at Northwood will be the temporary storage location for excavated material throughout the Construction Phase of the proposed Project. However, where possible excavated material will be placed directly into tipper-type HGVs for transport to its final destination.

24.6.6.1 By-Product Material

In so far as is possible, options for beneficial reuse of the clean, suitable soil and stone material in accordance with Article 27 (**Mitigation RWM7**) is being progressed. This will prevent the need to classify all of the 2.9 million m^3 of excavated material as a waste. As set out in Section 24.5.3 it has been predicted that approximately 89.4% of the excavated material could be classified under Article 27 and the remaining 10.6% would be classified as waste (inert, non-hazardous or hazardous). Table 24.20 provides a summary of the predicted quantities of excavated materials classified under Article 27, the quantity of excavated material to be reused onsite and those materials that are classified as inert, non-hazardous and hazardous.

Huntstown Quarry in County Dublin has been identified as the preferred location to accept the excavated material classified under Article 27 due to its ability to take all by-product material as forecasted will be produced by the proposed Project.

Huntstown Quarry is operated by Roadstone and is located just outside the M50 Motorway near Junction 5, approximately 5.5km from the Northwood Portal location. Roadstone currently have a Waste Licence

(No. W0277-03) for a Soil Recovery Facility which permits recovery of 1,500,000 tonnes of soil and stones per annum at the facility, with a total backfilling capacity of 9,450,000 tonnes of backfilling capacity over the life of the facility, of which approximately 2,600,000 tonnes are remaining. The waste licence only covers soil recovery activities in the North and West Quarry, however Roadstone has planning permission in place for development of the wider Huntstown Quarry, including provision for ultimate backfilling and restoration of the North, West and South Quarries and planned Central Quarry to the original ground level.

Additional locations which may be suitable to accept such by-product soil and stone may also become available by the time construction commences and a further review and consultations with suitable facilities will be undertaken as needed in advance of the commencement of the Construction Phase.

Should there be any issues with the use of Huntstown Quarry by the time construction commences, suitable alternatives will be found. Where practical the closest suitable facilities will be used to minimise the impacts associated with transporting the material, such as air and noise emissions from vehicle movements. It is intended that in so far as is possible, the surplus excavated material will be managed within Ireland in order to minimise impacts associated with the transport of the material.

24.6.7 Waste Excavated Material

All remaining balance of surplus excavated material will be classified as 'waste'. See Section 24.5.3 for further details on the classification of the waste. The sections below set out the proposed mitigation measures for managing inert, non-hazardous and hazardous waste generated by the proposed Project.

While being retained on-site, the excavated material will be properly managed and stored in order to reduce impacts associated with storage of soil and stone. Different types of excavated material will be stored separately, i.e. where applicable, made ground will be stockpiled separate to soils and subsoils, which will be stockpiled separate to rock. Any material which has been classified in accordance with Article 27 shall be stored separately to any material which is classified as a waste.

Any contaminated land will be stockpiled separately from all other material in order to minimise the risk of cross contamination. Stockpiling shall be strictly controlled so as to ensure that impacts to the environment surrounding the Northwood site are kept to a minimum. There will be three separate stockpile storage areas, namely an area for the storage of material to be reused within the proposed Project, an area for storage of by-product material, and an area for excavated material which is to be removed from site.

24.6.7.1 Inert Excavated Waste

It is predicted that the remaining Article 27 non-compliant material classified as inert would be reused on site for backfilling and used for bunding and landscaping purposes. Therefore, there would be no surplus inert excavated material requiring management off site or disposal.

24.6.7.2 Non-Hazardous Excavated Waste

It is predicted that approximately 155,481m^3 (279,866 tonnes) of non-hazardous excavated waste would be generated from the proposed Project. Approximately 39,870m^3 (71,766 tonnes) would be reused on site for backfilling and used for bunding and landscaping purposes. This leaves a remaining 115,611m^3 (208,100 tonnes) of non-hazardous excavated material that would be classified as a waste and need to be managed off site either sent to landfill or exported out of Ireland. Table 24.21 provides a breakdown of this non-hazardous material with a peak production year in 2025.

The wastes will be sent to a suitably licensed, permitted or registered waste facility for compliant handling and recovery or disposal. Any material to be removed from site will be transported by vehicles in possession of a valid Waste Collection Permit.

24.6.7.3 Hazardous Excavated Waste

It is predicted that approximately 94,775m^3 (170,595 tonnes) of excavated hazardous waste would be generated by the proposed Project.

As detailed by the EPA Waste Statistics in 2019 in Ireland approximately 83% of contaminated soils were sent for treatment. Based on the above and in consultation with hazardous waste companies it is considered that the majority of contaminated soils would be treated. It has been forecast that 83% of hazardous soils generated by the proposed Project would be treated. This means that is it likely that the remaining 17% would need to be exported.

Section 24.4.3 provides details on the management of hazardous waste and information on hazardous landfill capacity in Germany.

24.6.7.4 Soil Recovery Facilities

By the time construction starts, if at Huntstown Quarry the capacity required by the proposed Project is limited and/or not available it is likely that soil recovery facilities would be able to accept this material. Section 24.4.2 provides details on the available capacity of soil recovery facilities in proximity to the proposed Project. Table 24.10 shows that the annual authorised intake at soil recovery facilities in the surrounding counties of the proposed Project is between approximately 3.6 million and 4.5 million tonnes. Table 24.27 provides details of the breakdown of the non-hazardous, increased inert, inert and hazardous material over the construction years, if Article 27 was not achieved. The table provides the tonnage of inert material that could be sent to soil recovery facilities in the absence of Article 27 approval. If during the peak generation year (2025) all the increased inert and inert material (145,946 tonnes) was to be sent to soil recovery facilities and based on the information in Table 24.10 the increased inert and inert material generated by the proposed Project would take up between 3.2% and 4% annual capacity at those identified soil recovery facilities.

Table 24.27: Details of the Breakdown of the Non-Hazardous, Increased Inert, Inert and Hazardous Material over the Construction Years, if Article 27 is not achieved

Year	Non-hazardous (tonnes)	Increased Inert (tonnes)	Inert (tonnes)	Hazardous (tonnes)
Year 1 of Construction	-	-	-	-
Year 2 of Construction				-
Year 3 of Construction	33,584	10,604	47,774	
Year 4 of Construction	67,168	21,208	95,548	85,298
Year 5 of Construction	83,960	26,510	119,436	85,298
Year 6 of Construction	58,772	18,557	83,605	-
Year 7 of Construction	36,383	11,488	51,755	-
Year 8 of Construction	-	-	-	-
Year 9 of Construction	-	-	-	-
Year 10 of Construction	-	-	-	-
Total	**279,866**	**88,367**	**398,119**	**170,595**

24.6.7.5 Tunnel Boring Material

Drilling material and waste during the Construction Phase of the proposed Project will be managed by the Contractor(s) (Table 24.23). Where the Variable Density TBM is used in Slurry TBM mode, waste bentonite will be created. During operation of the tunnel boring machine, the bentonite slurry will be reused within the system. The spoil is filtered and separated from the water and bentonite slurry, with the slurry then being recirculated and reused within the system. Liquid sludge from this process is placed under a soil separator and dewatered with a centrifuge or filter press. Bentonite slurry can be

reused repeatedly provided its properties are carefully monitored and controlled. Once it is no longer required, the spoil and residual slurry from the tunnel boring will be disposed of off-site to a suitable authorised waste facility through an appropriate waste contractor.

All tanks for storage of slurry will be bunded to ensure that any leakages are contained and are not allowed to enter the groundwater and/or nearby surface waters. All bentonite usage will be monitored through materials balance calculations, pressure monitoring in the lines and visual assessment of the works to ensure that, should breakout occur the volume is minimised. Should leakages or breakouts occur, they will be responded to immediately with repairs and clean-up of any slurry which has spilled.

24.6.8 Operational Phase

Operational Phase impacts associated with material and waste management at stations and during maintenance are predicted to not be significant in the context of the proposed Project.

All wastes generated during the will be managed in accordance with the waste hierarchy. Operational waste plans will be prepared by the Project operator in order to ensure that the aims of the Project Sustainability Plan are met. The future Operator will be required to have a Sustainability Plan which will be linked to the ISO 14001 accreditation (or similar).

The assessment of any environmental impacts and effects associated with materials and waste during maintenance or any large-scale future renewal or improvement works, will be undertaken by the future Operator in accordance with all legal and other necessary requirements. The future Operator will be required to be accredited to ISO 14001 Environmental Management Systems (or similar) for the operation and maintenance of the proposed Project.

24.7 Residual Impacts

The assessment indicates that the construction of the proposed Project will consume large quantities of materials and hence will result in potential impacts on the environment, through the depletion of natural resources. The assessment also shows that constructing the proposed Project will generate large quantities of excavated material and C&D waste, leading to impacts on the available waste management infrastructure (i.e. through the permanent use of landfill void space).

The significance of each residual effect is assessed in Table 24.28 after mitigation has been applied. Following implementation of mitigation measures as prescribed in Section 24.6, potential impacts in relation to inert and non-hazardous and hazardous waste for the proposed Project will be avoided, reduced or offset.

The associated effects from the use of materials during construction were found not to be significant prior to mitigation therefore have not be included in Table 24.28 however various mitigation measures with regards to the consumption of materials will also be implemented and are detailed in Section 24.6.

Table 24.28: Summary of Significant Effects after Mitigation

Element	Description of Potential Impacts	Significance Criteria	Assessment Summary	Significance of Effect
Waste (inert and non-hazardous waste)	The sensitivity of waste relates to the availability of national landfill void capacity. The volume of waste predicted to be generated nationally has been compared to the remaining inert and non-hazardous landfill void capacity. The future landfill capacity has been calculated and detailed in Section 24.3, analysing the available data from the EPA. Based on the construction years of 2024-2031 is has been modelled on average over the 8-year construction period that the inert and	**Sensitivity** Across the Construction Phase the baseline/future baseline (without the proposed Project) of national inert and non-hazardous waste landfill void capacity is expected to reduce	**Sensitivity of the receptor: Very High**	**Significance of effect: Moderate or Large** **Significant for the purposes of EIAR: Yes**

Element	Description of Potential Impacts	Significance Criteria	Assessment Summary	Significance of Effect
	non-hazardous landfill void capacity is expected to reduce by over 10% as a result of the waste forecast (without the proposed Project).	very considerably (by >10%).		
	The magnitude of impact from waste has been assessed by determining the percentage of the remaining landfill void capacity that will be depleted by the predicted waste during the construction of the proposed Project. It is predicted that approximately 90% of the approximately 3 million m^3 of excavated material will be classified under Article 27 and thus would not become a waste nor require disposal to landfill. This will significantly reduce the amount of excavated material requiring disposal thus reducing the need for national non-hazardous landfill void capacity to be used. As detailed in Section 24.6.7 there is no inert excavated material requiring disposal to landfill. The proposed Project will implement the waste hierarchy and apply good industry practice to management of the waste materials generated by the proposed Project, it is predicted that an overall recovery rate of 95% can be achieved for C&D wastes (excluding soils and stones). This exceeds the Government's 70% target for recovery of C&D waste and reduces the amount of waste requiring disposal. With the implementation of the above and the mitigation measures detailed in Section 24.6, the quantity of inert and non-hazardous waste (265,184 tonnes) requiring disposal to landfill is likely to reduce national inert and non-hazardous landfill capacity void by 1.4%. This reduces the magnitude of impact from major to minor.	**Magnitude**		
		Waste generated by the proposed Project will reduce national landfill void capacity baseline by 1% to 5%	**Magnitude of impact: Minor**	
Waste (hazardous waste)	The sensitivity of waste relates to the availability of national hazardous landfill void capacity. There are no commercial hazardous waste landfills in Ireland Thus, any hazardous waste generated in Ireland destined for landfill is exported. Therefore, the assessment has been based on landfill void capacity data for Germany as this is currently where a large percentage of hazardous waste generated in Ireland. The future hazardous landfill capacity has been calculated and detailed in Section 24.4.4, analysing the available data from Eurostat. Based on the construction years it has been estimated on average over the nine year construction period that the hazardous landfill void capacity is expected to reduce by over 10% as a result of the waste forecast (without the proposed Project).	**Sensitivity**		**Significance of effect: Slight** **Significant for the purposes of EIAR: No**
		Across the Construction Phase the baseline/future baseline (without the proposed Project) of national hazardous waste landfill void capacity is expected to reduce very considerably (by >1%).	**Sensitivity of the receptor: Very High**	

Element	Description of Potential Impacts	Significance Criteria	Assessment Summary	Significance of Effect
	The magnitude of impact from waste has been assessed by determining the percentage of the remaining landfill void capacity that will be depleted by the predicted waste during the construction of the proposed Project. However, there are there is no commercial hazardous waste landfill capacity in Ireland and a large percentage of hazardous waste is exported to Germany. It is also unlikely that Ireland will gain new hazardous waste landfill capacity. On this basis the magnitude has been assessed based on hazardous landfill capacity in Germany rather than Ireland. In 2019 the EPA reported that in Ireland approximately 25% of the hazardous waste (excluding soils) and approximately 83% of contaminated soils classified as hazardous were sent for treatment in Ireland. Therefore, it has been forecast that 25% of the hazardous waste and 83% of hazardous soils generated by the proposed Project would be treated. Thus approximately 31,843 tonnes of hazardous waste generated by the proposed Project is predicted to be sent for disposal to landfill. Based on these figures, hazardous landfill void capacity in Germany is expected to reduce by approximately 0.03% as a result of the hazardous waste forecast to be generated by the proposed Project.	**Magnitude**		
		Waste generated by the proposed Project will reduce national landfill void capacity baseline by <0.1%	**Magnitude of impact: Negligible**	

24.7.1 Ancillary Discussion

The information detailed in this section is a supplementary discussion and does not form part of the impact assessment detailed in Section 24.5.5. It provides a further breakdown of the impact on inert and non-hazardous landfill capacity considered separately. Table 24.29 details the percentage landfill capacity for inert, non-hazardous and hazardous used by the proposed Project based on the average forecast capacity during the construction phase of the proposed Project. It is based on the total quantity of waste anticipated for disposal to landfill (post mitigation). The table shows the following:

- 0.04% of the inert landfill capacity would be taken up in the EMR;
- 2.9% of non-hazardous landfill capacity would be taken up in the EMR; and
- 0.04% of hazardous landfill capacity would be taken up in Germany.

Table 24.29: Summary of Estimated Quantities of Inert, Non-Hazardous and Hazardous Waste Generated from the proposed Project (post mitigation) compared against the Forecast Landfill Capacity and the % Used Landfill Capacity

Indicative Waste Classification	Total Quantity of Waste (Tonnes)	Used Landfill Capacity (%)	Location of landfills
Inert	6,613	0.04%	Eastern Midlands Region, Ireland
Non-hazardous	265,184	2.9%	Eastern Midlands Region, Ireland
Hazardous	31,843	0.03%	Germany

As shown in Table 24.29 approximately 2.9% of non-hazardous landfill capacity would be taken up based on average forecast capacity over the 10-year construction programme. The peak year for the generation of non-hazardous C&D and excavated waste is anticipated to be Year 5 where approximately 7.5% of non-hazardous landfill capacity would be taken up.

24.8 Difficulties Encountered

No difficulties were encountered during the compiling of this Chapter.

24.9 Glossary

Term	Meaning
Alignment	Alignment refers to the three-dimensional (3D) route of the railway, considering both the horizontal and vertical alignment.
Bitumen	Bitumen, also known as asphalt, is a substance produced through the distillation of crude oil that is known for its waterproofing and adhesive properties. Bitumen production through distillation removes lighter crude oil components, such as gasoline and diesel, leaving the "heavier" bitumen behind.
C&D waste	Construction and demolition (C&D) waste generated from construction, renovation, repair, and demolition of houses, large building structures, roads, bridges, piers, and dams. C&D waste is made up of wood, steel, concrete, gypsum, masonry, plaster, metal, and asphalt.
Construction compound	An area occupied temporarily for construction-related activities. The main construction compounds will act as strategic hubs for core project management activities (ie engineering, planning and construction delivery) and for office-based construction personnel. The main construction compounds will include: offices and welfare facilities, workshops and stores, and storage and laydown areas for materials and equipment (e.g. aggregate, structural steel, and steel reinforcement).
Easement strip	During construction, easement strips will be located along the proposed railway alignment within AZ1 and AZ3 to aid construction of retained cutting, cut and cover, elevated track and surface track sections. The easement strips will range between 10m and 25m wide on either side of the alignment. A portion of these strips will be retained as permanent features for rail maintenance purposes during the operational phase.
Enabling works	These are works to prepare a site in advance of the main construction works, for example, demolition, removal of vegetation, land levelling.
Hazardous waste	a waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment.
Intervention shaft	required to allow access for the fire and rescue service in the event of an emergency underground; to allow control of smoke in the event of fire in the tunnel; and to maintain the tunnel air quality and temperature within prescribed limits during periods of train service congestion.
Intervention tunnel	A tunnel parallel to the railway tunnel to provide emergency access.
Park & ride facility	A location usually sited out of the main urban areas comprising a large car park and connected with a mass transit system, in the case of MetroLink an urban metro to attract potential travellers to drive and park at the facility and take the metro into the city centre and avoid driving into the city centre.
Recycling	the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products.
Retained cut station	A railway station constructed primarily below ground level with vertical retaining walls either side of the alignment to reinforce the walls and no roof or enclosure overhead.
Surface station	A railway station designed at ground level.
Tunnel portal	The openings at the end of the tunnel.
Underground stations	A railway station located fully underground with a roof slab over the station to enclose it fully.
Waste electrical and electronic equipment (WEEE)	electrical and electronic equipment, such as computers, televisions, VCRs, stereos, copiers, that is broken or unwanted.

24.10 References

- Construction Industry Research and Information Association (CIRIA) (1997). CIRIA Special Publication 133: Waste Minimisation in Construction – Site Guide
- Construction Industry Research and Information Association (CIRIA) CIRIA (2010). CIRIA Report C692 – Environmental Good Practice on site
- Department for Environment, Climate & Communications (DECC) (2021) Ireland's First Whole-of-Government Circular Economy Strategy- Public Consultation on the Proposed Publication of the Strategy (Department for Environment, Climate & Communications
- Department of Communications, Climate Action and Environment (DCCAE) (2019) Consultation on the Transposition of the Circular Economy Waste Package
- Department of Communications, Climate Action and Environment (DCCAE) (2020) A Waste Action Plan for a Circular Economy, Ireland's National Waste Policy 2020-2025
- Department of Environment, Community and Local Government (DECLG) (2012). A Resource Opportunity – Waste Management Policy in Ireland
- Department of Environment, Heritage and Local Government (DEHLG) (2006). Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects
- Department of Food, Environment and Rural Affairs UK (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites
- Dublin City Council (DCC) (2015) (on behalf of the Eastern-Midlands Waste Region). Eastern-Midlands Region Waste Management Plan 2015-2021
- Dublin City Council (DCC) (2016a) (on behalf of the Eastern-Midlands Waste Region). Eastern-Midlands Waste Region Annual Report 2015/2016
- Dublin City Council (DCC) (2016b) (on behalf of the Eastern-Midlands Waste Region). Eastern-Midlands Waste Region Annual Report 2015/2016 – Primary Household Waste & Plan Performance Indicators
- Dublin City Council (DCC) (2018) (on behalf of the Eastern-Midlands Waste Region). Eastern-Midlands Waste Region Annual Report 2015/2016
- Ecorys (2016) (on behalf of the European Commission). EU Construction & Demolition Waste Management Protocol
- Environmental Protection Agency (EPA) (2014). National Hazardous Waste Management Plan 2014-2020
- Environmental Protection Agency (EPA) (2015). Advice notes for preparing Environmental Impact Statements (Draft)
- Environmental Protection Agency (EPA) (2015). Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-hazardous
- Environmental Protection Agency (EPA) (2017). Guidelines on the Information to be contained in Environmental Impact Assessment Reports (Draft)
- Environmental Protection Agency (EPA) (2017). EPA's National Statistics – Progress towards EU waste recycling, recovery and diversion targets
- Environmental Protection Agency (EPA) (2020) Guidance on waste acceptance criteria at authorised soil recovery facilities
- Environmental Protection Agency (EPA) (2021) Circular Economy Programme 2021-2027
- Environmental Protection Agency (EPA) (August 2022). Guidelines on the Information to be contained in Environmental Impact Assessment Reports
- European Commission (2018) EU Construction and Demolition Waste Protocol and Guidelines
- European Commission (2020) A new Circular Economy Action Plan for a Cleaner and More Competitive Europe
- Eurostat (2021) Number and capacity of recovery and disposal facilities https://ec.europa.eu/eurostat/databrowser/view/env_wasfac/default/table?lang=en
- Institute of Environmental Management and Assessment (IEMA) (2020). Materials and Waste in Environmental Impact Assessment
- International Tunnelling and Underground Space Association (2019). Handling, Treatment and Disposal of Tunnel Spoil Materials – Working Groups 14 and 15 Underground Construction and the Environment and Mechanized Tunnelling
- Irish Concrete Federation (2018) Essential Aggregates: Providing for Ireland's needs to 2040' report

- Mineral Products Association (2021) 'Profile of the UK Mineral Products Industry 2020 Edition' https://www.mineralproducts.org/MPA/media/root/Publications/2021/Profile_of_the_UK_Mineral_Products_Industry_2021.pdf
- RPS (2016) (*on behalf of Construction Industry Federation*). Review of Soil Waste Management in the Greater Dublin Area – Market Analysis Report
- RPS (2016) (*on behalf of Dublin City Council, on behalf of the regional waste management offices*). Construction & Demolition Waste – Soil and Stone Recovery / Disposal Capacity
- RPS (2020) (*on behalf of Dublin City Council, on behalf of the regional waste management offices*). Construction & Demolition Waste – Soil and Stone Recovery / Disposal Capacity
- Transport Infrastructure Ireland (2014). Guidelines for the Management of Waste from National Road Construction Projects
- Transport Infrastructure Ireland (TII) (2008). Environmental Impact Assessment of National Road Schemes – A Practical Guide
- Transport Infrastructure Ireland (TII) (2013). Specification for Road Works Series 600 – Earthworks (including Erratum No. 1, dated June 2013) CC-CPW-00600
- Transport Infrastructure Ireland (TII) (2017) The Management of Waste from National Road Construction Projects. Standard GE-ENV-01101
- WRAP (2008). Net Waste Tool Dataset [Online] Available from http://nwtool.wrap.org.uk/Reports/WRAP%20NW%20Tool%20-%20Data%20download.xls
- WRAP (2012) SMARTWASTE Data Reporting Tool

24.10.1 Directives

- Directive 2008/98/EC of 19 November 2008 of the European Parliament and of the Council on waste [2008]

The European Communities (Waste Directive) Regulations 2011 - S.I. No. 126 of 2011

The Waste Management Act 1996 (as amended) – S.I. No. 10 of 1996

S.I. No. 820/2007 - Waste Management (Collection Permit) Regulations 2007, as amended

S.I. No. 419/2007 - Waste Management (Shipments of Waste) Regulations 2007.

S.I. No. 821/2007 - Waste Management (Facility Permit and Registration) Regulations 2007 - S.I. No. 821 of 2007

S.I. No. 163/1998 - Waste Management (Hazardous Waste) Regulations - S.I. No. 163 of 1998

Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (hereafter referred to as the Landfill Directive); and

European Union (1999). S.I. No. 126/2011 - European Communities (Waste Directive) Regulations 2011 (hereafter referred to as the Waste Directive Regulations);

- European Union (2018). Directive 2014/52/EU of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment [2014]

Waste Framework Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste.;

24.10.2 Legislation

European Communities (Waste Directive) Regulations 2011 - S.I. No. 126 of 2011

Waste Management (Collection Permit) Regulations 2007 – S.I. No. 820 of 2007

Waste Management (Facility Permit and Registration) Regulations 2007 - S.I. No. 821 of 2007

Waste Management (Hazardous Waste) Regulations 1998 - S.I. No. 163 of 1998

Waste Management (Shipments of Waste) Regulations 2007 – S.I. No. 419 of 2007

Waste Management Act 1996 Revised – S. I. No. 10 of 1996