22 Infrastructure and Utilities

Contents

List of Abbreviations

Acronym	Meaning
AZ	Assessment Zone
BSI	British Standard Institute
BT	British Telecom Ireland
CRU	Commission for Regulation of Utilities
DAA	Dublin Airport Authority
DASP	Dublin Airport South Portal
DANP	Dublin Airport North Portal
DCC	Dublin City Council
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EML	Electromagnetic location
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
ESBN	Electricity Supply Board Networks
EU	European Union
FCC	Fingal County Council
GDDS	Greater Dublin Drainage Scheme
GNI	Gas Networks Ireland
GPR	Ground Penetrating Radar
HPPE	High-Pressure Polyethylene
HV	High Voltage
IAA	Irish Aviation Authority
LOD	Limits Of Deviation
LP	Low Pressure
LV	Low Voltage
MP	Medium Pressure
MV	Medium Voltage
N/A	Not Applicable
OPW	Office of Public Works
PAS	Publicly Available Specification
PE	Polyethylene
RESA	Runway Exclusion Safety Area
RO	Railway Order
SUDS	Sustainable Drainage Systems
TBM	Tunnel Boring Machine
TII	Transport Infrastructure Ireland

22. Infrastructure and Utilities

22.1 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 Infrastructure and Utilities during the Construction Phase and Operational Phase.

This Chapter describes and assesses the likely direct and indirect significant effects of the proposed Project on Infrastructure and Utilities 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).

In the context of this chapter, Infrastructure and Utilities relates to each of the following and their associated infrastructure and systems:

- Gas transmission/distribution pipework;
- Gas pressure reduction equipment;
- Electricity transmission/distribution systems (including underground and overhead cables and sub-stations);
- Potable (drinking) water pipes, foul or combined sewers, surface water sewers;
- Telecommunications (including telephone, cable television networks, internet services, signalling and traffic cables);
- Railway lines (and associated bridges) where there is interchange between the proposed Project and existing track or stations; and
- Navigable waterways (canals).

Road infrastructure and associated footbridges, footpaths and cycleways are not assessed within this Chapter. Effects of the proposed Project on these are a function of the effect on traffic and pedestrian flows and are assessed within the Traffic & Transport Chapter (Chapter 9).

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

- Chapter 8 (Consultation);
- Chapter 9 (Traffic & Transport);
- Chapter 11 (Population & Land Use);
- Chapter 20 (Soils & Geology);
- Chapter 24 (Materials & Waste Management); and
- Chapter 28 (Risk of Major Accidents & Natural Disasters).

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

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.

22.2 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).

Table 22.1 presents an outline description of the key proposed Project elements which are appraised in this Chapter.

Table 22.1: 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.

Project Elements	Outline Description
	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. ▪ 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 Rivers Viaduct	A 260m long viaduct is proposed between Estuary and Seatown Stations, to cross the Broadmeadow and Ward Rivers and their floodplains.
Proposed 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 Viaduct	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 22.1 presents an outline of the main elements of the proposed Construction Phase that are appraised within this Chapter.

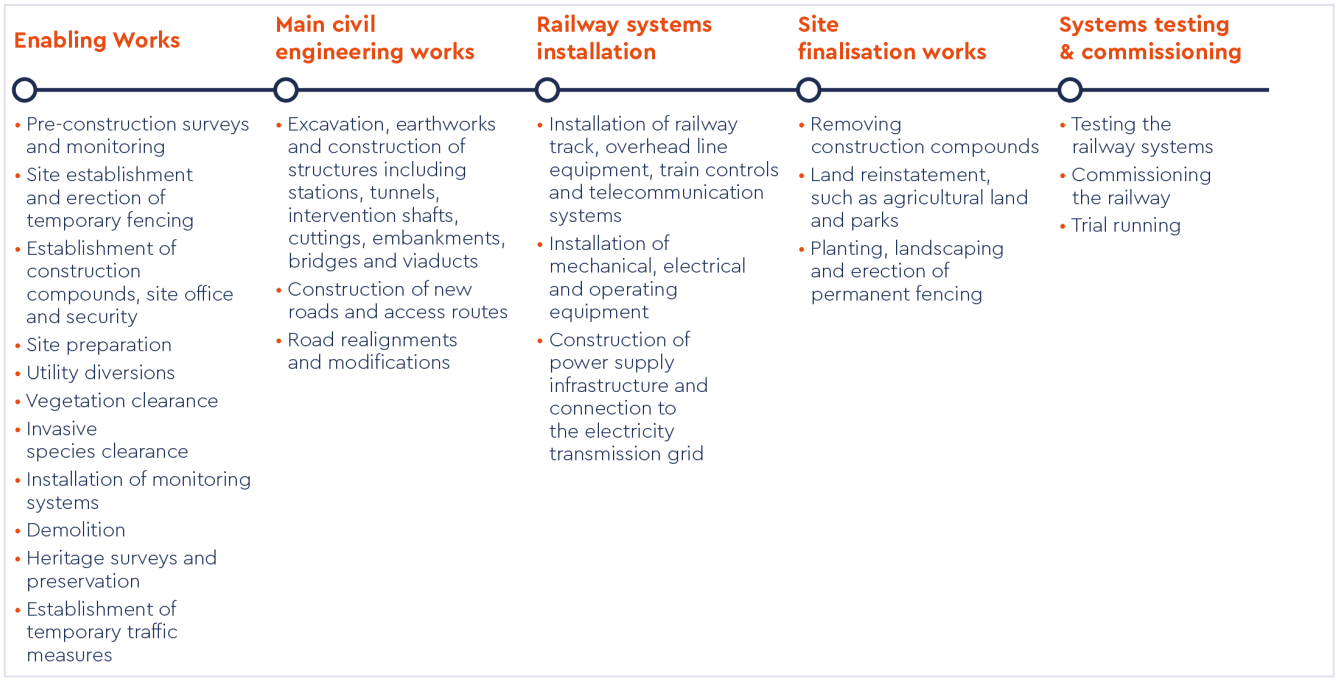

Diagram 22.1: Summary of Key Activities During the Construction Phase of the Proposed Project

Diagram 22.2 presents an outline of the main elements of the Operational Phase of the proposed Project that are appraised within this Chapter.

Diagram 22.2: Summary of the Key Activities During the Operational Phase of the Proposed Project

22.3 Methodology

22.3.1 Study Area

Diagram 22.3 provides an overview of the four geographical areas (Assessment Zone (AZ) 1 to 4) of the proposed Project route alignment. The study area for this Chapter has been defined with reference to the potential for impact from the proposed Project and the availability of relevant information. The study area includes all utilities and rail and canal infrastructure which will be affected by the proposed Project. This includes all utilities where temporary or permanent diversions are required.

Diagram 22.3: Infographic Overview of Principal Locations along the Alignment

22.3.2 Relevant Guidelines, Policy & Legislation

This Chapter has been prepared in accordance with the requirements of the Transport (Railway Infrastructure) Act 2001 and 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).

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

- Environmental Impact Assessment of Projects - Guidance on Scoping (EU 2017);
- Environmental Impact Assessment of Projects - Guidance on the Preparation of the Environmental Impact Assessment Report (EU 2017);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency (EPA) 2022); and
- Draft Advice Notes for Preparing Environmental Impact Statements (EPA 2015).

The EPA Guidelines (EPA 2022) indicate that 'material assets' can be taken to mean built services and infrastructure. The EPA Guidelines specifically list built services, roads and traffic, and waste management as topics which fall into the category of material assets. This EIAR includes separate chapters for a number of those material assets, as follows:

- Chapter 9 (Traffic & Transport); and
- Chapter 24 (Materials & Waste Management).

Built services are listed in the EPA Guidelines as electricity, telecommunications, gas, water supply infrastructure and sewerage.

The scope of the appraisal in this Chapter is based on a review of legislation, guidance documents, other EIAR feedback from public consultation, consultation with prescribed bodies and on consideration of the likelihood of significant impacts arising, having regard to the nature of the baseline environment and the nature and extent of the proposed Project.

22.3.3 Data Collection and Collation

The identification of utilities and infrastructure within the study area commenced with consultation with the various providers. Records were requested from the providers detailed in Table 22.2. This list was compiled by TII based on experience from previous infrastructure projects. Data relating to roads is addressed separately in Chapter 9 (Traffic & Transport).

Table 22.2: Data Collection – List of Stakeholders

Stakeholder	Department (where applicable)
Local Authorities	
Fingal County Council	Water
	Drainage (foul and surface water)
	Public Lighting
Dublin City Council	Water
	Drainage (surface water)
	Public Lighting
	Fibre and traffic communications ducting
State / Semi-State Organisations	
Aurora Telecom (subsidiary of Gas Networks Ireland)	
EirGrid	
ESB Networks	Distribution – Medium and Low Voltage
ESB Networks International	High Voltage (HV) 38kv
	HV 110/220kv
Gas Networks Ireland (GNI)	Distribution
	Transmission
GTT - Hyberian Network	
Irish Water	Water supply
	Foul sewerage

Stakeholder	Department (where applicable)
	Major projects – Greater Dublin Drainage Scheme (GDDS)
Third Party Communication Systems	
British Telecom (BT) Ireland	
Eir	
ENET	
JCDecaux	
Three Ireland	
Virgin Media Ireland	
Vodafone Ireland	
Zayo (EU Network)	
Transport Infrastructure (excluding roads)	
Larnród Éireann	
Waterways Ireland	
Dublin Airport Authority (DAA)	
Irish Aviation Authority (IAA)	
Government Organisations	
Office of Public Works	
Privately Owned Utilities	
Hertz Europe Business Centre, Swords	
Lissenhall Veterinary Clinic, Swords	
An Post, Swords	
Woodies DIY, Seatown	
North Dublin Business Park, Swords	

The records received from utility providers varied in both age and accuracy. Therefore, to confirm the location of all utility infrastructure along the length of the route, various surveys were procured. The survey works involved topographical surveys, the identification of underground utilities using equipment such as Ground Penetrating Radar (GPR) and Electromagnetic location (EML), as well as manhole inspection.

The utility survey was conducted in accordance with British Standards Institute (BSI) Publicly Available Specification (PAS) 128:2014 Specification for Underground Utility Detection, Verification and Location. This PAS specifies the requirements for the detection, verification and location of active, abandoned or underground utilities and the location of their associated surface features. The scope of the utility survey comprised the following:

- Desktop utility record search;
- Site reconnaissance;
- Site survey (utilities detection) to achieve quality level B1P in accordance with PAS 128;
- Verification (through visual inspection of the utility at access points such as manhole or inspection chamber;
- Processing of the data gathered to produce digital models and drawings of existing utilities (services); and
- Survey reporting and photographic evidence.

Site surveys and consultations with infrastructure and utility stakeholders were carried out to inform the utility diversion design.

22.3.4 Consultation

As part of the preliminary design process, Jacobs/Idom undertook consultation with infrastructure and utility stakeholders to identify the location, size and/or number and status of all material assets within the study area. This consultation afforded the opportunity to establish communication channels and to determine potential diversion/enabling works requirements. The preliminary design was advanced based on the outcomes of these consultations. Following progression of the design, further consultations were undertaken with utility providers in order to reach outline agreements with regard to the required utility diversions. Key stakeholders such as Fingal County Council (FCC), Dublin City Council (DCC) and Irish Water were met regularly by the Project Team to discuss the ongoing development of the project.

In addition to the meetings held with infrastructure and utility stakeholders, meetings were also held with service providers (such as An Post and Dublin Bus) as well as landowners along the route to identify any additional infrastructure which may be impacted by the scheme.

Table 22.3 provides a summary of the key issues raised by infrastructure and utility stakeholders and how they were considered in the preparation of this EIAR. A meeting register can be found in Appendix A8.19 of Chapter 8 (Consultation).

Table 22.3: Schedule of Consultations

Stakeholder	Summary of Key Issues Raised	Response from Project Team
FCC Water & Drainage Departments	The implementation of Sustainable Drainage Systems (SUDS) measures should be considered as part of the drainage design. Records of existing utilities may not be accurate.	The design for the proposed Project has been updated to include additional SUDS measures and further engagement has been undertaken with FCC with regard to the use of SUDS. Utility surveys, consultation and desktop research enabled the identification of existing utilities.
DCC Water Department	DCC cannot guarantee fire hose pressure and that MetroLink fire prevention systems should allow for this. Maintenance issues with utilities above station boxes.	Water pressure demand has been taken into consideration as part of the fire prevention strategy. Maintenance of assets over stations boxes will be similar to the agreed procedure in place for maintenance of utilities under Luas infrastructure.
DCC Drainage Department	DCC noted that discussions would not be just about sewers directly affected but also sewers impacted by tunnelling, the existing condition of sewers in the area and access issues post construction. Important to distinguish between DCC and MetroLink managed drainage after construction.	Further assessment has been undertaken on the potential impact tunnelling may have on existing sewers, in respect of the full length of the alignment within the functional area of both DCC and FCC. CCTV and conditioning surveys will be procured to inform the design during the next stage. Ownership distinction to be highlighted on relevant Railway Order drawings, in respect of the full length of the alignment within the functional area of both DCC and FCC.
DCC Public Lighting Department	Potential impact on DCC Public Lighting assets.	Further engagement has been undertaken with DCC with regard potential impact on DCC Public Lighting assets.

Stakeholder	Summary of Key Issues Raised	Response from Project Team
		Relocation of assets proposed where they are directly impacted.
DAA (formerly Dublin Airport Authority)	DAA noted that there is a "Runway Exclusion Safety Area" (RESA) to the south of the cross runway where the portal for the tunnel running beneath the airport is proposed.	Following further engagement with DAA, the proposed trunnel portal has been relocated outside the RESA.
Irish Aviation Authority (IAA)	The IAA identified three main areas of concern: 1. The possibility of power and or telecommunications cables damaged by works. 2. The possibility of impact on communications, Navaids and Surveillance systems by new buildings. 3. The possibility that the project hasn't considered the new parallel runway as it isn't included in any of the designs.	1. Utility surveys, consultation and desktop research enabled the identification of all power and or telecommunications cables. Potential for vibration and movement impact on utilities will be mitigated against on the main works - suitable mitigation measures to be developed. 2. Consultation and electromagnetic interference/compatibility surveys enabled the identification of any potential impacts on communications, Navaids and Surveillance systems. Sensitive receptor surveys have also taken place and consultation with the airport with regards to sensitive equipment. 3. The new runway is assessed in Chapter 31 (Cumulative Impacts).
EirGrid	The tunnels are likely to cross transmission underground cables. The cables may need to be switched out during construction of the tunnel. It is very important that the Project Team liaises closely and early with EirGrid to arrange the necessary outages of these key electricity transmission circuits. Any MetroLink cables in the tunnels may impact on the rating of existing and planned future electricity transmission circuits if they are laid too close to, or if they cross, existing or planned cables. Careful coordination of design and planning is required with EirGrid and ESB Networks to avoid any deration of electricity capacity of the circuits. Construction of such a major piece of infrastructure may provide opportunities for other companies to co-locate their infrastructure in a cost-effective manner. We would welcome opportunities to discuss potential synergies. EirGrid will also be working closely with ESB Networks in relation to the design of the HV supply for the project.	Further engagement has been undertaken with EirGrid with regard to any potential impacts on electricity transmission circuits. Engagement has been undertaken with EirGrid to address both of these issues.
Electricity Supply Board (ESB) Networks for (Medium and Low Voltage)	Potential impact on ESB assets.	Further engagement has been undertaken with ESB with regard potential impact on ESB assets.

Stakeholder	Summary of Key Issues Raised	Response from Project Team
		Relocation of assets proposed where they are directly impacted.
Electricity Supply Board Networks (ESBN) (HV)	Potential impact on ESBN assets.	Further engagement has been undertaken with ESB with regard potential impact on ESB assets. Relocation of assets proposed where they are directly impacted.
GNI	Potential impact on GNI assets.	Further engagement has been undertaken with GNI with regard potential impact on GNI assets. Relocation of assets proposed where they are directly impacted.
Irish Water	Recommend utility surveys and proposals outlined for dealing with situations where works would interfere with existing water services infrastructure. Recommend a number of aspects to be considered in the scope of the EIAR. Including impacts to water services and IW physical assets.	Extensive utility surveys have been carried out. All potential impacts and mitigation measures, including those raised by IW, are detailed in this Chapter. Several meetings have also taken place with IW and the Project Team during the design phase.
Irish Water GDDS	Potential impact on proposed sewer.	Relocation of the maintenance depot during design development has mitigated impact on the proposed sewer.
Aurora Telecom (subsidiary of GNI)	No impact on infrastructure.	No impact on infrastructure.
British Telecom (BT)	A number of places where British Telecom (BT) infrastructure is present along the proposed MetroLink route were identified.	Further engagement has been undertaken with BT with regard to the relocation of assets impacted by the project.
Eir	A number of places where Eir infrastructure is present along the proposed MetroLink route were identified.	Further engagement has been undertaken with Eir with regard to the relocation of assets impacted by the project.
Enet	No impact on infrastructure.	No impact on infrastructure.
Three Ireland	Potential impact on masts at Estuary and Seatown.	Further design development has resulted in no impact on the masts at these locations.
Vodafone Ireland	Potential impact on Vodafone masts at Fosterstown and Northwood.	Further engagement has been undertaken with Vodafone with regard to the relocation of affected masts.
JCDecaux	Potential impact on a number of assets at a number of locations along the MetroLink route.	Potential impact on assets has been identified and noted. Proposed relocation of assets impacted by the project to be addressed at detailed design stage.
Virgin Media	A number of places where Virgin Media infrastructure is present along the proposed MetroLink route were identified.	Further engagement has been undertaken with Virgin Media with regard to the relocation of assets impacted by the project.

Stakeholder	Summary of Key Issues Raised	Response from Project Team
GTT – Hibernian Network	Infrastructure housed in Virgin Media sub-duct. Any alterations that may be required will be carried out by Virgin Media.	No impact on infrastructure identified.
Zayo (EU Network)	No impact on infrastructure.	No impact on infrastructure identified.
Iarnród Éireann	The impact of the integrity of railway infrastructure; including retaining structures, buildings, trackside services, signal structures and utilities; must be analysed and quantified in the EIAR. The proposed construction impact assessment must consider the impact of the proposed Project on Iarnród Éireann services or otherwise address how construction will be managed and scheduled to facilitate continued passenger services.	Baseline surveys identified any potential impacts on railway infrastructure. Mitigation measures were identified in consultation with Iarnród Éireann. This has been assessed within Chapter 5 (MetroLink Construction Phase). The Construction Environmental Management Plan also details how construction will be managed.
Waterways Ireland	Consideration to potential impacts of both temporary construction works and the post construction impacts to the 5th Lock and access road/towpath at the Phibsborough Station (Glasnevin Station). Potential impact of a closure of the towpath during construction at the Royal Canal.	Potential impacts, both during construction and operation, are assessed in Chapter 11 (Population & Land Use) and Chapter 26 (Architectural Heritage). The potential impact on the lock and towpath is defined in the EIAR and all impacts to access and structure have been assessed and mitigated. This is being accounted for as part of the design and construction phasing.

22.3.5 Appraisal Method for the Assessment of Impacts

The assessment of the potential impact of the proposed Project on infrastructure and utilities has been undertaken in accordance with the following:

- Guidelines on the Information to be Contained in EIARs (EPA 2022) and in compliance with Directive 2014/52/EU of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment (EIA Directive) and other relevant guidance detailed in Section 22.3.2.
- EU Commission Guidance: Environmental Impact Assessment of Projects - Guidance on Scoping (EU 2017) - Environmental Impact Assessment of Projects - Guidance on the Preparation of the EIAR (EU 2017).

The description of impacts under various headings and further details on the definitions of impacts on the environment as contained in Section 3.7.3 of the Revised and Draft Guidelines (EPA 2015b; 2017) are developed in this Chapter.

22.3.6 Assessment Methodology

22.3.6.1 Baseline Categorisation Criteria

The baseline environment is defined as the existing environment against which future changes can be measured. The baseline infrastructure and utilities environment has been defined through a desktop study, consultation with relevant stakeholders and field surveys.

The baseline environment is assigned a baseline rating based on importance and sensitivity of the receiving environment. For the purposes of this Chapter, the importance of infrastructure and utilities

has been based on their functionality. The baseline rating is subsequently used in the impact assessment to determine the likely significance of impacts which is discussed in Section 22.5.

22.3.6.1.1 Importance of the Baseline Environment

Infrastructure and utilities ensure that transportation, power (electricity/gas), water and other services are provided in a reliable, consistent manner. The day-to-day lives of individuals and the commercial health of the city and the suburbs are dependent on this provision.

The importance of a utility is determined taking into account the function, strategic nature and capacity of the utility. These are categorised as:

- Distribution networks: these are of local importance and usually there is no contingency available to maintain continuity of supply from other sources (e.g. Irish Water mains water supply).
- Local connection: these are of local importance and usually there is no contingency available to maintain continuity of supply from other sources (i.e. connection from distribution networks to private properties).
- Transmission networks: these are of national or regional importance and there can be a contingency to continue supply from other sources.

The importance of rail infrastructure has been assessed where the proposed Project interfaces with existing stations. The importance of rail infrastructure has been considered in context of its existing connectivity and transport capacity.

The proposed Project will pass under the Royal Canal at the location of the proposed Glasnevin Station. The Royal Canal is a navigable waterway that connects the River Liffey in Dublin to the River Shannon 146km to the west near Longford. The Royal Canal is mainly used for leisure activities, namely boating and angling within the waterway, and walking and cycling along the towpath and pathways running alongside it. In this Chapter, the importance of the canal has been considered in context of its use as a transport corridor for boats.

22.3.6.1.2 Sensitivity of the Baseline Environment

Disruption of utilities at single point locations can often affect the functionality of the infrastructure over a large area. Therefore, all utilities are considered sensitive to change.

The disruption of rail lines at a single location can affect the functionality of the infrastructure over a large area. Therefore, all rail lines are also considered sensitive to change.

Similarly, the capacity of a canal waterway to accommodate change is limited and therefore considered sensitive.

22.3.6.1.3 Existing Adverse Effects on the Baseline Environment

For the purposes of this assessment existing adverse effects are not considered.

22.3.6.1.4 Baseline Rating

The baseline rating of the existing infrastructure and utilities environment is determined by having regard to the range of criteria which reflect the importance and sensitivity of the service/supply. These criteria have been defined as shown in Table 22.4.

Table 22.4: Criteria for Baseline Categorisation of Infrastructure and Utilities

Criteria	Baseline Rating
Gas transmission/high pressure pipework (≥4bar) Potable (drinking) water trunk mains and trunk foul or combined sewers Surface water sewers of greater than or equal to 300mm diameter	Very High

Criteria	Baseline Rating
Electricity (distribution) HV cables including underground cables and overhead lines Telecommunications (including cables such as telephone and internet, cable television networks, signalling and traffic cables and other control cables (e.g. other private services)) Railway infrastructure Navigable waterways (canals)	
Gas distribution pipework (≤4bar) Water pipes (arterial) for drinking water, combined surface water sewers, foul sewers Surface water sewers of less than 300mm diameter Electricity (transmission) cables including underground cables and overhead lines	High
N/A	Medium
N/A	Low
N/A	Very Low

For the purposes of the EIAR, the baseline rating for all rail infrastructure and navigable canal waterways has been considered to be Very High, given their sensitivity to disruption and limited capacity to accommodate change by diversion/realignment or closure.

22.3.6.2 Impact Identification and Magnitude

Impacts during the Construction Phase and Operational Phase which the proposed Project may have on the material assets are examined, and mitigation measures which may be required to minimise any adverse impacts of the proposed Project are identified and considered.

The impacts will be predominantly during the Construction Phase; where there are clashes with the alignment or risk of settlement arising from tunnelling or excavations works. The proposed Project also requires the provision of new connections to services during both the Construction and Operational Phases:

- Applications for new water supply and foul discharges have been submitted to Irish Water;
- A consent application for the underground power supply for the proposed Project is being brought forward by the ESB under a separate consent application but the environmental impacts of such power supply have been evaluated in this EIAR on the basis of the best and most up-to-date information; and
- Proposed discharge locations of surface water have been identified subject to approval.

For the assessment of infrastructure and utility clashes with the proposed Project alignment, the magnitude of impact has been considered in terms of the duration of service interruption (outage). The outage duration will be finalised with the relevant utility provider or consumer (in the case of private utilities), in accordance with their service level/business interruption requirements. However, this assessment is based upon consultation undertaken for the purpose of Railway Order (RO) design with stakeholders and although durations may be subject to some changes, the predicted duration of potential outages/service disruption is considered to be reliable. In the case of railways and canals, the duration of service interruption will be finalised in consultation with Iarnród Éireann and Waterways Ireland respectively.

The criteria used to assess the magnitude of impacts associated with infrastructure and utility clashes under the proposed Project are shown in Table 22.5.

Table 22.5: Criteria for the Assessment of Infrastructure and Utilities Clashes - Impact Magnitude

Criteria	Impact Magnitude
Disruption of service for more than one week. Relevant stakeholders are notified at short notice or not at all prior to disruption taking place. The level of service provided by the original utilities or infrastructure is not reinstated.	Very High
Disruption of service for up to one week. Relevant stakeholders are notified at short notice prior to disruption taking place. The level of service provided by the original utilities or infrastructure is reinstated.	High
Disruption of service for up to two days. Relevant stakeholders are notified prior to disruption taking place. The level of service provided by the original utilities or infrastructure is reinstated or improved.	Medium
Disruption of service for several hours. Relevant stakeholders are notified prior to disruption taking place. The level of service provided by the original utilities or infrastructure is reinstated or improved.	Low
N/A	Negligible

For the assessment of settlement impacts, the magnitude of impact has been determined by the technical engineering assessments detailed in Section 22.5.2.2 of this Chapter.

22.3.6.3 Impact Significance

The significance of impacts on infrastructure and utility clashes with the proposed Project alignment was assessed, having consideration of the magnitude of the impact and the baseline rating.

Table 22.6 shows how the baseline rating and the impact magnitude are combined to give the likely significance of the impact prior to any mitigation measures being implemented. The impact significance ranges are then defined using the following categories: Imperceptible; Not Significant; Slight; Moderate; Significant; Very Significant; and Profound. This is based on the table of impact significance from the EPA Guidelines.

Table 22.6: Impact Significance

Impact Significance (+/-)					
Impact Magnitude (+/-)	**Baseline Rating**				
	Very Low	Low	Medium	High	Very High
Negligible	Imperceptible	Imperceptible	Not Significant	Not Significant	Not Significant
Low	Not Significant	Not Significant	Slight	Slight	Moderate
Medium	Slight	Slight	Moderate	Moderate	Significant
High	Slight	Moderate	Significant	Significant	Very Significant
Very High	Moderate	Significant	Very Significant	Profound	Profound

For the assessment of settlement impacts, significance has been determined by the technical engineering assessments detailed in Section 22.5.2.2 of this Chapter.

Following assessment of the predicted potential impacts, the proposed Project was methodically reviewed so that mitigation methods could be conceived that will avoid, prevent or reduce any negative impacts as a result of the proposed Project. These are described in further detail in Section 22.6.

Factoring in the mitigation methods outlined in Section 22.6, the residual impacts are summarised in Section 22.7.

The impact evaluation is based on the understanding that existing best practices in design, construction and operation are employed for the proposed Project as set out in this EIAR.

22.4 Baseline Environment

Due to the primarily urban and suburban nature of the location of the proposed Project there are a large number of utilities and services located in the public roads, adjacent to carriageways and in footpaths along the alignment, particularly along the R132 Swords Bypass and in Dublin City Centre. These existing utilities and services include:

- Surface water, foul and combined sewers: older sewers within the study area are typically of brick arch construction with in-situ concrete or block work manholes and are generally located in deep areas where they are difficult to move. Newer sewers are constructed using concrete pipes and, in some cases, precast manholes have been built as part of the network;
- Watermains: the majority of the water supply pipes (distribution and arterial) occur as cast or ductile iron pipes. Some of the older mains are asbestos concrete pipes with newer mains occurring as high-pressure polyethylene (HPPE);
- Overhead and underground electricity cables: these cables occur at various voltage levels including 10, 38 and 110kV. Most cables have an aluminium core with a plastic coating, but some older distribution and transmission cables are oil-impregnated or gas cooled;
- Gas mains: gas distribution pipes occur throughout the study area as either polyethylene (PE) or PE inserted into cast iron pipes; and
- Telecommunication and cable services (including fibre and copper cables).

A summary of the baseline categorisation for infrastructure and utilities present within each of the four geographical areas (Assessment Zone (AZ) 1 to 4) of the proposed Project route alignment is presented in Table 22.7. Further information on utilities and infrastructure in each area is provided in Section 22.5.2.1.

Table 22.7: Baseline Categorisation of Infrastructure and Utilities

Section	Infrastructure/Utility	Type/Size	Owner	Baseline Rating
AZ1: Northern Section Estuary Station to DANP	Potable water main	762mm diameter	Irish Water	Very High
	Potable water mains	<300mm diameter	Irish Water	High
	Foul sewers	300mm – 1,600mm diameter	Irish Water	Very High
	Foul sewers	<300mm diameter	Irish Water	High
	Surface water sewers	375mm – 1,200mm	FCC	Very High
	Surface water sewers	<300mm diameter	FCC	High
	Communications network cables - underground	Various	Eir, BT Ireland, Virgin Media	Very High
	Telecoms Mast	N/A	Vodafone	Very High
	HV underground electricity cables	3 x 1 x 630v	ESB	Very High
	Medium Voltage (MV) underground and	Various	ESB	High

Section	Infrastructure/Utility	Type/Size	Owner	Baseline Rating
	overhead electricity cables			
	Electricity substations	2 x MV	ESB	High
	Gas pipelines – Medium Pressure (MP)	Various; 32mm, 63mm, 125mm, 250mm diameter	GNI	High
AZ2: Airport Section DANP to South Portal	Foul sewers	300mm diameter	DAA	High
	Potable water mains	150mm, 225mm & 300mm diameter	Irish Water	High
	Surface water drains	300mm diameter	DAA	High
	Surface water drains	150mm diameter	FCC	High
	Communications network cables - underground	Various	DAA	Very High
	HV underground electricity cables	Various	ESB	Very High
	MV underground and overhead electricity cables	Various	ESB	High
	Electricity cables – low voltage and public lighting	Various	DAA	High
	Gas pipeline – MP	180mm	GNI	High
AZ3: Airport South Portal to Northwood DASP to Northwood	Foul sewers	900mm and 1,800mm diameter	Irish Water	Very High
	Foul sewers	<300mm diameter	Irish Water	High
	Foul Sewers	150mm and unknown diameter	Private (ABP Food Group)	High
	Foul sewer	Rising main	Private (DAA)	Very High
	Potable water mains	381mm - 800m diameter	Irish Water	Very High
	Potable water mains	<300mm diameter	Irish Water	High
	Communications network cables - underground	100mm	Eir	Very High
	Telecoms Mast	N/A	Vodafone	Very High
	HV underground electricity cables	Unknown	ESB	Very High
	MV underground and overhead electricity cables	Various	ESB	High
AZ4: City Section Northwood to Charlemont	Foul sewers	450mm and 990mm diameter	Irish Water	Very High
	Foul sewers	<300mm diameter	Irish Water	High
	Surface water sewers	525mm, 675mm, 1,350mm diameter	DCC	Very High
	Surface water sewers	<300mm diameter	DCC	High
	Potable water mains	406.4mm, 450mm, 800mm, 1,200mm diameter	Irish Water	Very High

Section	Infrastructure/Utility	Type/Size	Owner	Baseline Rating
	Potable water mains	<300mm diameter	Irish Water	High
	Communications network cables - underground	Various	Eir and Virgin Media	Very High
	Traffic fibre cables	2 x 100mm	DCC	Very High
	HV underground electricity cables	Various	ESB	Very High
	MV underground electricity cables	Various	ESB	High
	Gas pipelines – MP	125mm, 180mm diameter	GNI	High
	Gas pipelines – Low Pressure (LP)	Various; 125mm, 180mm, 315mm diameter	GNI	High
Glasnevin	Railway	South-Western Commuter Line (old GSWR)	Iarnród Éireann	Very High
Glasnevin	Railway	Western Commuter Line (old MGWR)	Iarnród Éireann	Very High
Glasnevin	Waterway	Royal Canal Basin	Waterways Ireland	Very High

22.5 Predicted Impacts

22.5.1 'Do Nothing' Scenario

With respect to material assets, the 'Do Nothing' scenario means that there are no changes to existing infrastructure or utilities as a result of the proposed Project. Therefore, there would be a Neutral impact on infrastructure and utilities under the 'Do Nothing' scenario.

22.5.2 'Do Something' Scenario

Should the proposed Project proceed as planned, it poses a potential risk of damage to existing infrastructure and utilities with consequent damage, disruption and economic cost. There are also new utilities and infrastructure requirements to service the operation of the proposed Project. These are discussed separately.

22.5.2.1 Existing Infrastructure and Utilities – Utility Clashes

The position of utilities was taken into consideration as part of an alignment options study undertaken for the proposed Project (ARUP, 2018). Although care was taken to route the proposed alignment away from utilities where possible, the construction of the proposed Project will still interact with some utilities of very high sensitivity.

In addition to these utilities of very high sensitivity, there is also a large number of other utilities along the proposed alignment. This would be considered normal infrastructure which would be encountered in any civil engineering works in rural and urban environments.

Figures 22.1 to 22.4 accompanying this chapter show the location of utilities along the proposed Project alignment.

A 'clash analysis' has been carried out to identify where utilities intercept with the alignment and the impact has been assessed, as detailed below. Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation provides a summary of the utilities and infrastructure impacted in each

geographical area. The impact magnitude is based on the duration of service interruption (outage) and the level of service provided following reinstatement, as defined in Table 22.5.

22.5.2.1.1 AZ1 Northern Section: Estuary Station to Dublin Airport North Portal

The majority of the proposed Project through Section AZ1 progresses in a cut section. This section of the alignment is characterised by a shallow excavated cut whereby the alignment runs below the existing ground level. There are significant areas along the AZ1 section of the project where the proposed alignment and station locations clash with existing utilities (Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation).

The water supply network throughout the AZ1 area includes the Irish Water distribution network and arterial water network. Potable water mains range from 80mm to 762mm in diameter. There are a significant number of water mains that clash with the alignment. This includes a water main crossing over the Broadmeadow and Ward Rivers at the site of the proposed Broadmeadow and Ward River Viaduct.

Foul water collection from domestic and commercial premises is provided by Irish Water. Foul sewers range in diameter from 300mm to 750mm. The northern section of the alignment follows the R132 Swords Bypass and clashes with a significant number of foul sewers. Existing Irish Water assets, including the incoming sewers to Swords Wastewater Treatment Plant (WwTP) will be impacted by the proposed alignment. There is also a privately owned 450mm foul sewer at the Fujitsu Ireland Limited building at Airside Business Park, Swords that is affected by the proposed alignment.

Surface water sewers are owned by FCC and range from 375mm to 900mm in diameter. There are approximately 20 surface water sewers that clash with the proposed alignment along the R132 and at Seatown, Swords Central and Fosterstown Stations.

A number of communication companies operate networks within the AZ1 area; Eir, BT Ireland, Virgin Media and Vodafone. These networks supply telephone and broadband services and are predominantly below ground, housed in plastic and sometimes concrete ducting. Around 40 clashes with telecommunications cables have been identified, owned by Eir, BT Ireland and Virgin Media. A Vodafone telecommunications mast at Fosterstown also conflicts with the alignment.

ESB operates Medium Voltage (MV) underground and overhead electricity cables within the AZ1 area which clash with the alignment along the R132 and at Seatown, Swords Central and Fosterstown Stations. The alignment also clashes with three ESB High Voltage (HV) underground electricity cables at Estuary and the location of two electricity sub-stations at Airside Shopping Centre, Swords.

GNI operate Medium Pressure (MP) gas pipe assets in the AZ1 area of various sizes. Clashes along the alignment occur at Swords Central and Fosterstown Stations and along the R132.

22.5.2.1.2 AZ2 Airport Section: Dublin Airport North Portal to South Portal

Most of the proposed land for the DANP construction site and the DASP main compound is currently unoccupied farmland and thus minimal utility interventions are required in this section. Underground tunnelling will connect both the north and south portal sites, so for this section of the alignment surface construction works are only associated with ventilation tunnels, intervention shafts and Dublin Airport Station.

The water supply pipework throughout the AZ2 area includes an Irish Water 609mm distribution main and FCC arterial water pipework ranging from 150mm to 300mm in diameter. There are no clashes of these utilities with the proposed alignment in this section. There are a small number of clashes (three no.) with FCC surface water drains.

Within the airport complex, foul water and surface water drainage and low voltage electricity cables and telecommunications cables are privately owned by DAA (formerly Dublin Airport Authority). A small

number of clashes with telecommunications cables owned by DAA have been identified in this area. Also, low voltage electricity and public lighting cables owned by DAA.

ESB operate MV underground electricity cables within the AZ2 area. There are several clashes with the alignment at the Airport Station.

GNI operate a MP gas pipe of 125mm diameter that clashes with the alignment at the Airport Station.

Utility clashes identified within Area AZ2 are summarised in Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation.

22.5.2.1.3 AZ3 Dardistown to Northwood: Dublin Airport South Portal to Northwood

Works proposed in Area AZ3 will include the construction of the proposed maintenance depot at Dardistown, Dardistown Station, the M50 Viaduct, Northwood Station and Northwood Portal. As the above ground works in this area will be undertaken on greenfield sites, there is more limited potential for impacts on existing utilities.

The water supply pipework throughout the AZ3 area includes the Irish Water distribution network and arterial water network. Potable water mains range from 90mm to 800mm in diameter. There are around 20 clashes with water mains in this section.

Foul water collection from domestic and commercial premises is provided by Irish Water. Two large diameter foul sewers (a 1,800mm diameter sewer proposed as part of the Greater Dublin Drainage Scheme (GDDS) and an existing 900mm diameter sewer not part of the GDDS) are present in this area. These sewers are located outside of any station works areas. The proposed alignment crosses the 1,800mm diameter sewer at Dardistown Depot and a 900mm sewer at Northwood Station. There are also two private foul water sewers in this area, owned by DAA and ABP Food Group that are impacted.

ESB operate various MV underground and overhead electricity cables within AZ3. There eight clashes of the proposed alignment with MV underground cables and two with overhead cables. There is also a HV underground electricity cable at Northwood Station that is impacted.

Various communication companies operate "non-cable" assets within the AZ3 areas, including a telecoms mast owned by Vodafone at Northwood Station that is impacted. Several Eir owned underground telecommunications cables clash with the alignment at Dardistown Depot and Northwood Station.

Utility clashes identified within Area AZ3 are summarised in Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation.

22.5.2.1.4 AZ4 Northwood to Charlemont: City Section

Works proposed in Area AZ4 will include the underground tunnelling from Northwood to Charlemont, the construction of nine underground stations, one interchange station at Glasnevin and an intervention shaft at Albert College Park and Charlemont. Given the highly urbanised nature of this section of the alignment, many utility clashes have been identified at the station sites, as summarised in Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation.

The water supply pipework throughout the AZ4 area includes the Irish Water distribution network and arterial water network. Potable water mains range in diameter from 80mm to 762mm in diameter. There are numerous clashes with water mains at the proposed station locations.

Foul water collection from domestic and commercial premises is provided by Irish Water. Foul sewers range in diameter from 225mm to 2,400mm. There are numerous clashes with foul sewers at the proposed station locations.

Surface water sewers are owned by DCC and range from 225mm to 1,350mm in diameter. Clashes have been identified at Collins Avenue, Tara and Ballymun Stations.

ESB operate high and MV underground cables in the AZ4 area. HV cables are impacted at Collins Avenue, St Stephen's Green and Charlemont Stations and MV cables at these, plus Glasnevin and Tara Stations.

GNI operate MP and LP gas pipe assets in the AZ4 area of various sizes. Two MP gas mains are impacted at St Stephen's Green Station and LP gas mains are impacted at Mater, Tara, St Stephen's Green and Charlemont Stations.

A number of communication companies operate networks within AZ4. Approximately 25 clashes with telecommunications cables, owned by Eir and Virgin Media, have been identified at Collins Avenue, Glasnevin, Mater, Tara and Charlemont Stations. These networks supply telephone and broadband services and are predominantly housed in plastic and sometimes concrete ducting. At Ballymun Station there are two traffic fibre cables owned by DCC that clash with the station alignment.

Rail and canal infrastructure impacts have also been identified in this section at Glasnevin Station.

The Glasnevin Station development is a complex project with key interfaces with other infrastructure stakeholders. The station development includes the construction of the new Metrolink station, platforms for two commuter railways – the Western Commuter Line (old MGWR - Midland Great Western Railway) and the South Western Commuter Line (old GSWR - Great Southern and Western Railway), a concourse area to connect all three railways together and dedicated substations for the MetroLink station and Iarnród Éireann.

There is a requirement to modify the track layout and alignment at Glasnevin, which involves lowering a large section of the track by circa 2m and modification to the existing junction. In preparing the construction sequence a coordinated approach to the track lowering is proposed to avoid closing both railways at the same time for the station construction works. Following consultation with Iarnród Éireann, closure of the Western Commuter Line for a period of 21 months is proposed, re-opening, and then closure of the South Western Commuter Line for five months. The overall sequence of works in the Glasnevin Station area has been linked with planned Iarnród Éireann infrastructure works.

The proposed Project will pass under and adjacent to the Royal Canal at Glasnevin Station. The construction of Glasnevin Station will temporarily affect the Royal Canal, with a working area to be created in the canal basin by use of a cofferdam or sheet piles, resulting in the closure and temporary draining of this section of the canal. The maximum duration of time that that canal will be closed is predicted to be 24 months. The towpath (Royal Canal Way) on the north side of the canal will also be temporarily closed for a period of four years.

22.5.2.2 Existing Infrastructure and Utilities – Settlement

22.5.2.2.1 Utilities

Excavation for the tunnels and other below ground structures could potentially lead to ground movements at the surface and below ground, with associated settlement impacts on utilities. A settlement analysis has been completed to assess the impacts of predicted settlement on utilities caused by construction of the proposed Project.

The settlement for each tunnel section and station/portal excavation along the alignment was determined using the methodology described in Appendix A22.1.

The utility locations were obtained using the data collection methods described in Section 22.3.3 and those utilities within the zone of influence analysed to estimate if they were impacted. The 'zone of influence' is the area which is bounded by the 1mm settlement contour caused by the construction works. In the region of 50,000 utilities were identified within the project boundaries potentially impacted by the tunnelling and station/portal excavation.

Due to the large quantity of utilities that are within the calculated settlement impact zone, utilities subject to 1mm or less of vertical movement were excluded from further assessment, considering the potential impact will be negligible.

As limited information was available on some utilities a number of assumptions were also made in the analysis as follows:

- Utilities shorter than 1m in length were excluded from the assessment;
- All utilities were assumed to be at 2m depth below surface, unless noted otherwise;
- Where a single utility line underwent an acute angle (less than 90 degrees) change in alignment, the utility was split into two and assessed as individual utilities;
- All gas, electric and telecom services were assumed to be 300mm diameter plastic pipework with 25mm thick walls;
- All water mains were assumed to be 250mm diameter cast iron pipework with 20mm thick walls; and
- The assessment covered distribution mains only.

Based on the analysis methods described in Appendix A22.1, an analysis for each individual pipe was completed. The maximum calculated values for each settlement criteria were compared to threshold criteria to estimate whether the impact would have a significant effect on the performance and structural integrity of the pipe. The threshold criteria were established based on literature and experience with similar pipes in terms of age and structural condition found in the United Kingdom. In particular, the assessment criteria published by Thames Water PLC for water pipeline and sewer assets were adopted for comparison.

Where the utilities are assessed to be below the criteria limits established, these were categorised as having 'negligible' damage severity. For those utilities which exceeded the criteria, a categorisation by damage severity above the criteria limit was established to assist in highlighting and prioritising utilities. The following categories were applied to the utilities:

- Negligible - pass, assessment is lower than the criteria limit;
- Very Slight – criteria exceedance, up to 20% greater than the criteria limit;
- Slight – criteria exceedance, greater than 20% but less than 40% greater than the criteria limit;
- Moderate – criteria exceedance, greater than 40% but less than 60% greater than the criteria limit;
- Severe – criteria exceedance, greater than 60% but less than 80% greater than the criteria limit;
- Very Severe – criteria exceedance, greater than 80% but less than 100% greater than the criteria limit; and
- Extremely Severe – criteria exceedance, greater than 100% over the criteria limit.

Table 22.8 below shows a summary of the output from the 50,000 utilities analysed. It conservatively indicates that there is a risk of 397 cases of pipes exceeding the criteria due to settlement. This total figure can be further broken down as follows:

- In 16 cases these utilities clash with the proposed project alignment and are proposed to be diverted away from the alignment; and
- 120 of the pipes exceed the criteria at maximum settlement values of less that 20mm which is unexpected and suggests that there are issues with the input data causing exceedance. These will need further investigation and refinement of the analysis. It is anticipated that all of these will be downgraded to negligible damage on further assessment.

The remaining 261 pipes represents a 0.5% criteria exceedance rate (for the 50,000 assessed).

Table 22.8: Summary of Utilities Settlement Analysis Results

	Foul & Storm	Gas	Telecoms	Electric	Water	Total
Exceed assessment criteria	84	2	1	16	294	397

	Foul & Storm	Gas	Telecoms	Electric	Water	Total
Clash with alignment – to be diverted	5	0	1	0	10	16
Low (<20mm) settlement criteria exceedance result	20	0	0	5	95	120

The settlement analysis uses a number of conservative assumptions (Appendix A22.1), and it is anticipated that the number of predicated exceedances of criteria due to settlement will be significantly lower on further assessment. Further information is being sourced from the utility providers to validate current assessments.

If, after further analysis, pipes remain in the 'severe' to 'extremely severe' impacted category, these may require additional structural measures, as detailed in Section 22.6.2 of this chapter.

22.5.2.2.2 Infrastructure

A preliminary settlement impact assessment has been carried out for the existing bridges and other assets within the potential impact zone of the MetroLink scheme and is presented in the Building Damage Report in Appendix A5.17. The assessment methodology is detailed in Chapter 5 (Construction) Section 5.4.9 and in the Building Damage Report (Appendix A5.17). The assessment covered existing bridges, Iarnród Éireann Lines, the Luas Lines, Dublin Airport assets and the Cross Guns Quay Canal Lock.

This study identifies structures where in a worst case scenario based on the assessments done to date, potential impacts may occur.

If, after further analysis, structures remain impacted, these may require additional structural measures, as detailed in Section 22.6.2 of this chapter.

22.5.2.3 Proposed Infrastructure and Utilities

As well as utility diversions, the proposed Project also requires the provision of new connections to services for the proposed Project during both Construction and Operational Phases.

22.5.2.3.1 Power

Power for operation of the proposed Project will be provided from the national grid (Electricity Supply Board Networks Ltd - ESBN). Grid Connections will be provided via cable routes and two new 110kV substations at DANP and Dardistown. An application for consent of the Operational Phase power supply will be made by the systems operator, ESBN (but is nonetheless evaluated in this EIAR on the basis of the best and most up-to-date available information). The proposed ESBN cable routes are shown in Figure 22.5.

The proposed Project will also require eight new traction substations to provide power to the trains, seven for the mainline, which will be located at the following stations; Estuary, Fosterstown, Dardistown, Collins Avenue, Glasnevin, Tara and Charlemont, and one for Dardistown Depot. The construction of these substations and installation of associated cabling and equipment is detailed in Chapter 5 (MetroLink Construction Phase).

The proposed substations will use a dielectric gas, sulphur hexafluoride (SF_6) at a moderate pressure for phase-to-phase and phase-to-ground insulation (see Chapter 3 (Background of MetroLink Project)). SF_6 is a potent greenhouse gas and will require the implementation of strict protocols within the design for construction and maintenance, including leak detection measures, to avoid fugitive emissions. Please refer to Chapter 17 (Climate) of the EIAR for further information.

Consent for the Construction Phase power supply is included in the RO application and accordingly is evaluated in this EIAR.

22.5.2.3.2 Water Supply and Wastewater

Permanent potable water supply and foul water connections will be required at all stations and Dardistown Depot. There will be no public toilets at the stations or on the trains and thus sanitary wastewater volumes will be low, arising from staff welfare facilities only. Pre-application enquiries for water supply and foul discharge connection have been submitted to Irish Water for each station and consultation is on-going.

A supply of water will be required at all construction compounds. It is anticipated that a mains supply will be available at all stations, intervention shaft and tunnel worksites. Satellite sites which are located in or adjacent to existing urban facilities would also be expected to benefit from a mains supply. For worksites in the northern section, tankers may be required to supply water to sites which are remote to mains supply or other sources.

An early study has been undertaken to assess potential availability for connection supply and foul water disposal at each of the worksites. Water supply requirements are detailed in Appendix A5.11 (Water Management).

Water usage will vary from site to site and as the construction programme evolves. At peak, the most significant use of water will be at sites where on-site batching of concrete is proposed; at Estuary, the Dublin Airport South Portal, Dardistown Depot, Northwood Station and Portal, Ballymun and Griffith Park Station.

It is anticipated that methods of collecting (harvesting) rainwater, and recycling and treatment of wastewater for general site use, will be adopted wherever practical to do so. Requirements for dewatering installations at deep station, tunnel portals, shafts and shallow sub surface works could provide a valuable source of water for general site use.

Foul water drainage will be installed at the construction sites to collect discharge from office and welfare accommodation. Where possible, this will be connected to mains sewers in local highways, or alternatively to a septic tank for emptying by road tanker.

Construction wastewater will principally be generated from the following activities: groundwater dewatering, washing down (surface, underground (deep stations) and tunnels), dust suppression, concrete batching, wheel washing, TBM cooling and TBM conditioning. Wastewater will be recycled where possible (e.g. for wheel washing and boot washing) or reused (e.g. for dust suppression or grout mixing). Water that cannot be recycled or reused will require disposal by discharge to a foul sewer. Where this is not possible, wastewater will need to be tankered off site to a suitably licensed treatment facility.

Wastewater may require pre-treatment prior to reuse or disposal. On-site treatment may involve settlement, filtration and/or flocculation to remove suspended solids. All wastewater discharges to sewer networks will be classed as trade effluent and will require a Trade Effluent Licence from Irish Water. Pre-connection applications have been submitted to Irish Water for each construction compound. A Trade Effluent Licence sets out conditions that businesses must comply with. These may include:

- The nature, composition and volume of the trade effluent discharge;
- The method of treatment, the location of discharge and the periods during which discharge may be made;
- The taking and analysis of trade effluent samples and the trade effluent records that must be kept; and
- Applicable charges for discharging trade effluent, as approved by the Commission for Regulation of Utilities (CRU).

22.5.2.3.3 Surface Water Drainage

Surface water drainage will be installed throughout the alignment, particularly at low points where pumped drain routes will be used to remove any collected water. Mechanical lifting aids will be installed for ease of maintenance access. Surface water drainage will be discharged to nearby watercourses or to surface water sewers following effective treatment and attenuation. Discharging to watercourses requires a wastewater discharge licence or certificate of authorisation from the EPA. There are stringent conditions attached to wastewater discharge licences to ensure the water is of good quality and does not negatively impact on the environment.

The proposed Project crosses five main waterbodies in the northern section where the alignment is above ground. These waterbodies are Broadmeadow River; Ward River; Sluice River; Mayne River and Santry River. All proposed watercourse culverts, crossing and diversions will be designed in accordance with Section 50 of the Arterial Drainage Act, 1945 (as amended) and compliance will be required from the Office of Public Works and Inland Fisheries Ireland. This will ensure continued conveyance of existing flows without any upgradient or downgradient impacts on flow or water quality.

Surface water run-off from the construction compounds will be discharged to ground where soil conditions allow, or to a watercourse or to surface water sewer if of sufficiently good quality.

A detailed assessment of potential impacts arising from Operational and Construction Phase drainage requirements on surface water quality and flood risk are contained in Chapter 18 (Hydrology). The management of surface water arising from construction activities is detailed in Chapter 5 (MetroLink Construction Phase).

22.5.2.3.4 Telecommunications

New telecommunications connections will be required to support operational signalling and communications systems, as described in Section 4.11 of Chapter 4 (Description of the MetroLink Project).

22.5.3 Worst-Case Scenario

The worst-case scenario would result if the design of the proposed Project did not take account of the identified infrastructure and utilities. The resulting predicted impact of the worst-case scenario for the proposed Project would be Negative, Significant and Short-term.

22.6 Mitigation Measures

The potential for the proposed Project to impact or interrupt utility supply has been assessed. Utility services near the proposed Project have been identified using the methods detailed in Sections 22.3.3 and 22.4.4 and locations where the proposed alignment crosses existing infrastructure have been established.

Consultations have been undertaken with all known service providers, as outlined in Table 22.3, and their requirements have been identified and incorporated into the design.

Designs for utility diversions and/or protection of infrastructure have been agreed in principle with the relevant utility providers. Design refinement will be subject to further consultation with the utility providers and targeted excavation by slit trenching to expose services and validate their position and depth, in accordance with PAS 128:2014 Quality Level A.

22.6.1 Utility Diversions

Where there is interaction between the proposed Project and existing infrastructure, the locations of the interactions have been identified and planned for, and therefore the potential for any service disruption is limited.

An overview of the required utility diversions is provided in Table 22.10.

Table 22.10: Utility Diversion Requirements

Utility	Approximate length of diversions / quantities (m)
Communications Ducts (1x100mm duct)	6,985
HV Electricity	750
MV/LV Electricity	7,630
Gas MP/LP	2,380
Water Main <300mm	1,590
Water Main >300mm	2,338
Foul Water <600mm	1,680
Surface Water <600mm	5,755
Foul Water >600mm	290
Surface Water >600mm	620

Construction works required to divert utilities have been detailed in Chapter 5 (MetroLink Construction Phase). Utility diversions and any required strengthening works will normally be undertaken as part of the Enabling Works, prior to commencement of the Main Civil Works.

To ensure that the operation of the proposed Project is not affected by future utility maintenance or diversions activities, utility services will generally be diverted away from the alignment where necessary. All utilities that cross the alignment will have appropriate protection measures installed and spare capacity for future maintenance or expansion provided where necessary.

In some cases, planned service disruptions will be required to facilitate the connection of existing services to the newly diverted services. In such cases, cognisance of the requirements of those premises served by the utility will be taken in determining the type, duration and phasing of the planned disruption. The duration of service interruption will be agreed with the relevant utility provider, in accordance with their service level/business interruption requirements, however in most cases the duration of disruption should be no more than a number of hours.

The impact of the integrity of railway and canal infrastructure at the proposed Glasnevin Interchange Station has been assessed in consultation with Iarnród Éireann and Waterways Ireland and mitigation measures identified.

A summary of the mitigation measures to be employed to minimise the impact on infrastructure and utilities within each geographical area of the proposed Project is provided below and in Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation.

22.6.1.1 AZ1 Northern Section: Estuary Station to Dublin Airport North Portal

The majority of the proposed Project through Section AZ1 progresses in a cut section where there are significant clashes with existing utilities. In order to mitigate the impacts in this area, utility diversions will be undertaken in advance of the main Construction Phase for the proposed Project. The required diversions are significant and are outlined in Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation.

Where existing sewers require diversion to facilitate the route of the Metrolink line in Swords along the R132 roadway, these will be facilitated by proposed interceptor sewers which pick up existing wastewater connections where they cross the proposed alignment. To support the reconfiguration of the existing wastewater collection system, a new pumping station is proposed at Seatown West (south-west of the Estuary Roundabout) which will pump through twin 450mm diameter rising mains and join a 1,600mm gravity sewer on the eastern side of the alignment which in turn travels via gravity to the Swords WwTP. Construction of the pumping station will include holding tanks for storm water. The

construction of these tanks and the pumping station is detailed in Section 5.8 of Chapter 5 (MetroLink Construction Phase) of the EIAR.

An existing water main crossing over the Broadmeadow and Ward Rivers will be diverted below ground at the site of the proposed Broadmeadow and Ward River Viaduct. The diverted utility will pass under both rivers using Horizontal Directional Drilling (HDD) technology, thereby removing the requirement to impact the waterbody during the Construction Phase. Relevant approvals will be obtained from the Office of Public Works (OPW) for this crossing as required under the Section 50 of the Arterial Drainage Act, 1945.

At Fosterstown Station the decommissioning and relocation of two electrical sub-stations serving the Airside Retail Park will be required.

Telecommunication cables will be either decommissioned and replaced, diverted outside the alignment or permanently decommissioned, depending upon each situation. An Eir fibre route from Swords to the airport will be diverted outside of the alignment. A Vodafone telecommunications mast at Fosterstown will be relocated slightly north of its current location, away from the alignment.

22.6.1.2 AZ2 Airport Section: Dublin Airport North Portal to Dublin Airport South Portal

Most of the proposed land for the DANP construction site and the DASP main compound is currently unoccupied farmland and as a result there is limited potential for clashes with utilities. However, where these occur, utility diversions will be undertaken in advance of the main Construction Phase for the proposed Project in order to mitigate any significant impacts on these utilities (Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation).

A small number of clashes with electricity and telecommunications cables owned by DAA have been identified in this area. These will be diverted outside the alignment.

Several MV electricity cables owned by ESB and a MP gas main owned by GNI are to be decommissioned.

22.6.1.3 AZ3 Dardistown to Northwood: Dublin Airport South Portal to Northwood

Works proposed in Area AZ3 will include the construction of the proposed maintenance depot at Dardistown, Dardistown Station, the M50 Viaduct, Northwood Station and the Northwood Portal. Potential impacts on utilities in this area will be mitigated by way of utility diversions as outlined in Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation.

Foul water collection from domestic and commercial premises is provided by Irish Water. Two large diameter foul sewers (a 1,800mm diameter sewer proposed as part of the GDDS and an existing 900mm diameter sewer not part of the GDDS) are present in this area.

The alignment crosses a 1,800mm diameter sewer proposed as part of the GDDS at Dardistown Depot. A 900mm sewer clashes with the alignment at Northwood Station. This would be decommissioned and diverted. A private foul rising main, owned by DAA, would need to be diverted for an approximate 200m section south of the M50 Viaduct and 100m section north of the M50 Viaduct. A second privately owned foul sewer would need to be decommissioned and diverted at Dardistown Depot.

MV electricity cables where they clash with the alignment will be either decommissioned and replaced, or diverted outside the alignment, depending upon each situation. A HV electricity cable will be diverted at Northwood Station.

A small number of clashes with telecommunications cables owned by Eir have been identified in this area. These will be diverted outside the alignment. At Northwood a telecoms mast will be relocated to the north of its current location, away from the proposed alignment.

22.6.1.4 AZ4 Northwood to Charlemont: City Section

Given the highly urbanised nature of this section of the alignment a significant number of utility impacts have been identified. Utility diversions, as detailed in Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation, will be undertaken to mitigate potential impacts.

The design of the proposed O'Connell Street Station will be integrated with a planned commercial development for the site. Dublin Central GP Ltd (DCGP) has submitted a planning application to DCC to develop the location known as Dublin Central for a mixed-use development. Under this scenario the MetroLink station will be housed within a structural box provided by the Developer (Hammerson). Once the structural box is in place, and completed to the levels agreed with TII, the oversite development can be constructed over and around the station. However, if the Dublin Central scheme does not obtain planning consent, the station development will proceed with the station box being constructed by the appointed MetroLink contractor(s). No utility clashes have been identified within the O'Connell Street station box. The only locations where utilities cross the alignment are tunnelled sections, where there is no impact.

Around twenty clashes with telecommunications cables, owned by Eir and Virgin Media, have been identified at Collins Avenue, Glasnevin, Mater, Tara and Charlemont Stations. These telecommunication cables will be either decommissioned and replaced, reinstated post station box construction, diverted outside the alignment or permanently decommissioned, depending upon each situation. At Ballymun Station there are two traffic fibre cables owned by DCC that clash with the station alignment. These will be decommissioned and replaced outside of the station alignment.

Foul water sewers owned by Irish Water clash with the alignment at Collins Avenue, Glasnevin, Mater, Tara and Charlemont Stations. These will need to be decommissioned and diverted outside the station alignments. There are also water mains at each of the stations that will need to be decommissioned and diverted.

At Ballymun, Collins Avenue and Tara Stations there are sections of surface water sewers owned by DCC that require diversion.

With respect to electricity cables, the alignment clashes with HV underground cables at Collins Avenue, St Stephen's Green and Charlemont Stations and with MV underground cables at Glasnevin and Tara Stations. These will require diversions as detailed in Table 22.10.

Within the AZ4 area there are two MP gas mains and a LP gas main that require diversion at St Stephen's Green Station. There are also LP gas mains at Mater and Tara Stations that clash with the alignment and again will need to be diverted.

The Glasnevin Station development includes the construction of the new MetroLink station, platforms for two Iarnród Éireann commuter railways - the Western Commuter Line and the South-Western Commuter Line, and a concourse area to connect all three railways together.

There is a requirement to modify the Iarnród Éireann track layout and alignment at Glasnevin Station as part of the Project works. This will involves lowering a large section of the track by circa 2m and modification to the existing junction. The proposed construction site is very constrained and in order to carry out the works, multiple phasing of activities will be undertaken. In preparing the construction sequence, a coordinated approach to the track lowering is proposed to avoid closing both railways at the same time for the station construction works. Following consultation with Iarnród Éireann, closure of the Western Commuter Line for a period of 21 months is proposed, re-opening, and then closure of the South Western Commuter Line for five months. The overall sequence of works in the Glasnevin Station area has been linked with planned Iarnród Éireann infrastructure works.

The main known utilities impacted at Glasnevin Station are:

- 225mm foul water sewer on the north and south side;
- 4 No. communication ducts;

- 1 No. HV electrical cable (38kV);
- 1 No. electrical cable >150m north of the station;
- 1 No. surface water sewer;
- Water main along the canal towpath; and
- Railway utilities along the railway.

There is a requirement for a temporary electrical substation at Glasnevin to facilitate delivery of the DART+ and MetroLink projects. The Iarnród Éireann temporary substation must be in place before the permanent traction substation is incorporated into the future station. The installation of a 38kV power supply will be within the MetroLink construction area. It is anticipated that the cable route will directly conflict with multiple temporary and permanent structures during the construction period and will need to be managed and protected. Options for the location of the substation within the construction area are under review with Iarnród Éireann.

Enabling works will require the demolition of existing railway infrastructure, including existing tunnels and retaining walls. There will be a requirement for possession to be taken of the existing railway lines.

The construction of Glasnevin Station will also temporarily affect the Royal Canal with the temporary closure of the canal and the northern towpath, which also provides vehicular access to the residential Coke Oven Cottages.

To construct the Western Commuter Line side platform and access stairs, a new secant pile retaining wall is necessary in the towpath behind and south of the existing masonry retaining wall over at least the length of the platform (174m). Additionally, temporary infilling of part of the canal basin is likely to be needed for construction access.

During construction, vehicular access along Royal Canal Way to Coke Oven Cottages will be severed by the piling works for the station. In mitigation, Enabling Works will include the construction of a temporary bridge crossing the Royal Canal to maintain access into the Coke Oven Cottages and to allow for connectivity along the Royal Canal Way. This will involve the construction of a temporary bridge crossing that will allow vehicular access to Coke Oven Cottages and pedestrians/cyclists to cross the canal and continue along the southern canal towpath to Prospect Road. The bridge will have sufficient clearance to allow canal traffic to operate and pedestrians on the tow path to pass underneath.

On the south side of the proposed station there is an existing water main owned by Irish Water, which runs in an east west orientation. It is proposed that this main is diverted along the canal tow path to facilitate station construction.

Following the completion of the Construction Phase the canal towpath will be fully reinstated on its existing alignment. In order to maintain the existing width along the towpath a permanent cantilever structure will be provided to carry the towpath over the proposed Iarnród Éireann platform serving the Western Commuter Line.

The maximum duration of time that the Royal Canal will be impacted by the works is predicted to be 34 months. However, subject to further consultation and agreement with Waterways Ireland, it is considered that the duration of full closure could be limited to approximately five to six months, with the canal remaining operational but with restricted width for the remaining time. It will only be necessary to close the canal towpath for a period of four weeks while the temporary road bridge is installed.

At the proposed Tara Station there are also a large number of existing utilities both within the footprint of the proposed station, and in the areas immediately surrounding the proposed works. The utilities currently located within the footprint of the station must be decommissioned during the course of the works, as it will not be possible to retain these utilities during the construction works.

These utilities will be moved to their final permanent position in advance of the works where possible. Where this is not possible, diversions will be provided to ensure continuity of service/maintenance of network connections for the various utilities, and on completion of the station, the utilities will be relocated to their final, permanent position.

Of the existing utilities to be retained during the course of the works, a 2.4m internal diameter (8′ 00″) 100-year-old, brick-lined sewer (commonly referred to as the 8-foot sewer) is of particular concern, as this is a critical piece of network infrastructure for the drainage of municipal waste in Dublin City. The 8-foot sewer is located beneath Townsend Street, running in an east-west direction, directly to the south of the proposed Tara Station. As a result of the proposed works, and the proximity of the 8-foot sewer to Tara Station, the sewer may be subjected to ground movements and vibration arising from construction of the station and TBM driven tunnel. A geotechnical settlement assessment has been undertaken for the sewer and other utilities at Tara Street and is included within the RO application.

The geotechnical assessment concludes that while the works related to the proposed construction of Tara Station and the associated tunnelling will introduce risks to adjacent utilities, it will be possible to implement geotechnical mitigation measures and associated monitoring and control measures to protect against these risks. This will ensure that the Townsend Street sewer can remain in operation during the construction of the station and tunnel and subsequent operation of MetroLink, with no impact on the capacity of the sewer.

22.6.2 Settlement

22.6.2.1 Existing Utilities

Protective measures will be undertaken to keep the risk of utilities settlement to a minimum. It is intended that the primary form of mitigation will be to use good tunnelling practice, including continuous working, erecting linings immediately after excavation and providing tight control of the tunnelling process to reduce the magnitude of settlement. For the majority of utilities, they would be monitored, inspected on completion of the works and any damage repaired. Where this approach is deemed insufficient to mitigate the risk of damage to utilities, then intrusive mitigation measures will need to be considered in conjunction with the utility owner. These may include direct works on the utilities. These three categories are described in more detail below.

- At-source measures - these include all actions taken from within the tunnel, that will be detailed in the TBM Management Plan, requiring no additional land take:

- during its construction to reduce the magnitude of ground movements generated at source such as TBM closed face operation; and
- increased tunnel face pressure.

- Ground treatment measures - these comprise methods of reducing or modifying the ground movements generated by tunnelling/shaft/station box excavation by improving or changing the engineering response of the ground immediately surrounding the station box or shaft. Categories of ground treatment include:

- permeation or jet grouting which involves the creation of stiffer ground to reduce settlement; and
- control of groundwater to avoid changes which could potentially cause ground movement.

These measures would be undertaken from the proposed construction worksite areas, as detailed in Chapter 5 (MetroLink Construction Phase).

- Structural measures - these methods reduce the impact of ground movements by increasing the capacity of a utility to resist movement. Available measures would include:

- support;
- repairs;
- isolation from the moving ground;
- relining; and
- replacement or diversion (in the most significant cases).

These measures would require works to the utility similar to those regularly undertaken by utility providers to maintain or upgrade existing assets. They would be undertaken either by the utility provider or by MetroLink contractors in conjunction with the utility provider under their existing powers. The

approach to intrusive mitigation measures will be further developed during the detailed design process in cooperation with the contractor.

Any required mitigations will be designed and agreed with the asset owner. The contractors will prepare, *inter alia*:

- Ground Movement Management Plans;
- Groundwater Monitoring Plans; and
- Instrumentation and Monitoring Plans.

Ground movements will be monitored against specific asset triggers to ensure critical damage is avoided.

Chapter 28 (Risk of Major Accidents & Natural Disasters) considers the risk of settlement impacting on critical infrastructure. The residual risk is considered to be Medium. Further mitigation and management plans, as described above, are required to ensure that the risk is as low as reasonably possible.

22.6.2.2 Existing Infrastructure

A settlement impact assessment has been carried out for the existing bridges and other assets within the potential impact zone of the MetroLink scheme (Appendix A5.17). Appropriate Instrumentation and Monitoring will be designed and installed on these assets as required.

The assessment of existing bridges within the settlement impact zone and the proposed resultant mitigations are shown in Table 22.11.

The Luas Line crosses the MetroLink route however, no intervention is anticipated to be required at these.

Some intervention to adjust the Iarnród Éireann rail levels is anticipated during the construction of Tara Station.

An appropriate instrumentation and monitoring strategy will be developed and agreed with Iarnród Éireann/Luas operators to verify the actual settlements on site and ensure the safe operations of these services.

Chapter 28 (Risk of Major Accidents & Natural Disasters) considers the risk of train derailment on the Iarnród Éireann and Luas Lines arising from settlement subsidence under existing track and surrounding infrastructure. The residual risk is considered to be low given the embedded design measures and proposed construction measures and management practices.

There is potential for the MetroLink construction to impact the Cross Guns Quay Canal Lock and further assessment will therefore be undertaken. If required, appropriate protective measures will be implemented to ensure that the lock gates remain operational and meet the performance requirements.

Any settlement impact to the airport infrastructure is anticipated to be minimal. The monitoring of the airfield and any control measures will be agreed with the Airport Authorities.

Only minimal impact is anticipated on roads crossing the proposed Project route. However, there is some risk of surface cracking which might require resurfacing works at the end of construction at station locations and will be addressed during the completion works.

Table 22.11: Summary of Infrastructure Settlement Impacts

Ref	Chainage	Description	Comments
ST-1	8+320	Old Airport Road	Differential settlement gradient less than 1 in 450. No mitigation proposed.

Ref	Chainage	Description	Comments
ST-2	12+860	Ballymun Road Petrol Station	Outside 1mm settlement contour. No mitigation proposed.
ST-3	13+900	St Mobhi Road Bridge	Single-span bridge on shallow foundations. No mitigation proposed.
ST-4	14+890	Road bridge	Single-span bridge on shallow foundations. Mitigation proposed: Inspect bearings; and provide temporary bearings and jacks.
ST-5	14+940	Road bridge	Single-span bridge on shallow foundations. Mitigation proposed: Inspect bearings; and provide temporary bearings and jacks.
ST-5a	14+950	Road bridge	Single-span bridge on shallow foundations Mitigation proposed: Inspect bearings; and provide temporary bearings and jacks.
ST-5b	14+950	Cross Guns Quay Canal Lock	Mitigation proposed: Survey and adjust lock gates to ensure free movement.
ST-6	16+900	O' Connell Street – Jim Larkin Statue	Rigid structure. No mitigation proposed.
ST-7	17+120	Rosie Hackett Road Bridge	Single-span bridge supported on pile foundations. No mitigation proposed.
ST-8	17+380	Rail bridge over Poolbeg Street corner with Luke Street	Single-span bridge on shallow foundations. Mitigation proposed: Inspect bearings; and provide temporary bearings and jacks.
ST-9	17+500	Rail bridge over Townsend Street	Single-span bridge on shallow foundations. No mitigation proposed.
ST-10	17+580	Rail bridge Over Shaw Street	Outside 1mm settlement contour. No mitigation required.
ST-11	19+420	Luas Line bridge over Dartmouth Road	Single-span bridge on shallow foundations. Mitigation proposed: Inspect bearings; and provide temporary bearings and jacks.
ST-12	19+520	Luas Line bridge over Northbrook Road	Single-span Luas Line bridge on shallow foundations. No mitigation currently proposed.
ST-13	19+780	Luas Line bridge over Ranelagh Road	Outside 1mm settlement contour. No mitigation required.
ST-14	19+943	Luas Line bridge over Cullenswood Road	Outside 1mm settlement contour. No mitigation required.
ST-15	19+300 to 19+800	Embankment carrying Luas Line	No intervention to Luas Line anticipated. Appropriate Instrumentation & Monitoring strategy to be agreed with the Luas line operators.
Irish Rail Line	17+380 to 17+580	Irish Rail Line adjacent to Tara Station	Some intervention to adjust the rail levels is anticipated during the construction of Tara Station. Appropriate Instrumentation & Monitoring strategy to be agreed with the Irish Railway authorities.
Luas Line	16+800 to 17+200	Green Line and Red Line	No intervention to Luas Line anticipated. Appropriate Instrumentation & Monitoring strategy to be agreed with the Luas line Operators.
Airport Infrastructure		Airfield / Taxiway	No interventions to airport infrastructure are anticipated.

Ref	Chainage	Description	Comments
			Appropriate Instrumentation & Monitoring strategy to be agreed with the Operators.
Key Roads		Roads crossing above the MetroLink Tunnel Route or running close to the proposed station boxes.	Minimal impact in general, except for the roads close to the station boxes/retained cuttings with Phase-1 greenfield peak settlements greater than 50mm; in these areas there is a risk of surface cracking and stage resurfacing / patch repairs might be required during the construction of station boxes/retained cuttings. In these zones, appropriate surface settlement monitoring, inspection and intervention strategy to be agreed with the Highway Authorities.

22.7 Residual Impacts

If the mitigation measures described in Section 22.6 are put in place, the residual impact of the proposed Project on utilities is considered to be Neutral in effect.

All impacted utilities will be reinstated in accordance with current standards and specifications for the relevant utility (as specified by the utility owner). In the case of older utilities, this means that the replacement section will be constructed with modern materials. There may be a localised positive environmental impact an associated with this, for example, the replacement of cast iron pipes with ductile iron or HDPE pipes, which are more durable and less prone to leakage, and the replacement of underground oil or fluid filled electricity cables with plastic insulated cables.

In the case of the railway infrastructure at Glasnevin, the residual impact of the proposed Project is considered to be Positive in effect. The new station development will provide an interface with the Iarnród Éireann Western Commuter Line and the South-Western Commuter Line; with a new concourse area to connect all three railways together. The overall sequence of works at Glasnevin Station has been linked with planned Iarnród Éireann improvement works in the station area and to the west of the station.

In relation to the Royal Canal at Glasnevin, the residual impact of the proposed Project is considered to be Neutral in effect. The canal retaining wall and base will be strengthened and the functioning of the canal will remain unchanged.

Following completion of the Construction Phase, the Royal Canal towpath at Glasnevin will be fully reinstated on its existing alignment. In order to maintain the existing width along the towpath a permanent cantilever structure will be provided to carry the towpath over the proposed Iarnród Éireann platform serving the Western Commuter Line.

Minimal settlement impact is predicted on existing bridges and other infrastructure assets within the calculated potential settlement zone of the proposed Project. Where there has been assessed to be a moderate settlement impact, mitigation measures are as stated, further assessment will be undertaken and intervention measures will be implemented, if required. Appropriate instrumentation and monitoring strategies will be developed and agreed with the asset operators to verify the actual settlements on site and ensure the safe operations of services. At Dublin Airport the settlement impact on infrastructure is anticipated to be minimal. The monitoring of the airfield and any control measures will be agreed with the airport authorities.

Based on the current assessment, up to 0.5% of utilities within the calculated settlement impact zone could be adversely affected. However, the settlement analysis undertaken uses a number of conservative assumptions and it is anticipated that with additional assessment at the detailed design stage this number will be further reduced. Settlement risk will be predominantly controlled by

construction working practices but, if necessary, adequate remedial measures are available to protect utilities so that their integrity will not be compromised.

Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation provides a summary of the infrastructure and utilities impacted, proposed mitigation measures and residual impact on structures and services.

Table 22.12: Summary of Residual Infrastructure and Utility Impacts Post Mitigation

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
AZ1: Northern Section	Estuary Station	Foul sewer	300mm - concrete	Irish Water	Very High	Low	Moderate	Divert outside alignment	Not significant
	Seatown Station	Foul sewer	1,000mm - concrete	Irish Water	Very High	Low	Moderate	Divert outside alignment	Not significant
	Seatown Station	Foul sewer	355mm - concrete	Irish Water	Very High	Low	Moderate	Over-pump during works, reinstate following completion of works	Not significant
	R132	Foul sewers	225mm and 300mm	Irish Water	High	Low	Slight	To be decommissioned and diverted	Not significant
	R132	Foul sewers	350mm and 375mm	Irish Water	Very High	Low	Moderate	To be diverted, replaced by new main or reinstated	Not significant
	R132	Foul sewer	450mm - unknown	Private	Very High	Low	Moderate	Tied into diverted sewer	Not significant
	R132	Foul sewers	600mm - concrete	Irish Water	Very High	Low	Moderate	Diverted via proposed pumping station	Not significant
	R132	Foul sewers	750mm - concrete	Irish Water	Very High	Low	Moderate	Diverted or replaced by new main	Not significant
	R132	Foul sewers	1,000mm, 1,300mm - concrete	Irish Water	Very High	Low	Moderate	Diverted and connected to new main	Not significant
	R132	Foul sewer	1,600mm - concrete	Irish Water	Very High	Low	Moderate	Diverted via proposed pumping station	Not significant
	Swords	Foul sewers	225mm, 300mm - concrete	Irish Water	High	Low	Slight	Diverted and connected to new main	Not significant
	Swords	Foul sewers	600mm - concrete	Irish Water	Very High	Low	Moderate	Diverted and connected to new main	Not significant
	Swords	Foul sewers	900mm - concrete	Irish Water	Very High	Low	Moderate	Diverted and connected to new main	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
	Swords Station	Foul sewers	225mm - unknown	Irish Water	High	Low	Slight	Reinstated or decommissioned and diverted	Not significant
	Swords Station	Foul sewer	300mm - unknown	Irish Water	High	Low	Slight	To be decommissioned and diverted	Not significant
	R132	Surface Water	600mm, 900mm, 1,200mm - concrete	FCC	Very High	Low	Moderate	Divert outside alignment	Not significant
	Seatown Station	Surface Water	600mm - concrete	FCC	Very High	Low	Moderate	Decommission. To be replaced by new sewer	Not significant
	Seatown Station	Surface Water	375mm - unknown	FCC	Very High	Low	Moderate	Connect to storage tank	Not significant
	R132, Seatown, Swords & FosterstownStations	Surface Water	225mm, 300mm – unknown/ concrete	FCC	High	Low	Slight	Divert outside alignment or decommission depending upon each situation.	Not significant
	Broad-meadow and Ward Rivers Viaduct	Water supply Existing water main crosses over the Broadmeadow and Ward Rivers	762mm - CO	Irish Water	Very High	Low	Moderate	To be diverted below ground, beneath the rivers	Not significant
	R132, Estuary, Seatown, Swords & Fosterstown Stations	Water supply	Various; 100mm, 150mm, 160mm, 200mm, 225mm	Irish Water	High	Low	Slight	To be decommissioned and diverted outside alignment	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
	R132, Seatown, Swords & Fosterstown Stations	Communications network cables - underground	Various	Eir/BT/Virgin Media	Very High	Low	Moderate	Cables to be either decommissioned and replaced, diverted outside the alignment or permanently decommissioned, depending upon each situation	Not significant
	South of Airside (CH5-200)	Communications network cables - underground	Various	Eir	Very High	Low	Moderate	Fibre route from Swords to airport to be diverted outside the alignment.	Not significant
	Fosterstown Station	Telecoms mast at Airside Shopping Centre	N/A	Vodafone	Very High	Low	Moderate	Relocate north of current location at chainage CH04+780	Not significant
	Fosterstown Station	Electrical substations at Airside Shopping Centre	2 x MV substations	ESB	High	Low	Slight	Substations to be decommissioned and relocated	Not significant
	Estuary Station	HV underground electricity cables	3 x 1 x 630v	ESB	Very High	Low	Moderate	Provide new cable crossing under track at CH02+220	Not significant
	R132, Seatown & Fosterstown Stations	Medium & Low Voltage underground and overhead electricity cables	Various	ESB	High	Low	Slight	Cables to be either decommissioned, diverted outside the alignment or provided with a new crossing	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
	R132, Swords & Fosterstown Stations	Gas pipelines – MP	Various; 32mm, 63mm, 125mm, 250mm	GNI	High	Low	Slight	Pipes to be either diverted outside station alignment, provided with a new crossing or decommissioned, depending upon each situation.	Not significant
AZ2: Airport Section	Tunnel	Foul sewers	300mm	DAA	High	None (no clashes)	N/A	N/A	N/A
	Tunnel	Surface water sewers	300mm	DAA	High	None	N/A	N/A	N/A
	Airport Station	Surface water drains	150mm	FCC	High	Low	Slight	Decommissioned	Not significant
	Tunnel	Potable water mains	150mm, 225mm & 300mm	Irish Water	High	None (no clashes)	N/A	N/A	N/A
	Airport Station	Communications network cables – underground	Various	DAA	Very High	Low	Moderate	Divert outside alignment	Not significant
	Tunnel	HV underground electricity cables	Various	ESB	Very High	None (no clashes)	N/A	N/A	N/A
	Tunnel	MV underground and overhead electricity cables	Various	ESB	High	None (no clashes)	N/A	N/A	N/A
	Airport Station	MV underground	3 x 125mm, 1 x 150mm	ESB	High	Low	Slight	Decommissioned	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
		electricity cables							
	Airport Station	Electricity cables – low voltage and public lighting	Various	DAA	High	Low	Slight	Divert outside alignment to west	Not significant
	Airport Station	Gas pipeline – MP	180mm	GNI	High	Low	Slight	To be decommissioned	Not significant
AZ3: Airport South Portal to North-wood	Dardistown Station	Foul	150mm and unknown diameter	Private (ABP Food Group)	High	Low	Slight	To be decommissioned and diverted	Not significant
	Dardistown	Foul	1,800mm - concrete	Irish Water	Very High	Low	Moderate	To be installed with sufficient cover and protection	Not significant
	M50 Viaduct	Foul	Rising main	Private (DAA)	Very High	Low	Moderate	Approx. 200m section south of M50 and approx. 100m north of M50 to be diverted.	Not significant
	Northwood Station	Foul	600mm - concrete	Irish Water	Very High	Low	Moderate	Divert to decommissioned and diverted	Not significant
	Northwood Station	Foul	255mm - concrete	Irish Water	High	Low	Slight	Divert to decommissioned and diverted	Not significant
	Dardistown Depot, Northwood	Water supply	Various; 50mm, 75mm, 80mm, 150mm	Irish Water	High	Low	Slight	Divert to decommissioned and diverted	Not significant
	Northwood Station	Water supply	381mm, 400mm, 450mm, 800mm	Irish Water	Very High	Low	Moderate	Replace as part of diversion of 800mm main	Not significant
	Northwood Station	Telecoms mast	N/A	Vodafone	Very High	Low	Moderate	Mast to be relocated to the north at approximate chainage CH10+100	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
	Dardistown Depot	Communications network cables - underground	100mm	Eir	Very High	Low	Moderate	Divert outside alignment	Not significant
	Northwood Station	HV underground electricity cable	Unknown	ESB	Very High	Low	Moderate	Divert outside Northwood station alignment	Not significant
	Dardistown Depot & Northwood Station	MV underground and overhead cables	Various	ESB	High	Low	Slight	Cables to be either decommissioned, diverted outside the alignment/ station box or provided with a new crossing	Not significant
AZ4: City Section	Collins Avenue Station	Foul	450mm - concrete	Irish Water	Very High	Low	Moderate	To be decommissioned and diverted outside station alignment	Not significant
	Glasnevin Station	Foul	2 x 450mm – clay and unknown material	Irish Water	Very High	Low	Moderate	To be decommissioned and diverted outside station alignment	Not significant
	Tara Station	Foul	990mm - brick	Irish Water	Very High	Low	Moderate	Decommission	Not significant
	Charlemont Station	Foul Existing public sewer runs through private apartment development	450mm - concrete	Irish Water	Very High	Low	Moderate	Public sewer diverted. Section of sewer within apartment development retained as private drainage to development.	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
	Charlemont Station	Foul Existing combined sewer runs through private apartment development	300mm - concrete	Irish Water	High	Low	Slight	To be decommissioned. Diversion of new combined sewer currently running through apartment development. Section retained as private drainage to apartment development.	Not significant
	Glasnevin & Mater Stations	Foul	225mm, 300mm – concrete, vitrified clay	Irish Water	High	Low	Slight	Divert outside station alignment	Not significant
	Collins Avenue Station	Surface water	1,350mm - unknown	DCC	Very High	Low	Moderate	Divert outside station alignment	Not significant
	Tara Station	Surface water	525mm and 675mm - concrete	DCC	Very High	Low	Moderate	Decommission sections of surface water sewers affected by Tara Station and connect into existing 1200mm combined sewer.	Not significant
	Ballymun Station	Surface water	150mm	DCC	High	Low	Slight	Divert outside station alignment	Surface water
	Collins Avenue Station	Water	800mm and 1,200mm - DI	Irish Water	Very High	Low	Moderate	Divert outside station alignment	Not significant
	Glasnevin Station	Water	406.4mm - CI	Irish Water	Very High	Low	Moderate	To be decommissioned and new main installed along canal tow path	Not significant
	Mater Station	Water	406.4mm - CI	Irish Water	Very High	None	N/A	To be decommissioned and diverted	Not significant
	St Stephen's Green Station	Water	450mm - DI	Irish Water	Very High	Low	Moderate	To be decommissioned and diverted outside station alignment	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
	Collins Avenue, Griffith Park, Glasnevin, Mater, Tara, St Stephens Green & Charlemont Stations	Water	Various; 50mm, 90mm, 125mm, 100mm, 150mm, 200mm, 300mm	Irish Water	High	Low	Slight	To be decommissioned and diverted outside station alignment	Not significant
	Collins Avenue, Glasnevin, Mater, Tara & Charlemont Stations	Communications network cables - underground	Various	Eir and Virgin Media	Very High	Low	Moderate	Cables to be either decommissioned and replaced, reinstated post station box construction, diverted outside the alignment or permanently decommissioned, depending upon each situation.	Not significant
	Ballymun Station	Traffic fibre cables	2 x 100	DCC	Very High	Low	Moderate	Cables to be decommissioned and replaced to east outside alignment.	
	Collins Avenue Station	HV underground electricity cables	3 x 260, 3 x 260	ESB	Very High	Low	Moderate	Divert outside alignment	Not significant
	St Stephen's Green Station	HV underground electricity cables	3 x 1 x 1,000v	ESB	Very High	Low	Moderate	Decommission as part of HV diversion	Not significant
	St Stephen's Green Station	HV underground electricity cables	3 x 125mm ducts	ESB	Very High	Low	Moderate	Divert outside station alignment to east, between CH18+420 and CH520	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
	Charlemont Station	HV underground electricity cables	1x100	ESB	Very High	Low	Moderate	Decommissioned and replaced following completion of the works	Not significant
	Collins Avenue, Glasnevin, Tara, St Stephen's Green & Charlemont Stations	MV underground cables	Various	ESB	High	Low	Slight	Cables to be either decommissioned and replaced, reinstated post station box construction, diverted outside the alignment or permanently decommissioned, depending upon each situation.	Not significant
	St Stephen's Green Station	Gas pipelines – MP	125mm, 180mm	GNI	High	Low	Slight	Pipes to be either diverted outside station alignment, provided with a new crossing or decommissioned, depending upon each situation.	Not significant
	Mater, Tara, & St Stephen's Green	Gas pipelines – LP	Various; 125mm, 180mm, 315mm	GNI	High	Low	Slight	Divert outside station alignment	Not significant
	Charlemont Station	Gas pipeline – LP	125mm 25mb	GNI	Very High	Low	Moderate	Short section to be decommissioned	Not significant
	Glasnevin Station	Railway	South Western Commuter Line (old GSWR)	Iarnród Éireann	Very High	Very High	Profound	Sequence of works has been linked with planned Iarnród Éireann infrastructure works to ensure interfacing and timing of works is optimised.	Not significant

Section	Location	Infrastructure/ Utility	Type/Size/ Material	Owner	Baseline Rating	Impact Magnitude	Impact Significance (pre-mitigation)	Mitigation Measures	Significance of Residual Impact
	Glasnevin Station	Railway	Western Commuter Line (old MGWR)	Iarnród Éireann	Very High	Very High	Profound	Sequence of works has been linked with planned Iarnród Éireann infrastructure works to ensure interfacing and timing of works is optimised.	Not significant
	Glasnevin Station	Waterway	Royal Canal Basin	Waterways Ireland	Very High	Very High	Profound	Sequence of works to be planned with Waterways Ireland to minimise the period of full closure of the canal. Temporary bridge to be installed across the canal to maintain access to residential properties and allow for connectivity along towpath. Full reinstatement of the canal following completion of the new retaining wall. Full reinstatement of the towpath along existing alignment on completion of the construction works.	Not significant

22.8 Difficulties Encountered in Compiling Information

Obtaining accurate records of existing utilities is difficult. In particular, information regarding the age and material of existing services is in some cases insufficient or unreliable. Consultation has been undertaken with infrastructure and utility stakeholders to supplement records where required. This assessment represents a prudent view of the baseline environment based on the information that was provided and otherwise obtained at this stage of the process.

22.9 Glossary of Terms

Term	Meaning
Alignment	Alignment refers to the three-dimensional (3D) route of the railway, considering both the horizontal and vertical alignment.
Construction Compound	An area occupied temporarily for construction-related activities. The main construction compounds will act as strategic hubs for core project management activities (i.e. 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).
Combined sewer	A combined sewer is where surface water run off and wastewater is collected in a single pipeline system and carried to a sewage works for treatment.
Foul sewer	A foul sewer is a pipe (usually below ground) that carries wastewater to a sewage works for treatment. Wastewater includes sanitary wastewater and trade effluent.
Enabling Works	These are works to prepare a site in advance of the main construction works, for example; demolition, removal of vegetation, land levelling, utility diversions, establishment of temporary traffic measures.
High pressure gas main	Pipes carrying natural gas at high pressure (typically >4bar) within the transmission network. The transmission network is used to move large volumes of natural gas.
High voltage electricity cable	Cables carrying electricity at high voltages (400kV, 220kV and 110kV) from generation stations to bulk supply points.
Infrastructure	The basic services that are needed in order to support an economy. In the context of this chapter, Infrastructure relates primarily to railway lines (and associated bridges) where there is interchange between the proposed Project and existing track or stations and navigable waterways (canals).
Medium and Low pressure gas mains	Pipes carrying natural gas at the pressure that the local distribution network operates at (typically <4bar). The distribution network typically supplies urban areas.
Medium and Low voltage electricity cables	Cables distributing electricity at a range of voltages from the transmission system, typically ranging from <10 kV to 38 kV.
Potable water main	A pipe carrying treated drinking water for public supply.
Railway Order	The approval from the planning authority (An Bord Pleanála) for permission to build and operate a Strategic Infrastructure Development (in this case, MetroLink).
Settlement	A downward movement of the ground caused by vertical strain in the soil. Excessive ground movements can result in damage to infrastructure and utilities.
Surface water sewer	A surface water sewer is a pipe (usually below ground) that carries uncontaminated rainwater to a local river, stream or soak away.
Telecommunications	Cables for the transmission of information, including telephone and internet, cable television networks, signalling and traffic cables and other control cables (e.g. other private services).
Trade effluent	Any liquid waste, other than surface water and sewage, that is discharged from premises being used for a business, trade or an industrial process.
Utility	A public service supply to homes and businesses. In the context of this chapter, Utilities relates to gas and electricity transmission/distribution systems, potable

Term	Meaning
	(drinking) water systems, foul or combined sewers, surface water sewers and telecommunications systems.
Utility clash	Where the proposed route of the railway (the alignment) intercepts with existing utilities.

22.10 References

British Standards Institute PAS128:2014. Specification for underground utility detection, verification and location

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