Chapter 14
Land, Soils, Geology & Hydrogeology

Contents

14. Land, Soils, Geology & Hydrogeology

14.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) considers the potential impacts on land, soils, geology and hydrogeology as a result of the Construction and Operational Phases of the Ballymun / Finglas to City Centre Core Bus Corridor Scheme (hereafter referred to as the Proposed Scheme). Chapter 4 (Proposed Scheme Description) includes a full description of the Proposed Scheme.

During the Construction Phase, the potential land, soils, geology and hydrogeology impacts associated with the development of the Proposed Scheme have been assessed. This includes the potential for contamination of soils and groundwater, and the loss of natural soils from excavation activities associated with utility diversions, road resurfacing and road realignments.

During the Operational Phase, the potential land, soils, geology and hydrogeology impacts associated with changes to water supply and the pollution of groundwater and watercourses have been assessed.

Potential impacts on the surface water environment are not considered in this assessment but are considered separately in Chapter 13 (Water).

The assessment has been carried out according to best practice and guidelines relating to land, soils, geology and hydrogeology assessment, and in the context of similar large-scale infrastructural projects.

An assessment is made of the likely significant impacts associated with the Construction and Operational Phases of the Proposed Scheme on these resources. Measures are presented to mitigate or eliminate the impacts of the Proposed Scheme on soils, subsoils, bedrock, geological resources and heritage and hydrogeology.

The aim of the Proposed Scheme, when in operation, is to provide enhanced walking, cycling and bus infrastructure on this key access corridor in the Dublin region, which will enable and deliver efficient, safe, and integrated sustainable transport movement along the corridor. The objectives of the Proposed Scheme are described in Chapter 1 (Introduction). The Proposed Scheme which is described in Chapter 4 (Proposed Scheme Description) has been designed to meet these objectives.

The design of the Proposed Scheme has evolved through comprehensive design iteration, with particular emphasis on minimising the potential for environmental impacts, where practicable, whilst ensuring the objectives of the Proposed Scheme are attained. In addition, feedback received from the comprehensive consultation programme undertaken throughout the option selection and design development process have been incorporated, where appropriate.

14.2 Methodology

The following sections outline the legislation and guidelines considered, and the adopted methodology for defining the baseline environment and undertaking the assessment in terms of land, soils, geology and hydrogeology.

The potential impacts of the Proposed Scheme on land, soils, geology and hydrogeology have been assessed by classifying the importance of the relevant attributes and quantifying the likely magnitude of any impact on these attributes.

14.2.1 Study Area

The land, soils, geology and hydrogeology study area for the Proposed Scheme extends 250m (metres) either side of the Proposed Scheme boundary which is in accordance with the Institute of Geologists of Ireland (IGI) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (hereafter referred to as the IGI Guidelines) (IGI 2013).

The Proposed Scheme has been divided into sections for ease of presentation and due to the volume of information available. The sections of the Proposed Scheme are as follows:

- Ballymun Road from St. Margaret's Road to Griffith Avenue;
- St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner;
- Prospect Road, Phibsborough Road from Hart's Corner to Western Way;
- Constitution Hill and Church Street to Arran Quay;
- Finglas Road from St. Margaret's Road to Wellmount Road;
- Finglas Road from Wellmount Road to Ballyboggan Road; and
- Finglas Road from Ballyboggan Road to Hart's Corner.

14.2.2 Relevant Guidelines, Policy and Legislation

The main documents that have been followed for the preparation of the land, soils, geology and hydrogeology assessment are:

- IGI Guidelines (IGI 2013); and
- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (hereafter referred to as the NRA Guidelines) (NRA 2008a).

Though the NRA is now known as Transport Infrastructure Ireland (TII), for the purpose of this Chapter the guidelines mentioned above are referred to as the NRA Guidelines.

In addition, the assessment has been prepared using the following guidelines and legislation:

- Environmental Protection Agency (EPA). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA 2022);
- Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (European Commission 2017);
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA 2008b);
- Strive Report Series No. 100. Evaluating the Influence of Groundwater Pressures on Groundwater-Dependent Wetlands. Strive EPA Programme 2007 - 2013 (EPA 2011); and
- Environmental Research Centre Report Series No. 12. A Framework for the Assessment of Groundwater-Dependent Terrestrial Ecosystems under the Water Framework Directive. Strive EPA Programme 2007 – 2013 (EPA 2008).

14.2.3 Data Collection and Collation

Data was compiled from publicly available datasets, the findings of ground investigations, design information, a scheme walkover survey, and other sources, as outlined below.

14.2.3.1 Publicly Available Datasets

The publicly available datasets listed in Table 14.1 have been acquired and consulted in the assessment of the baseline conditions. All datasets were accessed throughout 2020 and 2021.

Table 14.1: Publicly Available Datasets

Source	Name	Description
Ordnance Survey Ireland (OSI)	Current and historical ordnance survey maps	Current and historical survey maps produced by the OSI.
OSI	Aerial photography	Current and historical survey maps produced by the OSI.
Google	Aerial photography	Current aerial imagery produced by Google
Bing	Aerial photography	Current aerial imagery produced by Bing (Bing 2019)
Teagasc	Teagasc Soils Data	Surface soils classification and description
Geological Survey Ireland (GSI)	Quaternary Mapping	Geological maps of the site area produced by the GSI and also available on GSI online map viewer.
	Bedrock Mapping	
	Aggregate Potential Mapping	
	Mineral Localities	
	Geotechnical viewer	
	Groundwater Mapping	
	Groundwater Levels	
	National Landslide Database	
	Karst Database	
	Active Quarries and pits	
	County Geological Sites (CGS) and Geological Heritage Areas	
	GSI, Memoirs	
EPA	Corine Land Cover 2018	These datasets are based on interpretation of satellite imagery and national in-situ vector data.
	Designated Natural Heritage Area (NHA). Special Protections Area (SPA), Special Area of Conservation (SAC) sites	
	River Network Map	
	EPA Hydro Net	Reports of groundwater level monitoring points.
National Parks and Wildlife Service (NPWS)	Mapping within the area of the Proposed Scheme	This dataset provides information on national parks, protected sites and nature reserves
National Monuments Service (NMS)	State Mining and Prospecting Facilities	This dataset provides all recorded archaeological monuments (NMS 2019)
Department of Communications, Energy and Natural Resources (DCENR)	Minerals Ireland	A booklet contains a list of all current and prospecting mining facilities.
	Historic Mine Sites – Inventory and Risk Classification	Department of the Environment, Climate and Communications

14.2.3.2 Ground Investigation

The details of the existing / historical ground investigation reports located within the study area which have been used in the assessment of the baseline conditions are presented in Table 14.2. These reports are publicly available from the 'EXT GSI Geotechnical Sites layer' of the Geological Survey of Ireland (GSI) Spatial Resources Map Viewer (GSI 2019a).

Table 14.2: Existing Ground Investigations

GSI Report ID	Title	Year	Author	Location	Scope
R612	North City Milling Co.	1950	Unknown	113 Phibsborough Road.	Six boreholes (non-specified)
R346	Phibsborough Shopping Centre	1967	The Cementation Co. Ltd, Ireland.	R108 Phibsborough Road, Dublin.	Four cable percussion boreholes
R426	Flats Complex	Unknown	Unknown	N1 Church Street Upper.	Four boreholes (non-specified)
R892	Bridge Street SI	1989	IGSL	Bridge Street, Dublin	10 cable percussion boreholes
R942	North City Mills	1990	IGSL	North City Mills	Three cable percussion
R978	Site Investigation at Mellowes Road, Finglas	1977	Geotechnical Consulting Services Ltd.	Mellowes Road, Finglas.	Eight cable percussion boreholes
R7412	Dublin underground EIS	Unknown	IGSL	Dublin, Co Dublin.	27 cable percussion boreholes, 119 rotary core drilling, five trial pits and 12 window samples
R2500	Site Investigation at R148 Arran Quay / Hammond Lane	1989	IGSL	Old Maguire Match Factory at Hammond Lane, Dublin.	Eight cable percussion boreholes
R4673	Bedrock Outcrop	Unknown	Unknown	North Road, Dublin 11	Natural exposure
R4675	Bedrock Outcrop	Unknown	Unknown	North Road, Dublin 11	Natural exposure
R6069	Finglas Village Footbridge	2006	IGSL	Finglas Village, Dublin 11.	Two cable percussion, two rotary core drillings and two trial pits.
R6805	Mater Hospital	2007	IGSL	Mater Hospital;	Two Cable Percussion boreholes
R93	Proposed Development at Finglas Area 6, Dublin, Report on Trial Pit Inspection	1972	G&T Crampton Limited	Finglas Area 6, Dublin	Fifteen trial pits
R5433	Hotel Finglas Road, Sub-soil Investigation	2004	IGSL	Finglas Road	Eight rotary core boreholes, Eleven cable percussion boreholes
R5434	Finglas Road/ Tolka Valley Road Ground Investigation	2003	IGSL	Finglas Road/ Tolka Valley	Seven cable percussion boreholes
R4679	Bedrock Outcrop	Unknown	Unknown	R135 Finglas Road, Dublin 11.	Natural exposure
R706	Finglas Village Footbridge	Unknown	Unknown	Various Locations in Finglas Village	Six borehole wells (non-specified)
R4681	Bedrock Outcrop	Unknown	Unknown	R135 Finglas Road, Dublin 11.	Natural exposure
R6337	Proposed Development at Santry Demesne	2005	IGSL	Santry Demesne	Ten cable percussion boreholes, fifty trial pits and one hundred dynamic cone penetration

The scheme specific ground investigation carried out to inform the Proposed Scheme and the EIAR is listed in Table 14.3 and the factual report provided in Appendix 14.2 Ground Investigation Report in Volume 4 of this EIAR. This provides useful verification for the data already compiled relating to the baseline environment.

Table 14.3: Scheme Specific Ground Investigations

Title	Contractor	Year	Location	Scope
Bus Connect Detailed Stage 1 Lot 1 - Route 3 – Ground Investigation Report	Ground Investigations Ireland	2021	Route 3	3 no, cable percussion boreholes, 3 no. rotary boreholes, 3 no. window samples and 2 no. dynamic probes

14.2.3.3 Design Information

The information as provided in Chapter 4 (Proposed Scheme Description) and Chapter 5 (Construction), as well as the Plan and Profile Drawings (BCIDD-ROT-GEO_HV-0304_ML_00-DR-CR-9001 in Volume 3 of this EIAR), have been used in the assessment.

14.2.3.4 Scheme Walkover

A scheme walkover survey was carried out on 7 February 2020 and 9 July 2021 to inform and verify the review of publicly available datasets.

The findings of the scheme walkover survey including photos and scheme walkover survey notes are included in Appendix A14.1 Scheme Walkover Summary in Volume 4 of this EIAR.

14.2.4 Appraisal Method for the Assessment of Impacts

The impact assessment for this Chapter has been carried out in accordance with the NRA Guidelines (NRA 2008a) and the IGI Guidelines (IGI 2013).

The likely significant impacts have been assessed by classifying the importance of the relevant attributes and quantifying the magnitude of any likely significant impacts on these attributes, as outlined below:

14.2.4.1 Baseline – Initial Assessment

In order to identify and quantify the likely significant impacts of the Construction Phase and Operational Phase of the Proposed Scheme, it is first necessary to undertake a detailed study of the (baseline) geological and hydrogeological environment of the study area for the Proposed Scheme.

The existing land, soils, geology and hydrogeology conditions in the study area have been interpreted from a review of existing data, consultation, scheme walkover surveys and from Proposed Scheme specific ground investigations.

This assessment includes the development of a preliminary Conceptual Site Model (CSM), which describes the ground conditions expected throughout the study area of the Proposed Scheme based on existing literature. Also, as part of this initial assessment, the preliminary generic type of geological / hydrogeological environment was determined. The IGI Guidelines (IGI 2013) provide five types of environments as examples (Types A to E, as described in Step 3 of the IGI Guidelines).

14.2.4.2 Baseline – Direct and Indirect Site Investigation

Information gathered on the baseline environment during specific ground investigations for the Proposed Scheme corresponds to the second element of the methodology, ‘Direct and Indirect Site Investigation and Studies’.

As part of the second element, relevant site investigations and studies close to the Proposed Scheme were gathered and assessed. Then, the preliminary CSM was refined accordingly.

14.2.4.3 Gradation of Impacts

The NRA Guidelines (NRA 2008a) provide criteria and examples for determining likely significant impacts. The relevant tables from the NRA Guidelines are as follows:

- Box 4.1: Criteria for Rating Site Attributes – Estimation of Importance of Soil and Geology Attributes (Table 14.4);
- Box 4.3: Criteria for Rating Site Attributes – Estimation of the Importance of Hydrogeology Attributes (Table 14.5);
- The magnitude of impacts should be defined in accordance with the criteria provided in the NRA Guidelines (Table 14.6);

- Box 5.1: Criteria for Rating Site Attributes at Environmental Impact Assessment EIA Stage – Estimation of Magnitude of Impact on Soil / Geology Attribute (Table 14.7);
- Box 5.3: Criteria for Rating Site Attributes at EIA Stage – Estimation of Magnitude of Impact on Hydrogeology Attributes (Table 14.8); and
- Box 5.4: Rating of Significant Environmental Impacts at EIA Stage (Table 14.9).

The NRA Guidelines' criteria uses similar significance terminology as the EPA Guidelines (EPA 2022). However, it has intermediate steps to justify using that terminology:

- Step 1: Quantify the importance of a feature for geology (Box 4.1) and hydrogeology (Box 4.3);
- Step 2: Estimate the magnitude of the impact on the feature from the Proposed Scheme (Box 5.1, Box 5.3); and
- Step 3: Determine the significance of the impact on the feature from the matrix (Box 5.4) based on the importance of the feature and the magnitude of the impact.

Table 14.4: Criteria for Rating the Importance of Identified Soil and Geological Features (Table C2 (IGI 2013) and Box 4.1 (NRA 2008a)).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and / or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and / or soft organic soil underlying route is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (CGS). Well drained and / or highly fertility soils. Moderately sized existing quarry or pit. Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and / or soft organic soil underlying route is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes Moderately drained and / or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and / or soft organic soil underlying route is small on a local scale.	Large historical and / or recent site for construction and demolition wastes. Small historical and / or recent landfill site for construction and demolition wastes. Poorly drained and / or low fertility soils. Uneconomically extractable mineral resource.

Table 14.5: Criteria for Rating the Importance of Identified Hydrogeological Features (Box 4.3 (NRA 2008a)).

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation (e.g. a candidate Special Area of Conservation (cSAC) or Special Protection Area (SPA) status).
Very High	Attribute has a high quality or value on a regional or national scale	Regionally important aquifer with multiple well fields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation. Natural Heritage Area (NHA) status. Regionally important potable water source supplying >2500 homes. Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes.

Table 14.6: Definition of Magnitude of Impact (Table 5.1 (NRA 2008a))

Magnitude of Impact	Description
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistence with existing or emerging trends
Significant	An impact which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Profound	An impact which obliterates all previous sensitive characteristics

Table 14.7: Criteria for Rating Soils and Geology Impact Significance and Magnitude at EIA Stage (Table C4 (IGI 2013) and Box 5.1 (NRA 2008a))

Magnitude of Impact	Criteria	Typical Example
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves Irreversible loss of high proportion of local high fertility soils Removal of entirety of geological heritage feature Requirement to excavate / remediate entire waste site Requirement to excavate and replace high proportion of peat, organic soils and / or soft mineral soils beneath alignment
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves Removal of part of geological heritage feature Irreversible loss of moderate proportion of local high fertility soils Requirement to excavate / remediate significant proportion of waste site Requirement to excavate and replace moderate proportion of peat, organic soils and / or soft mineral soils beneath alignment
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves Removal of small part of geological heritage feature Irreversible loss of small proportion of local high fertility soils and / or high proportion of local low fertility soils Requirement to excavate / remediate small proportion of waste site Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

Table 14.8: Criteria for Rating Hydrogeological Impact Significance and Magnitude at EIA Stage (Box 5.3 (NRA 2008a))

Magnitude of Impact	Criteria	Typical Example
Large Adverse	Results in loss of attribute and/or quality and integrity of attribute	Removal of large proportion of aquifer Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems Potential high risk of pollution to groundwater from routine run-off Calculated risk of serious pollution incident during operation >2% annually
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems Potential medium risk of pollution to groundwater from routine run-off Calculated risk of serious pollution incident during operation >1% annually
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems Potential low risk of pollution to groundwater from routine run-off Calculated risk of serious pollution incident during operation >0.5% annually
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident during operation <0.5% annually

Table 14.9: Rating of Significant Environmental Impacts at EIA Stage (NRA 2008a)

		Magnitude of Impact			
		Negligible	**Small**	**Moderate**	**Large**
Importance of Attribute	**Extremely High**	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
	High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

14.2.4.4 Mitigation Measures, Residual Impacts and Final Impact Assessment

The third element of the recommended steps builds on the outcome of the preceding two elements, by identifying mitigation measures to address potential significant or profound impacts and then assessing the significance of any residual impacts. Mitigation by design measures which have been incorporated into the design for the Proposed Scheme are also considered in Section 14.5.

The final impact assessment includes a description of any residual impacts. The significance of any residual impact is determined based on the same methodology and reported.

14.3 Baseline Environment

14.3.1 Introduction

This Section describes the existing conditions and important features in terms of the land, soils, geology and hydrogeology within the study area of the Proposed Scheme. A regional overview is followed by a description of site-specific baseline conditions and a CSM. Features are then identified, and their importance ranked in accordance with the NRA Guidelines (NRA 2008a).

14.3.2 Regional Overview

The regional geomorphology, topography, soils and subsoils, bedrock geology and hydrogeology are discussed in this Section for the majority of County Dublin, including the City Centre and extends north to Swords and to Bray in County Wicklow in the south of the region.

14.3.2.1 Regional Topography and Geomorphology

The topography of the region is dominated by the Wicklow Mountains to the south with undulating topography to the north, west and east with localised highs generally synonymous with outcropping rock or near surface bedrock. There is a gradual drop in elevation across the region from west to east approaching the coast.

The landscape of the Greater Dublin Area (GDA) principally reflects the erosional and depositional legacy of the last period of glaciation, which ended some 10,000 years ago following the Devensian geological period. Glacial erosion of pre-existing topographic features and deposition of thick glacial drift deposits, mainly till (boulder clay), resulted in a rather subdued post-glacial topography.

The post-glacial landscape also reflects the effects of fluvial (river) processes that have altered the topography, with the River Liffey and its tributaries dominating the region, since the ice sheet retreat. The topography of the area reflects the geomorphology, showing topographic lows moving eastwards to the sea near Dublin City, becoming steeper to the west, north and south towards the Dublin and Wicklow Mountains.

There are a large number of geomorphology features across the region including mega scale glacial lineation in the north of the region, streamlined bedrock, numerous meltwater channels, hummocky sands and gravel deposits, drumlins, eskers and glaciofluvial terraces throughout the region (refer to Figure 14.1 in Volume 3 of this EIAR).

The post-glacial landscape also reflects the effects of fluvial (river) processes that have altered the topography, albeit only to a small extent in the region, since the ice sheet retreat. The coastline within the region is characterised by sandy beaches and rock outcrops.

The land uses in the region are mainly comprised of urban developments including but not limited to; industrial, commercial, residential and recreational. Moving away from the City Centre there are also marine, agricultural and forested areas in the region.

14.3.2.2 Regional Soils (Teagasc Classification)

Soils comprise the unconsolidated geological deposits which overlie the subsoil (i.e. the topsoil). The main soils within the region, as classified by Teagasc (Teagasc *et al*. 2017) are presented on Figure 14.2 in Volume 3 of this EIAR and have been listed in Table 14.10. The majority of Dublin is underlain by made ground with areas of alluvial, estuarine and marine deposits present that may be associated with recent and ancient water bodies. To the north of the region, there are soils which are deep and well drained as well as poorly drained soils derived from basic parent material. To the south of the region the soil is derived from acidic material.

Table 14.10: Summary of Soil Types Within the Region

Soil Code	Description	Location
AeoUND	Aeolian undifferentiated	Coast
AlluvMin	Alluvial (min)	Along river courses and meltwater channels
AminDW	Deep well drained mineral soil (mainly acidic)	South towards Bray
AminPD	Mineral poorly drained (mainly acidic)	South towards Bray
AminPDPT	Peaty Gleys Acidic	Near Wicklow Mountains
AminSP	Surface water gleys/ Ground water gleys shallow	South towards Bray
AminSW	Shallow well drained mineral soil (mainly acidic)	South towards Bray
AminSRPT	Shallow rocky peaty, non-peaty mineral complexes (mainly acidic)	Near Wicklow Mountains
BktPT	Blanket Peat	Near Wicklow Mountains
BminDW	Deep well drained mineral soil (mainly basic)	North near Swords
BminPD	Mineral poorly drained (mainly basic)	North near Swords
BminPDPT	Peaty gleys basic parent materials basic	Near Wicklow Mountains
BminSP	Surface water gleys/ groundwater gleys shallow	South towards Newcastle
BminSPPT	Peaty gleys shallow	Near Wicklow Mountains
BminSRPT	Lithosols peats	Near Wicklow Mountains
BminSW	Rendzinas/Lithosols	Dublin outskirts
Cut	Raised bog cutaway/cutover	Near Wicklow Mountains
FenPT	Fen peat	Near Wicklow Mountains
Lac	Lacustrine sediments	South near Wicklow Mountains
Made	Made ground	Dublin City and outskirts
MarSands	Marine sands and gravels	Coast
MarSed	Marine / estuarine sediments	Coast
Scree	Scree	Near Wicklow Mountains

14.3.2.3 Regional Subsoils (GSI Quaternary Classification)

Superficial deposits (subsoil) comprise the unconsolidated geological deposits which overlie the solid geology. The subsoils within the region, as classified by the GSI Quaternary mapping (GSI 2016a), are presented on Figure 14.3 in Volume 3 of this EIAR and have been listed in Table 14.11.

During the Pleistocene epoch of the Quaternary, two glaciations covered County Dublin and County Wicklow which gave rise to the deposition of glacial till. Typically, during the ice advance, boulder clays were deposited sub-glacially as lodgement till over the eroded bedrock surface, whilst moraine granular deposits were laid down at the glacier margins.

Subsequently, with the progressive retreat of the ice sheets from the region, granular fluvio-glacial deposits were laid down in places by melt waters discharging from the front of the glacier which are generally encountered as sand and gravel lenses within the glacial till deposits. The glacial deposits can exhibit significant lateral and vertical variations in grain size distributions over short distances.

This glacial till is the predominant subsoil of the region and described as till derived from limestones. The subsoils of the region may also be comprised of made ground where major development has occurred. More recent alluvial deposits (silts and clays and sands and gravels) may be present along historic and recent watercourses.

To the east of the region, along the coast the subsoils consist of estuarine silts and clays and marine beach sands. Outcropping and sub cropping rock and till derived from granites and metamorphic rock are present to the south and west of the region where the topography rises towards the Dublin / Wicklow Mountains and Bray.

Table 14.11: List of Subsoils (Quaternary) Within the Region

Soil Type	Description	Location
A	Alluvium	Along river channels and meltwater channels
Ag	Alluvium (gravelly)	Along river channels and meltwater channels
As,	Alluvium (sandy)	Along river channels and meltwater channels
Asi	Alluvium (silty)	Along river channels and meltwater channels
BktPt	Blanket Peat	Near Wicklow Mountains
Cut	Cut over raised peat	Near Wicklow Mountains
AcEsk	Eskers comprised of gravels of acidic reaction	Tallaght / Ballymount
GCh	Gravels derived from chert	North West Dublin
GLPSsS	Gravels derived from Lower Palaeozoic sandstones and shales	Howth
GLs	Gravels derived from limestones	Dublin City
GMp	Gravels derived from metamorphic rocks	South towards Bray
GGr	Gravels derived from granite	South Dublin
Rck	Bedrock outcrop or subcrop	Localised pockets within Dublin City / near Wicklow Mountains
Scree	Scree	Near Wicklow Mountains
L	Lacustrine sediments	South near Wicklow Mountains
Mbs	Marine beach sands	Coast
Mesc	Estuarine silts and clays	Portmarnock
TdlMr	Tidal Marsh	Bull Island
IrSTCSsS	Irish Sea Till derived from Cambrian sandstones and shales	Bray South
IrSTLPSsS	Irish Sea Till derived from Lower Palaeozoic sandstones and shales	Bray South
IrSTLs	Irish Sea Till derived from limestones	South towards Bray
TCSsS	Till derived from Cambrian sandstones and shales	Bray South
TGr	Till derived from granites	South Dublin
TLPSsS	Till derived from Lower Palaeozoic sandstones and shales	South Dublin
TLs	Till derived from limestones	Dublin City
TMp	Till derived from metamorphic rocks	Near Wicklow Mountains
TQz	Till derived from quartzites	South towards Bray
Ws	Windblown sands	Coast
Wsd	Windblown sands and dunes	Coast
Dam	Dam	Tallaght
Embankment	Embankment	Sandyford
Landfill	Landfill	Near Blanchardstown
Urban	Urban (made ground)	Dublin City and outskirts

14.3.2.4 Regional Bedrock Geology

The bedrock geology of the region, as classified by the GSI 1:100,000k Bedrock Geology Map (GSI 2018) are presented on Figure 14.4 in Volume 3 of this EIAR and have been listed in Table 14.12. The region is predominantly underlain by Carboniferous Limestones. The majority of the Dublin City area was a deep marine basin known as the Dublin Basin where these sedimentary rocks were deposited.

To the south of the region, stretching from Dún Laoghaire on the coast in a south to south-west direction and located beneath much of the Dublin and Wicklow Mountains, are the older Caledonian granites known as the Leinster Granite. This is a large intrusion of igneous rock which occurred during the Devonian Period mountain building event known as the Caledonian Orogeny.

The oldest rocks in the region are the Cambrian and Ordovician Metasediments which extend from Loughlinstown towards Bray with the Cambrian Bray Head Formation dominating the Bray to Greystones area and synonymous with the Quartzite of the Sugar Loaf.

The structural geology within the region is highly variable and complex. A series of parallel faults running mainly in a north-west to south-east direction are indicated in the north of the region between Blanchardstown and Dublin Airport. Additional faulting in this area is indicated in a north / north-west to south / south-east direction with associated fold axes both synclinal and anticlinal running in a north-east to south-west direction. The contact between the Lucan formation and the Leinster Granite is characterised by a west-east trending fault. The south of the region is dominated by metamorphic intrusions and north-west / south-east trending faults within the Leinster Granite. The south-eastern section of the region around Bray and Shankill is heavily faulted and folded with a number of west-east thrust faults and numerous north-west / south-east synclinal fold axis.

The depth to bedrock within the region ranges from one metre below ground level (mBGL) in the south-west of the region near Tallaght and the north-west near Blanchardstown to potentially greater than 25mBGL in the Dublin City Centre area and up to 45mBGL in Dublin Port. The bedrock level ranges from 80 metres above Ordnance Datum (mOD) towards the mountainous and inland parts of the region to approximately -40mOD near Dublin Port.

Table 14.12: Rock Formation Within the Region.

Geological Period	Formation	Description	Location
Carboniferous	Visean basinal limestone “Calp”	(Calp) Dark-grey argillaceous and cherty limestone and shale	Central and north County Dublin
	Waulsortian mudbank	Pale grey massive limestone	North-west near the N2 and N3 National Roads, Malahide and Swords
	Courceyan Limestone	Argillaceous dark-grey bioclastic limestone and subsidiary shale	North-west
	Upper Devonian -Lower Carboniferous Old Red Sandstone	Sandstone, conglomerate and siltstone	North of Swords
Caledonian Orogeny (Mountain Building Era)	Type 2p microcline porphyritic	Granite with microcline phenocrysts	South near Bray
Caledonian Orogeny (Mountain Building Era)	Caledonian Granite	Granite, granodiorite	South near Bray
Silurian	Silurian sandstone, greywacke and shale	Mudstone, greywacke and conglomerate	South-west
Ordovician	Middle to Upper Ordovician basic volcanics	Basalt-andesite, tuff, slate and mudstone	North-west
	Lower to Middle Ordovician slate	Slate, schist and minor greywacke	South-west
	Lower to Middle Ordovician acid volcanics	Rhyolite and rhyolitic tuff	South-west
	Lower to Middle Ordovician basic volcanics	Basalt- andesite, tuff and shale	South-west
Cambrian	Cambrian Greywacke	Greywacke and Shale	Bray

14.3.2.5 Regional Aquifer Type and Classification

The aquifers of the region (groundwater bearing bodies), as classified by the National Draft Bedrock Aquifer Map (GSI 2019b) are presented on Figure 14.5 in Volume 3 of this EIAR and have been listed in Table 14.13. The GSI (GSI 2019b) has devised a system for classifying aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource. The aquifer classes and sub-classes are shown in the National Draft Bedrock Aquifer Map. There are three principal types of aquifer, corresponding to whether they are major, minor or unproductive resources, whereby:

- Regionally Important Aquifers are capable of supplying regionally important abstractions (e.g. large public water supplies), or excellent yields (>400 metres cubed per day (m^3/d)).

- Locally Important Aquifers are capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or good yields (100m^3/d to 400m^3/d); and
- Poor Aquifers are capable of supplying small abstractions (e.g. domestic supplies), or moderate to low yields (<100m^3/d).

The lower permeability glacial till soils which overlay the bedrock (gravelly clay / boulder clay), slow infiltration and restrict recharge to bedrock aquifers. The glacial till is not classified as an aquifer by the GSI.

Under the WFD, the regional hydrogeology has been assessed using the GSI groundwater viewer (GSI 2019b). The regional groundwater bodies (GWB) in the area are (refer to Figure 14.5 in Volume 3 of this EIAR):

- Dublin GWB;
- Swords GWB;
- Kilcullen GWB; and
- Wicklow GWB.

Table 14.13: Aquifer Types Within the Region

Aquifer Type	Location	Description	Code
Locally Important	North and centre of the region	Bedrock which is moderately productive only in local zones	(Ll)
	Bray (south-eastern extent of the region	Gravel	(Lg)
Poor Aquifer	Most of southern extent of the region	Bedrock which is generally unproductive except for local zones	(Pl)

14.3.2.6 Regional Aquifer Vulnerability

Aquifer vulnerability of a groundwater body is the term used to describe the intrinsic geological and hydrogeological characteristics which determine the ease with which a groundwater body may be contaminated by human activities.

The vulnerability is determined by the travel time and the attenuation capacity of the overlying deposits. The groundwater vulnerability is determined mainly by the permeability and thickness of the subsoils that underlay the topsoil. For example, bedrock with a thick, low permeability overburden is less vulnerable than bedrock with a thin high permeability, gravel overburden.

The GSI aquifer vulnerability classification guidelines (GSI 2019b), which are outlined in Table 14.14, demonstrate that the aquifers are most at risk in areas where subsoils are thin or absent and where karst features such as swallow holes are present. This is due to the ability of potential contaminants to reach the aquifer in a relatively short period and with little or no contaminant attenuation due to the thin or absent overburden. The regional groundwater vulnerability varies significantly across the region, ranging from Rock at Surface (X) to Low (L) vulnerability.

Table 14.14: Aquifer Vulnerability

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High Permeability (Sand / Gravel)	Moderate Permeability (e.g. Sandy Subsoil)	Low Permeability (e.g. Clayey Subsoil, Clay, Peat)	Sand / Gravel Aquifers Only)	(<30m Radius)
Rock at or close to surface (X)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Extreme (E)	0m – 3.0m	0m – 3.0m	0m – 3.0m	0m – 3.0m	Not applicable
High (H)	>3.0m	3.0m – 10.0m	3.0m – 5.0m	>3.0m	Not applicable
Moderate (M)	Not applicable	>10.0m	5.0m – 10.0m	Not applicable	Not applicable
Low (L)	Not applicable	Not applicable	>10.0m	Not applicable	Not applicable

14.3.2.7 Regional Recharge

Recharge is the amount of rainfall that replenishes the aquifer. It is a function of the effective rainfall, the permeability and thickness of the subsoil and the aquifer characteristics. The GSI Groundwater Recharge mapping (GSI 2019b) for the region indicates annual groundwater recharge across the region ranges from approximately 1mm/yr (millimetre per year) to 600mm/yr (Figure 14.6 in Volume 3 of this EIAR).

14.3.2.8 Regional Groundwater Abstractions

Groundwater resources describe any large spring, well or boreholes which are used as a groundwater abstraction source by domestic, agricultural, commercial, industrial, local authority or group water scheme users.

The GSI keeps a record of groundwater wells drilled (GSI 2019b). However, the record does not state which wells are currently used for abstraction.

In addition to these abstractions, Dublin City Council (DCC) also maintains a database of groundwater and surface water abstractions. However, this data is not available to the public. The EPA have also launched a register of water abstractions, whereby people who abstract 25m^3 (cubic metres) of water or more per day are required to register their water abstraction. However, this data is not available to the public.

Source Protection Zones (SPZ) reports have been produced by the GSI (GSI 2019b) in conjunction with the EPA for groundwater sources, particularly public water supplies, group water schemes or important industrial supplies. The reports aim to guide development planning and regulation to provide protection to groundwater sources. To date no SPZ reports have been produced with regard to any sites within the study area.

Groundwater is not used extensively for residential or industrial purposes in the area. The majority of potable water used within the region is abstracted elsewhere and piped to the region, and therefore groundwater abstraction is not considered further in this Chapter.

14.3.2.9 Groundwater Quality and Levels

Based on professional experience and previous ground investigations in the area, groundwater levels are generally within 5m of the surface in Dublin City and are closer to the surface near rivers and streams. Historical groundwater monitoring is available from a monitoring borehole at the GSI Beggar's Bush Office, Dublin 4 (monitored from 1990 to 2000). Groundwater level monitoring has commenced at Beggar's Bush since August 2018 with the data available online (GSI 2019e). Beggar's Bush lies approximately 2km south-east of the City Centre. There is an inactive EPA monitoring borehole located in Goatstown, Dublin 14 which is approximately 6km south of the City Centre (monitored from 1997 to 2006). The results from both monitoring points show that the groundwater levels have a seasonal range over their entire monitoring record of 0.55m and 0.27m respectively.

The hydro-chemical analyses of groundwater within the Dublin GWB are available at the EPA Rye Water monitoring stations at Carton House, near Maynooth, County Kildare. The limestone groundwater quality is very hard water (350 milligrams per litre (mg/l) to 480mg/l of Calcium carbonate ($CaCO_3$)), with a high alkalinity (300mg/l to 350mg/l ($CaCO_3$)) and conductivities (550 micro siemens per centimetre (µS/cm) to 900µS/cm). The pH is relatively neutral ranging from 6.5 to 7.5.

Further to the south, where the region is underlain by granites of the Maulin Formation, the groundwater is softer and less mineralised with hardness values of 100mg/l ($CaCO_3$) to 150mg/l ($CaCO_3$), alkalinity of <50mg/l ($CaCO_3$) and conductivity values of 300µS/cm to 500µS/cm and a lower pH range of 6 to 7.

14.3.2.10 Regional Hydro-Ecology Designated Sites

Designated protected sites within Ireland compiled by the National Parks and Wildlife Service (NPWS) such as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) could be groundwater dependent habitats, and therefore, an impact on the hydrogeology could be an impact on a designated site. Further information regarding the designated sites within the region are provided in Chapter 12 (Biodiversity). Only the hydrogeology related impacts on groundwater dependant designated sites are assessed within this Chapter.

14.3.2.11 Regional Geological Heritage

The basic designation for wildlife is the Natural Heritage Area (NHA). This is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection. The GSI is compiling a list of geological / geomorphological sites in need of protection through NHA designation (not available at the time of writing). However, these sites will be compiled from the existing database of County Geological Sites (CGS) (GSI 2019c), as listed in Table 14.15.

Table 14.15: Designated Sites Within the Region.

Designation Code	Designated Site
CGS, SPA	North Bull Island
CGS	Glasnevin Cemetery
CGS	Phoenix Park
CGS	River Poddle
CGS	Greenhills Esker
CGS	Dodder Terraces
CGS	Belgard Quarry
CGS	Killiney Bay
CGS	Enniskerry Delta
CGS	GPO (General Post Office)
CGS	Museum Building, Trinity College Dublin
CGS	Oscar Wilde Statue
CGS	51 St. Stephens Green
CGS	Dublin City Walls
CGS	Temple Bar Street Well
CGS	Guinness Wells
CGS	Kippure
CGS	Lucan Esker
CGS	Liffey Valley Centre road sections
CGS	N4 Lucan cutting
CGS	Ballinascorney Quarry
CGS	Newcastle Buried channel
CGS	Carrickgollogan
CGS	Ballycorus
CGS	Killiney Hill
CGS	White Rock, Killiney
CGS	Ballybetagh Bog
CGS	Dalkey Island
CGS	Killiney Bay
CGS	The Scalp
CGS	Three Rock Mountain
CGS	Blackrock Breccia
CGS	Dalkey Hill
CGS	Murphystone Quarry
CGS	Enniskerry Delta
CGS	Glencullen River

Designation Code	Designated Site
CGS, pNHA	River Dargle Valley
CGS, SAC	Bray Head

14.3.3 Site-Specific Environment

The following Section discusses the site-specific conditions (refer to Figure 14.7 to Figure 14.15 in Volume 3 of this EIAR) within the study area for the Proposed Scheme as defined in Section 14.2.1. Where applicable, the importance of the attributes for which the impact of the Proposed Scheme is to be assessed are reported in this Section.

14.3.3.1 Current and Historic Land Use

The current and historic land use is discussed in order to give context to any potential changes to land, soils, geology and hydrogeology that have the potential to influence the importance of a feature and the magnitude of any impacts. The current land use is based on current aerial imagery and mapping available from Ordnance Survey Ireland (OSI) (OSI 2019), Google (Google 2019), Bing (Bing 2019), and the Corine Land Cover maps (EPA 2018). The historic land use is based on the following OSI (OSI 2019) historic aerial imagery and historic maps:

- OSI 6-inch mapping produced between 1837 and 1842;
- OSI 25-inch mapping produced between 1888 and 1913;
- OSI 6-inch Cassini mapping produced between 1830 and 1930s;
- OSI 1995 aerial photography;
- OSI 2000 aerial photography; and
- OSI 2005 aerial photography.

14.3.3.1.1 Ballymun Road from St. Margaret's Road to Griffith Avenue

The Corine Land Cover 2018 classifies the land use within the study area from the junction at St. Margaret's Road with R108 Ballymun Road as industrial or commercial units at the Ballymun Industrial Estate and Gulliver's Retail Park along with green urban areas along R108 Ballymun Road. From south of Gulliver's Retail Park to R102 Griffith Avenue the land use is classed as discontinuous urban fabric with industrial or commercial units at Dublin City University (DCU) and land principally occupied by agriculture, with significant areas of natural vegetation south of DCU.

The OSI 25-inch mapping shows the area within this section of the study area was predominately used as agricultural land with occasional wooded areas associated with former demesne landscapes and intermittent residential and farm buildings connected by various roads and tracks. The OSI 6-inch mapping (Cassini) shows the area becoming more developed around Glasnevin along with a historic stream and bridge south of R103 Glasnevin Avenue called the Wad Bridge.

14.3.3.1.2 St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

The Corine Land Cover 2018 classifies the land use within the study area from R102 Griffith Avenue to Hart's Corner along R108 St. Mobhi Road and R108 Botanic Road as discontinuous urban fabric with an area classed as green urban areas at the National Botanic Gardens.

The first edition 6-inch OS (1837-1842) shows Glasnevin developing as a suburb around a church and graveyard with the Botanic Gardens and Cemetery located to the south of the River Tolka. South of the Royal Canal, the land has developed into streets and terraces with residential and commercial properties. The OSI 25-inch mapping shows the area of Glasnevin expanding to encompass all the lands north of the Royal Canal, developed with roadside terraced housing .The railway and Royal Canal are depicted extending in an east to west direction and Mountjoy Prison is annotated along with the St. Vincent de Paul male Orphanage.

14.3.3.1.3 Prospect Road, Phibsborough Road from Hart's Corner to Western Way

The Corine Land Cover 2018 classifies the land use within the study area from Hart's Corner to the Royal Canal as discontinuous urban fabric. South of the Royal Canal to R135 Western Way, the land use is classed as continuous urban fabric.

The OSI 6-inch, OSI 25-inch, and 6-inch Cassini mapping shows this section of the study area underwent urbanisation from Phibsborough to R135 Western Way with the development of Broadstone and the Blessington Street Basin annotated on the later maps. The Royal Canal has since been infilled where the Proposed Scheme intercepts the former Blaquiere Bridge on the R101 North Circular Road along the Royal Canal Bank near Mountjoy.

14.3.3.1.4 Constitution Hill and Church Street to Arran Quay

The Corine Land Cover 2018 classifies the land use within the study area along the Constitution Hill and Church Street to Arran Quay section as continuous urban fabric.

The OSI 6-inch, OSI 25-inch, and 6-inch Cassini mapping shows this section of the study area has become urbanised with industries of note being a copper and brass works, north of the Four Courts and a match factory at Hammond Lane. Kings Inn (originally labelled Queens Inn) of the first edition 6-inch OS is shown to the east of Constitution Hill. While St. Michan's Church is shown to the west of Church Street on all OS editions.

14.3.3.1.5 Finglas Road from St. Margaret's Road to Wellmount Road

The Corine Land Cover 2018 classifies the land use within the study area from R104 St. Margaret's Road along the R135 Finglas Road to Wellmount Road as discontinuous urban fabric with industrial or commercial units at the Jamestown Business Park industrial area extending south to the junction of the R135 Finglas Road and R103 Seamus Ennis Road.

The first edition 6-inch OS mapping shows a historic gravel pit adjacent to what is now called 'North Road' and a historic quarry where 'Brookville' is now located. Finglas village is shown as a nucleated settlement with secular, religious and civic buildings annotated. The OSI 25-inch mapping shows the area largely unchanged from the previous map with agricultural land present and some development occurring on the road north of Finglas. The 6-inch Cassini mapping shows the study area as more developed.

14.3.3.1.6 Finglas Road from Wellmount Road to Ballyboggan Road

The Corine Land Cover 2018 classifies the land use within the study area from the Wellmount Road to Ballyboggan Road as discontinuous urban fabric with an area classed as green urban areas north of the Clearwater Shopping Centre.

The OSI 25-inch, 6-inch and 6-inch Cassini mapping shows the area within this section of the study area was predominately used as agricultural land with a number of disused quarries surrounding the area of the River Tolka from Glenhill Road to Ballyboggan Road.

14.3.3.1.7 Finglas Road from Ballyboggan Road to Hart's Corner

The Corine Land Cover 2018 classifies the land use within the study area from Ballyboggan Road to Hart's Corner as discontinuous urban fabric with green urban areas along the alignment of the River Tolka and industrial or commercial units at the Dublin Industrial Estate and the Bannow Road Industrial Estate.

The OSI first edition 6-inch 25-inch, and 6-inch Cassini mapping charts the development of Prospect Cemetery (now known as Glasnevin Cemetery) to the north of the road. With a number of residential mid-size houses located to the south of the road. The historic OSI mapping shows the development of the suburb of Glasnevin.

14.3.3.2 Geomorphology and Topography

The geomorphology and topography is discussed in order to give context to any potential changes to land, soils, geology and hydrogeology that could influence the importance of a feature and the magnitude of any impacts. The geomorphology (GSI 2016a) and the topography are shown on Figure 14.7 in Volume 3 of this EIAR.

14.3.3.2.1 Ballymun Road from St. Margaret's Road to Griffith Avenue

The Ballymun Section of the Proposed Scheme will commence at the junction of St. Margaret's Road with R108 Ballymun Road, which according to the OSI 10m contours is at an elevation of 60mOD and gradually lowers to approximately 40mOD at R102 Griffith Avenue. The River Santry lies within the study area to the north of the junction of St. Margaret's Road and R108 Ballymun Road. The Ballymun Stream runs from R104 Santry Avenue into the River Santry within this section of the study area.

The geomorphology within this section of the study area is characterised by a south-east trending glacial meltwater channel associated with the River Santry north of Gulliver's Retail Park, a south-east trending mega scale glacial lineation at the junction of R108 Ballymun Road and R104 Balbutcher Lane and a south-east trending mega scale glacial lineation at the junction of R108 Ballymun Road and St. Canice's Road.

14.3.3.2.2 St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

The route of the Proposed Scheme will continue from R102 Griffith Avenue at an elevation of 40mOD and will gradually lower to approximately 20mOD at Hart's Corner. The Proposed Scheme will cross the River Tolka south of St. Mobhi Drive and north of Botanic Avenue.

The geomorphology within this section of the study area is characterised by a south-east trending glacial meltwater channel following the alignment of the River Tolka north of Botanic Avenue and a south-east trending mega scale glacial lineation north of the R135 Finglas Road.

14.3.3.2.3 Prospect Road, Phibsborough Road from Hart's Corner to Western Way

The route of the Proposed Scheme will remain at a constant elevation of 20mOD from Hart's Corner along R108 Phibsborough Road to R135 Western Way. The Proposed Scheme will cross the Royal Canal at Phibsborough with the Blessington reservoir north of Primrose Avenue within the study area.

There are no geomorphological features associated with this section of the study area.

14.3.3.2.4 Constitution Hill and Church Street to Arran Quay

The route of the Proposed Scheme will gradually lower from 20mOD at R135 Western Way to 10mOD at R148 Arran Quay. The River Liffey is encountered south of R148 Arran Quay where the Proposed Scheme will terminate.

The geomorphology within this section of the study area is characterised by a glaciofluvial terrace associated with the River Liffey System at the junction of R132 Church Street and R804 King Street North.

14.3.3.2.5 Finglas Road from St. Margaret's Road to Wellmount Road

The Finglas Section of the Proposed Scheme (from R135 Finglas Road to Hart's Corner) will commence at the junction of R104 St. Margaret's Road with the R135 Finglas Road which is at an elevation of between 60mOD and 70mOD and gradually lowers to 50mOD at Wellmount Road.

The geomorphology within this section of the study area is characterised by a deglacial landform comprised of hummocky sands and gravels at the intersection of R104 St. Margaret's Road and R135 Finglas Road. There is a southward trending glacial meltwater channel following the alignment of the Proposed Scheme and Bachelors Stream from Brookville to Wellmount Road.

14.3.3.2.6 Finglas Road from Wellmount Road to Ballyboggan Road

The route of the Proposed Scheme will continue from Wellmount Road at an elevation of 50mOD and will gradually lower to 20mOD at Ballyboggan Road. Bachelors Stream will run parallel to the Proposed Scheme along the R135 Finglas Road within this section of the study area where it flows into the River Tolka north of Ballyboggan Road.

The geomorphology within this section of the study area is characterised by a southward trending glacial meltwater channel following the alignment of the Proposed Scheme which terminates north of Ballyboggan Road. There is a glaciofluvial terrace and glacial meltwater channel following the alignment of the River Tolka north of Ballyboggan Road.

14.3.3.2.7 Finglas Road from Ballyboggan Road to Hart's Corner

The route of the Proposed Scheme will continue from Ballyboggan Road to Hart's Corner at an elevation of 20mOD where it will join the Ballymun Section of the Proposed Scheme.

The geomorphology within this section of the study area is characterised by a glaciofluvial terrace south of Ballyboggan Road associated with the River Tolka. There is a south-east trending mega scale glacial lineation encountered along the R135 Finglas Road, north of Claremont Lawn.

14.3.3.3 Soils (Teagasc Soil Classification)

The majority of the soils expected to be encountered within the study area are made ground comprising varying forms of hardstanding materials including road pavements and footpaths. However, there are topsoil and other soils present within the study area for which there are a number of classifications on the Teagasc Soil Map (Teagasc *et al*. 2017). The main soils within the study area, as classified by Teagasc are presented on Figure 14.8 in Volume 3 of this EIAR, and are listed in Table 14.17, along with their importance with respect to drainage and fertility as determined by Box 4.1 in the NRA Guidelines (NRA 2008a). Where these soils are important features with respect to possible soft soils or contamination, their importance is detailed in Section 14.3.3.8 and Section 14.3.3.9.

14.3.3.3.1 Ballymun Road from St. Margaret's Road to Griffith Avenue

The soils within the study area for this section of the Proposed Scheme from the junction of St. Margaret's Road with R108 Ballymun Road to R102 Griffith Avenue are classified as topsoil (BminDW and BminPD) at Gulliver's Retail Park and St. Margaret's Road, north of R102 Griffith Avenue at DCU and south of St. Canice's Avenue. The Proposed Scheme is classified as made ground.

14.3.3.3.2 St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

The soils within the study area for this section of the Proposed Scheme from R102 Griffith Avenue to Hart's Corner are classified as made ground with topsoils (BminDW and BminPD) and alluvium present along the alignment of the River Tolka.

14.3.3.3.3 Prospect Road, Phibsborough Road from Hart's Corner to Western Way

The soils within the study area for this section of the Proposed Scheme from Hart's Corner to R135 Western Way are classified as made ground.

14.3.3.3.4 Constitution Hill and Church Street to Arran Quay

The soils within the study area for this section of the Proposed Scheme from R108 Constitution Hill to R148 Arran Quay are classified as made ground.

14.3.3.3.5 Finglas Road from St. Margaret's Road to Wellmount Road

The soils within the study area for this section of the Proposed Scheme from the junction of R104 St. Margaret's Road with R135 Finglas Road to Wellmount Road are classified as made ground and topsoils (BminSW) following the alignment of Bachelors Stream.

14.3.3.3.6 Finglas Road from Wellmount Road to Ballyboggan Road

The soils within the study area for this section of the Proposed Scheme from Wellmount Road to Ballyboggan Road are classified as made ground with topsoils (BminDW, BminPD and BminSW) encountered north of the River Tolka and along the alignment of the River Tolka, along with alluvium.

14.3.3.3.7 Finglas Road from Ballyboggan Road to Hart's Corner

The soils within the study area for this section of the Proposed Scheme from Ballyboggan Road to Hart's Corner are classified as made ground.

Table 14.16: Soils Within the Study Area

Soil Type	Notes / Description	Location	Importance	Justification for Importance Rating
Made Ground - Made	Associated with urban development	Widespread	Low	Poorly drained and / or low fertility soils
Topsoil - BminPD	Poorly drained (Mainly Basic)	Griffith Avenue to Hart's Corner	Low	Poorly drained and / or low fertility soils
Alluvium - AlluvMIN	Typically found along current and historic watercourses	River Tolka	Medium	Moderately drained and / or moderate fertility soils
Topsoil - BminSW	Shallow well drained (Mainly basic)	North of River Tolka, Bachelors Stream	High	Well drained and / or high fertility soils
Topsoil - BminDW	Deep well drained (Mainly basic)	North of River Tolka	High	Well drained and / or high fertility soils

14.3.3.4 Subsoil Deposits (GSI Quaternary Classification)

Superficial deposits (subsoil) comprise the unconsolidated geological deposits which overlie the solid geology. The subsoils within the study area, as classified by the GSI Quaternary mapping (GSI 2016a) are presented on Figure 14.9 in Volume 3 of this EIAR and are listed in Table 14.17, along with their importance with respect to feature quality and significance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a). Where these subsoils are important features with respect to possible soft soils or contamination, their importance is detailed in Section 14.3.3.8 and Section 14.3.3.9.

The main subsoils encountered within the study area are predominately glacial tills. Additionally, there are areas of made ground (urban), alluvial deposits, gravels and shallow bedrock as discussed below.

14.3.3.4.1 Ballymun Road from St. Margaret's Road to Griffith Avenue

The subsoils within the study area for this section of the Proposed Scheme from St. Margaret's Road to R102 Griffith Avenue are comprised of glacial tills derived from limestone with an area of alluvium encountered along the alignment of the River Santry, at Willow Park Grove and at R102 Griffith Avenue.

14.3.3.4.2 St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

The subsoils within this section of the study area from R102 Griffith Avenue to Hart's Corner are classified as glacial till derived from limestones with areas of alluvium and gravels derived from limestones encountered following the alignment of the River Tolka.

14.3.3.4.3 Prospect Road, Phibsborough Road from Hart's Corner to Western Way

The subsoils within this section of the study area from Hart's Corner to R135 Western Way are classified as glacial till derived from limestones with made ground (urban) encountered along the alignment of the Royal Canal and at Geraldine Street.

14.3.3.4.4 Constitution Hill and Church Street to Arran Quay

The subsoils within this section of the study area from Hart's Corner to R135 Western Way are classified as glacial till derived from limestones with an area of gravels derived from limestones at R804 King Street North along with alluvium following the alignment of the River Liffey and at the Four Courts. There is made ground (urban) encountered within the City Centre at R148 Arran Quay and east of R132 Church Street.

14.3.3.4.5 Finglas Road from St. Margaret's Road to Wellmount Road

The subsoils within this section of the study area from R104 St. Margaret's Road to Wellmount Road are classified as glacial till derived from limestones with alluvium and outcropping rock encountered along the alignment of Bachelors Stream. There are gravels derived from limestone present at the junction of R104 St. Margaret's Road and R135 Finglas Road.

14.3.3.4.6 Finglas Road from Wellmount Road to Ballyboggan Road

The subsoils within this section of the study area from Wellmount Road to Ballyboggan Road are classified as glacial till derived from limestones with alluvium and areas of outcropping rock following the alignment of the Proposed Scheme in this section. Alluvium along with gravels derived from limestones are encountered along the alignment of the River Tolka.

14.3.3.4.7 Finglas Road from Ballyboggan Road to Hart's Corner

The subsoils within this section of the study area from Ballyboggan Road to Hart's Corner are classified as glacial till derived from limestones with gravels derived from limestones encountered south of Ballyboggan Road.

Table 14.17: Subsoils Within the Study Area

Subsoil Type	Description	Location	Importance	Justification for Importance Rating
Made Ground - Urban	Associated with urban development	Widespread	Low	Low value on a local scale
Alluvium - A	Typically found along current and historic watercourses	River Santry and River Tolka	Low	Low value on a local scale
Glacial gravels - GLs	Gravels derived from limestones	River Tolka, Ballyboggan Road	Low	Low value on a local scale
Glacial till - TLs	Till derived from limestones	Widespread	Low	Low value on a local scale
Rock - Rck	Bedrock outcrop or subcrop	Bachelors Stream	Low	Low value on a local scale

14.3.3.5 Bedrock Geology

The bedrock geology of the study area, as classified by the GSI 1:100,000k Bedrock Geology Map (GSI 2018) are presented on Figure 14.10 in Volume 3 of this EIAR, and have been listed in Table 14.18, along with their importance with respect to feature quality and significance as determined by Box 4.1 in the NRA Guidelines (NRA 2008a). Where the bedrock is an important feature with respect to economic geology its importance is detailed in Section 14.3.3.10.

14.3.3.5.1 Ballymun Road from St. Margaret's Road to Griffith Avenue

The underlying bedrock of the study area is comprised of the Lucan Formation. A summary of the bedrock geology along the Proposed Scheme is presented in Table 14.18.

The bedrock encountered within this section of the study area is comprised of the Lucan Formation.

There is a north-west / south-east trending fault within this section of the study area which will intersect the Proposed Scheme at Gateway Avenue.

14.3.3.5.2 St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

The bedrock encountered within this section of the study area is comprised of the Lucan Formation.

No major structural bedrock features were identified along this section of the study area.

14.3.3.5.3 Prospect Road, Phibsborough Road from Hart's Corner to Western Way

The bedrock encountered within this section of the study area is comprised of the Lucan Formation.

No major structural bedrock features were identified along this section of the study area.

14.3.3.5.4 Constitution Hill and Church Street to Arran Quay

The bedrock encountered within this section of the study area is comprised of the Lucan Formation.

No major structural bedrock features were identified along this section of the study area.

14.3.3.5.5 Finglas Road from St. Margaret's Road to Wellmount Road

The bedrock encountered within this section of the study area is comprised of the Lucan Formation.

No major structural bedrock features were identified along this section of the study area.

14.3.3.5.6 Finglas Road from Wellmount Road to Ballyboggan Road

The bedrock encountered within this section of the study area is comprised of the Lucan Formation.

There is a north-west south-east trending fault within this section of the study area at Ballygall Road West.

14.3.3.5.7 Finglas Road from Ballyboggan Road to Hart's Corner

The bedrock encountered within this section of the study area is comprised of the Lucan Formation.

No major structural bedrock features were identified along this section of the study area.

Table 14.18: Rock Formations Within the Study Area

Formation	Description	Importance	Justification for Importance Rating
Lucan	(Calp) Dark Limestone and shale - Carboniferous	Low	Low value on a local scale

14.3.3.6 Ground Investigation

A summary of the ground conditions encountered by historical ground investigations adjacent to the Proposed Scheme and the scheme-specific ground investigations (listed in Section 14.2.3.2) are presented in Table 14.19 to Table 14.25.

The data presented in the tables are indicative and strata depth and presence will vary by location. The historical ground investigation data was carried out for purposes and projects other than this EIAR. Therefore, although the historical ground investigation data provides useful indication of ground conditions, the quality of the data cannot be verified.

The factual scheme specific ground investigation reports are included in Appendix A14.2 Ground Investigations in Volume 4 of this EIAR.

Table 14.19: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Ballymun Road from St. Margaret's Road to Griffith Avenue Section

Strata	General Extent / Location	Top of Strata (mBGL)	Thickness of Strata (m)
Topsoil	Green areas	0	0.5
Made Ground	Widespread	0 - 0.3	0.6 – 3.8
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	0.2 – 3.8	Not proven

Table 14.20: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner Section

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Made Ground	City Centre	0	1 – 2.5
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	1 – 2.5	Not proven

Table 14.21: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Prospect Road, Phibsborough Road from Hart's Corner to Western Way Section

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Made Ground	City Centre	0	0.6 – 7.8
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	0.6 – 6.5	11.95 – 14.00
Bedrock	Widespread	18.4 – 18.6	Not proven

Table 14.22: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme between the Constitution Hill and Church Street to Arran Quay Section

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Made Ground	City Centre	0	0.55 – 7.5
Alluvial Deposits	River channels	2.8 – 3.5	4.9 – 5.7
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	0.7 – 8.0	Not proven

Table 14.23: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Finglas Road from St. Margaret's Road to Wellmount Road Section

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Topsoil	Green areas	0	0.3
Made Ground	Widespread	0 – 0.3	0.6 – 3.8
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	1.2 – 3.8	4.3 – 4.9
Weathered Rock	Widespread	2 - 3	0.8
Bedrock	Widespread	3.8 – 4.8	Not proven

Table 14.24: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Finglas Road from Wellmount Road to Ballyboggan Road Section

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Topsoil	Green areas – including parks, large estates	0	0.2 -0.3
Made Ground	Widespread	0	1.0 – 2.2
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	0.4 – 1.0	Not proven

Table 14.25: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Finglas Road from Ballyboggan Road to Hart's Corner Section

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Topsoil	Green areas – including parks, large estates	0	0.2 – 0.3
Made Ground	Widespread	0	2.9 – 3.0
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	0.2 – 0.7	Not proven

14.3.3.7 Karst

Karst is a type of geological feature characterised by caves, caverns and other types of underground drainage resulting from the dissolution of the underlying bedrock. This typically occurs in areas of high rainfall with soluble rock.

There are no karst features identified within the study area in the GSI karst database (GSI 2019b). Consequently, the risk of karst is deemed negligible due to the low karst susceptibility of the geology of the region and will not be further assessed.

14.3.3.8 Soft and / or Unstable Ground

Soft soils consist of peat, fine grained alluvium or very soft cohesive material. Their presence within the study area could result in an impact if they require excavation and are therefore considered important features. Various sources of information were consulted in establishing these areas within the study area namely:

- Teagasc soil map (Teagasc et. al 2017);
- GSI Quaternary Map (GSI 2016a);
- Ground investigation data;
- Scheme walkover survey; and
- GSI Landslide Events (GSI 2017).

The GSI database (GSI 2017) shows no recorded landslide events within the study area and therefore unstable ground is not considered further in this assessment.

The soft soils identified within the study area are detailed in Table 14.26 along with their importance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a).

Table 14.26: Soft Soils Within the Study Area

Feature	Description	Importance	Justification for Importance Rating
Alluvium - AlluvMIN (soils) / A (subsoils)	Typically found along current and historic watercourses	Low	Volume of soft soil underlying the study area is small and of a local scale.

14.3.3.9 Contaminated Land

Considering the location of the Proposed Scheme in the urban environment, there are likely to be some sources of contamination within the made ground throughout the study area. Therefore, the assessment of contaminated land is focused on the footprint and directly on either side of the Proposed Scheme unless there is likely to be a pathway connecting the possible source of contamination to the footprint of the Proposed Scheme.

Various sources of information were consulted in assessing the Proposed Scheme for locations of potential contaminated land:

- CORINE land cover mapping (EPA 2018);
- Teagasc soil map (Teagasc et al. 2017);
- EPA (EPA 2019);
- OSI mapping (OSI 2019);
- The design information as listed in Section 14.2.3.3;
- The scheme-specific ground investigations carried out to inform the Proposed Scheme and this EIAR, as listed in Table 14.3. These provide useful verification for the data already compiled relating to the baseline environment; and
- Local authority archives and databases as listed in Table 14.1.

The known potential sources of contamination relevant to the Proposed Scheme identified within the study area are detailed in Table 14.27, along with their importance, as determined by Box 4.1 of the NRA Guidelines (NRA 2008a).

Soil analysis was carried out on samples retrieved during the ground investigations carried out by GII at depths ranging from 0.5m to 5.0m BGL.

The main findings of the soil analysis carried out along the Proposed Scheme are as follows (and summarised in Table 14.27):

- Asbestos was detected in one of the recorded results during the scheme-specific GI; fiber bundles of Amosite which were deemed non-hazardous (R03-CP08);
- Elevated concentrations of Antimony (Sb), Selenium (Se), Sulphate (SO_4) and Mineral Oil were recorded in the samples described as requiring disposal to non-hazardous licensed landfill; and
- Elevated concentrations of Total Organic Carbon (TOC) were recorded in the samples described as requiring disposal to hazardous licensed landfill.

Table 14.27: Summary of Potential Sources of Contaminated Land Adjacent to the Proposed Scheme

Feature	Description	Location	Importance	Justification for Importance Rating
Tobacco Factory	Industrial (Cassini) - R108 Botanic Road	R108 Botanic Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Printing Works	Industrial (Cassini)- R108 Botanic Road	R108 Botanic Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Copper and Brass Works	Industrial (25-inch Mapping) - North of the Four Courts	North of the Four Courts	Medium	Degree or extent of soil contamination is moderate on a local scale
Match Factory	Industrial (25-inch Mapping) - Arran Square	Arran Square	Medium	Degree or extent of soil contamination is moderate on a local scale
Gravel Pit	Gravel Pit (6-inch OSI Mapping) - North Road	North Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Quarry	Quarry (6-inch OSI Mapping) - Brookville	Brookville	Medium	Degree or extent of soil contamination is moderate on a local scale
6 Quarries	Quarry (6-inch OSI Mapping) - Glenhill Road to Ballyboggan Road	Glenhill Road to Ballyboggan Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Oil filled electricity cable	Potential oil-filled high tension electricity cable on the Finglas Road	Finglas Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Petrol Station	Various Petrol schemes along Proposed Scheme	59 Ballymun Road Finglas Road / Slaney Road (former)	Medium	Degree or extent of potential soil contamination is unknown but likely to be moderate on a local scale
Contaminated soils from recent Site Investigations	Non-Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Total Organic Carbon (TOC), Antimony (Sb), Selenium (Se), Sulphate (SO4), Mineral Oil and Molybdenum (Mb).	Whitworth Rd, Royal Canal Bank Rd (R03-CP14, R3-CP07, R3-CP03)	Medium	Degree or extent of potential soil contamination is unknown but likely to be moderate on a local scale
Contaminated soils from recent Site Investigations	Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Total Organic Carbon (TOC)	North Circular Rd (R3-CP08, R3WS02)	Medium	Degree or extent of potential soil contamination is unknown but likely to be moderate on a local scale

A summary of the facilities within the study area, along with their importance, as determined by Box 4.1 of the NRA Guidelines (NRA 2008a) is presented in Table 14.28.

Table 14.28: List of EPA Licensed Facilities Within the Study Area

Name	Description	Location	Importance	Justification for Importance Rating
Pepo Ltd	IPC – Licensed: 33 Botanic Road, Glasnevin, Dublin 9	Glasnevin, Dublin 9	Medium	Degree or extent of soil contamination is moderate on a local scale
Lithographic Web Press Ltd.	IPC – Surrendered: 57 Botanic Road, Glasnevin, Dublin 9	Glasnevin, Dublin 9	Medium	Degree or extent of soil contamination is moderate on a local scale
Various petrol stations	Various petrol stations along the route from Ballymun to Aran Quay	Various	Medium	Degree or extent of soil contamination is moderate on a local scale

14.3.3.10 Mineral / Aggregate Resources

Considering the location of the Proposed Scheme in the urban environment there are unlikely to be many opportunities to extract mineral or aggregate resources. However, the following datasets were consulted in order to assess the impact of the Proposed Scheme on the economic geology of the study area:

- GSI aggregate potential mapping (GSI 2016b; GSI 2016c);
- GSI mineral localities (GSI 2014); and
- GSI active quarries (GSI 2019d).

No active pits, mines or quarries were identified within the study area. There are no mineral localities within the study area.

The crushed rock aggregate potential is predominately low to moderate potential with the exception of shallow rocks associated with the River Tolka and shallow bedrock along the R135 Finglas Road (refer to Figure 14.12 in Volume 3 of this EIAR). The granular aggregate potential is highly variable as shown on Figure 14.12 in Volume 3 of this EIAR and discussed below.

A summary of the aggregate resources identified in the study area (refer to Figure 14.11 and Figure 14.12 in Volume 3 of this EIAR) are outlined in Table 14.29, along with their importance, as determined by the Box 4.1 of the NRA Guidelines (NRA 2008a).

14.3.3.10.1 Ballymun Road from St. Margaret's Road to Griffith Avenue

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area is low.

The granular aggregate potential within this section of the study area is very low along the alignment of the River Santry, Willow Park Grove and at R102 Griffith Avenue.

14.3.3.10.2 St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranges from low to very high, with a localised area of moderate to very high aggregate potential surrounding the River Tolka.

The granular aggregate potential within this section of the study area is very low to very high along the alignment of the River Tolka with the highest potential encountered along the eastern boundary of the study area.

14.3.3.10.3 Prospect Road, Phibsborough Road from Hart's Corner to Western Way

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area is low.

No granular aggregate potential is mapped within this section of the study area.

14.3.3.10.4 Constitution Hill and Church Street to Arran Quay

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area is generally low with an area of moderate potential mapped on the northern and southern bank of the River Liffey at the termination point of the Proposed Scheme at R148 Arran Quay.

The granular aggregate potential within this section of the study area is very low at R148 Arran Quay, the Four Courts, R148 Usher's Quay and Watling Street. The granular aggregate potential is high just north of Smithfield.

14.3.3.10.5 Finglas Road from St. Margaret's Road to Wellmount Road

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranges from low to very high. The very high potential is encountered along areas where there is outcropping rock present.

The granular aggregate potential within this section of the study area is very low along the alignment of the Proposed Scheme and moderate at the junction of R104 St. Margaret's Road with R135 Finglas Road.

14.3.3.10.6 Finglas Road from Wellmount Road to Ballyboggan Road

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranges from low to very high. Very high, high and moderate potential is encountered along the alignment of the Proposed Scheme and the River Tolka.

The granular aggregate potential within this section of the study area is very low to very high along the alignment of the River Tolka.

14.3.3.10.7 Finglas Road from Ballyboggan Road to Hart's Corner

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranges from low to very high. Very high, high and moderate potential is encountered along the alignment of the Proposed Scheme and the River Tolka. Low potential for crushed rock is encountered from Claremont Crescent to Hart's Corner.

The granular aggregate potential within this section of the study area is moderate to high, south of the River Tolka at Slaney Close.

Table 14.29: GSI Aggregate Potential for the Study Area

GSI Aggregate Potential Type	Potential	Location	Importance	Justification for Importance Rating
Crushed rock aggregate potential	Low potential	Claremont Crescent to Hart's Corner.	Low	Uneconomically extractable mineral resource
Crushed rock aggregate potential	Moderate potential	River Tolka	Medium	Sub-economic extractable mineral resource
Crushed rock aggregate potential	High potential	River Tolka	Medium	Extractable mineral resource
Crushed rock aggregate potential	Very high potential	River Tolka	High	Marginally extractable mineral resource
Granular aggregate potential	Very Low potential	River Santry, Willow Park Grove and at R102 Griffith Avenue. River Tolka. R148 Arran Quay, the Four Courts, R148 Usher's Quay and Watling Street.	Low	Uneconomically extractable mineral resource
Granular aggregate potential	Low potential	River Tolka	Low	Uneconomically extractable mineral resource
Granular aggregate potential	Moderate potential	River Tolka, Slaney Close	Medium	Sub-economic extractable mineral resource
Granular aggregate potential	High potential	River Tolka, north of Smithfield, Slaney Close	Medium	Extractable mineral resource
Granular aggregate potential	Very High potential	River Tolka	High	Marginally extractable mineral resource

14.3.3.11 Geological Heritage Areas

The Geological Heritage Areas (GSI 2019c) within the study area are presented on Figure 14.10 and detailed in Table 14.30, along with their importance, as determined by Box 4.1 of the NRA Guidelines (NRA 2008a).

Table 14.30: Geological Heritage Areas

Name (Code)	Description	Location	Importance	Justification for Importance Rating
Glasnevin Cemetery (DC004)	This is a very large cemetery of 120 acres dating from 1832. The variety of rock types here and the way they have been worked is unique	Glasnevin	High	Geological feature of high value on a local scale (CGS)

14.3.3.12 Aquifer Type and Classification

The GSI National Draft Bedrock Aquifer Map (GSI 2019b) for the study area (Figure 14.13 in Volume 3 of this EIAR) indicates that there is one aquifer type within the study area as summarised in Table 14.31, along with their importance, as determined by Box 4.3 of the NRA Guidelines (NRA 2008a).

The GSI Gravel Aquifer mapping (GSI 2019b) show there are no gravel aquifers within the study area.

Table 14.31: Aquifer Types Within the Study Area

Aquifer Type	Description	Location	Importance	Justification for Importance Rating
Locally Important Aquifer (Ll)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Locally important aquifer which supplies the local area

14.3.3.13 Groundwater Vulnerability

Groundwater vulnerability (GSI 2019b) within the study area ranges from 'extreme' where bedrock is close to or at the surface to 'low' vulnerability in areas where thick subsoil deposit is present, as shown on Figure 14.14 in Volume 3 of this EIAR.

14.3.3.13.1 Ballymun Road from St. Margaret's Road to Griffith Avenue

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area is low along R108 Ballymun Road from St. Margaret's Road to R102 Griffith Avenue.

14.3.3.13.2 St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges from low to extreme. An area of moderate to extreme is encountered at Botanic Avenue which follows the alignment of the River Tolka.

14.3.3.13.3 Prospect Road, Phibsborough Road from Hart's Corner to Western Way

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area is low from Hart's Corner to R135 Western Way.

14.3.3.13.4 Constitution Hill and Church Street to Arran Quay

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area is predominately low from R132 Church Street to R148 Arran Quay with an area of moderate vulnerability located south of R148 Arran Quay at the River Liffey.

14.3.3.13.5 Finglas Road from St. Margaret's Road to Wellmount Road

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges from moderate to extreme. Areas of extreme vulnerability are encountered where there is outcropping rock present.

14.3.3.13.6 Finglas Road from Wellmount Road to Ballyboggan Road

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges from moderate to extreme. Areas of extreme vulnerability are encountered where there is outcropping rock present and along the alignment of the River Tolka.

14.3.3.13.7 Finglas Road from Ballyboggan Road to Hart's Corner

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area passes from high to low vulnerability south of Glasnevin Cemetery.

14.3.3.14 Groundwater Recharge

The rate of groundwater recharge corresponds to the soil type, as shown in Figure 14.8 and Figure 14.15 in Volume 3 of this EIAR. The study area predominately has an annual recharge range of 51mm (millimetres) to 100mm in urban areas. Where there is topsoil or alluvium present instead of made ground the annual recharge is typically 1mm to 50mm.

14.3.3.15 Hydro-Ecology

There are no groundwater dependent habitats within the study area that have the status of SPA, SAC, NHA or pNHA (NPWS 2020).

14.3.4 Summary of Features of Importance

The importance ranking of the features, based on Box 4.1 of the NRA Guidelines (NRA 2008a), established for the baseline conditions is summarised below.

Features with an importance ranking of low are not considered further as they will not result in a significant impact according to Box 5.4 of the NRA Guidelines (NRA 2008a) and are summarised in Table 14.32 for completeness. Features with an importance ranking of medium or higher are summarised in Table 14.33 and the impact of the Proposed Scheme on these features will be assessed in Section 14.4.

Table 14.32: Summary of Land, Soils, Geology and Hydrogeology Features with Low Importance Within the Study Area

Category	Feature	Description	Location	Importance	Justification
Soil Fertility	Made Ground - Made	Associated with urban development	Widespread	Low	Poorly drained and / or low fertility soils
Soil Fertility	Topsoil - BminPD	Poorly drained (mainly basic)	Griffith Avenue to Hart's Corner	Low	Poorly drained and / or low fertility soils
Subsoils quality and significance	Made Ground - Urban	Associated with urban development	Widespread	Low	Low value on a local scale
Subsoils quality and significance	Alluvium - A	Typically found along current and historic watercourses	River Santry & River Tolka	Low	Low value on a local scale
Subsoils quality and significance	Glacial gravels - GLs	Gravels derived from limestones	River Tolka, Ballyboggan Road	Low	Low value on a local scale
Subsoils quality and significance	Glacial till - TLs	Till derived from limestones	Widespread	Low	Low value on a local scale
Subsoils quality and significance	Rock - Rck	Bedrock outcrop or subcrop	Bachelors Stream	Low	Low value on a local scale
Bedrock quality and significance	Lucan	(Calp) Dark Limestone and shale -Carboniferous	Widespread	Low	Low value on a local scale
Soft Soils	Alluvium - AlluvMIN (soils) / A (subsoils)	Typically found along current and historic watercourses	River Tolka	Low	Volume of soft soil underlying the route is small and of a local scale.
Economic Geology	Crushed rock aggregate potential	Low potential	Claremont Crescent to Hart's Corner	Low	Uneconomically extractable mineral resource
Economic Geology	Granular aggregate potential	Very Low potential	River Santry, Willow Park Grove and at R102 Griffith Avenue. River Tolka. R148 Arran Quay, the Four Courts, R148 Usher's Quay and Watling Street.	Low	Uneconomically extractable mineral resource
Economic Geology	Granular aggregate potential	Low potential	River Tolka	Low	Uneconomically extractable mineral resource

Table 14.33: Summary of Land, Soils, Geology and Hydrogeology Features with Medium to Very High Importance Within the Study Area

Category	Feature	Description	Location	Importance	Justification
Soil Fertility	Alluvium - AlluvMIN	Typically found along current and historic watercourses	River Tolka	Medium	Moderately drained and / or moderate fertility soils
Soil Fertility	Topsoil - BminSW	Shallow well drained (mainly basic)	North of River Tolka, Bachelors Stream	High	Well drained and / or high fertility soils
Soil Fertility	Topsoil - BminDW	Deep well drained (mainly basic)	North of River Tolka	High	Well drained and / or high fertility soils
Potential Sources of Contamination	Industrial (Cassini)	Tobacco Factory	R108 Botanic Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Industrial (Cassini)	Printing Works	R108 Botanic Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Industrial (25-inch Mapping)	Copper and Brass Works	North of the Four Courts	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Industrial (25-inch Mapping)	Match Factory	Arran Square	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Gravel Pit (6-inch OSI Mapping)	Gravel Pit	North Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Quarry (6-inch OSI Mapping)	Quarry	Brookville	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Quarry (6-inch OSI Mapping)	6 Quarries	Glenhill Road to Ballyboggan Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Oil filled electricity cable	Potential oil-filled high tension electricity cable on the Finglas Road	Finglas Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Contaminated soils from recent Site Investigation	Non-Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Total Organic Carbon (TOC), Antimony (Sb), Selenium (Se), Sulphate (SO4), Mineral Oil and Molybdenum (Mb).	Whitworth Rd, Royal Canal Bank Rd (R03-CP14, R3-CP07, R3-CP03)	Medium	Degree or extent of potential soil contamination is unknown but likely to be moderate on a local scale
Potential Sources of Contamination	Contaminated soils from recent Site Investigation	Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Total Organic Carbon (TOC)	North Circular Rd (R3-CP08, R3WS02)	Medium	Degree or extent of potential soil contamination is unknown but likely to be moderate on a local scale
Licenced Facility	Pepo Ltd	IPC – Licensed: 33 Botanic Road, Glasnevin, Dublin 9	Glasnevin, Dublin 9	Medium	Degree or extent of soil contamination is moderate on a local scale
Licenced Facility	Lithographic Web Press Ltd.	IPC – Surrendered: 57 Botanic Road, Glasnevin, Dublin 9	Glasnevin, Dublin 9	Medium	Degree or extent of soil contamination is

Category	Feature	Description	Location	Importance	Justification
					moderate on a local scale
Potential Sources of Contamination	Various petrol stations	Various petrol stations along the route from Ballymun to Aran Quay	Various	Medium	Degree or extent of soil contamination is moderate on a local scale
Economic Geology	Crushed rock aggregate potential	Moderate potential	River Tolka	Medium	Sub-economic extractable mineral resource
Economic Geology	Crushed rock aggregate potential	High potential	River Tolka	Medium	Extractable mineral resource
Economic Geology	Crushed rock aggregate potential	Very high potential	River Tolka	High	Marginally extractable mineral resource
Economic Geology	Granular aggregate potential	Moderate potential	River Tolka, Slaney Close	Medium	Sub-economic extractable mineral resource
Economic Geology	Granular aggregate potential	High potential	River Tolka, north of Smithfield, Slaney Close	Medium	Extractable mineral resource
Economic Geology	Granular aggregate potential	Very high potential	River Tolka	High	Marginally extractable mineral resource
Aquifer	Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Locally important aquifer which supplies the local area
Geological Heritage Site	Glasnevin Cemetery (DC004)	This is a very large cemetery of 120 acres dating from 1832. The variety of rock types here and the way they have been worked is unique	Glasnevin	High	Geological feature of high value on a local scale (CGS)

14.3.5 Conceptual Site Model

A CSM was developed based on all publicly available data along with scheme specific data that was provided.

The Proposed Scheme corridor is predominantly underlain by made ground over alluvium (where present associated with watercourses) over glacial till over limestone bedrock. The relevant subsections of the Proposed Scheme are presented in Table 14.34 to Table 14.40 along with the fill height (average and maximum) cut height (average and maximum) and the soils and geology at each earthwork areas.

Table 14.34: CSM – Ballymun Road from St. Margaret's Road to Griffith Avenue Prospect Rd, Dublin

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Ballymun Road: St. Margaret's Road to Griffith Avenue	2,930	At Grade	0	0	0	0	Based on desk study information the area is underlain by made ground and glacial till	0.5	N/A

Table 14.35: CSM – St Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
St. Mobhi Road: Griffith Avenue to Botanic Road	940	At Grade	0	0	0	0	Based on desk study information the area is underlain by made ground and glacial till	0.5	N/A
Botanic Road: St. Mobhi Road to Prospect Way	375	At Grade	0	0	0	0	Based on desk study information the area is underlain by made ground and glacial till	0.5	N/A
Structure No. 5: Retaining wall at Na Fianna GAA club	Approximately 120	Structure	No cut / fill due to existence of structure				Based on desk study information the area is underlain by made ground and glacial till	0.5	N/A

Table 14.36: CSM – Prospect Road, Phibsborough Road from Hart's Corner to Western Way

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Prospect Road: Prospect Way to Whitworth Road	300	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A
Structure No. 1: New pedestrian cycle bridge over the railway along Prospect Road at Lindsay Road	Approximately 17	Structure	No cut / fill due to existence of structure				Based on desk study information area is underlain by made ground and glacial till	0.5	N/A
Phibsborough Road: Whitworth Road to Western Way	1,150	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A
Structure No.2: New pedestrian cycle bridge over the railway along Prospect Road at Whitworth Road	Approximately 13	Structure	No cut / fill due to existence of structure				The exploratory locations indicate up to 2.5m of made ground overlying glacial tills. Bedrock was not proven at this location during the ground investigation	2.5	N/A
Royal Canal Bank Cycleway: Whitworth Road to Western Way	1,250	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.3	N/A
Structure No. 3: A new Pedestrian / Cycle Bridge over Royal Canal	Approximately 17	Structure	No cut / fill due to existence of structure				The ground investigation indicated up to 2.5m of made ground overlying glacial tills. Bedrock was not proven at this location during the ground investigation.	2.5	N/A
Structure No. 4: A new Royal Canal Bank Underpass under North Circular Road	Approximately 16.7	Structure	No cut / fill due to existence of structure				The exploratory locations encountered made ground over glacial till over limestone and mudstone bedrock. The made ground was encountered from depths ranging from 1.5m to 6.5m. The glacial till consisted of firm to very stiff clays. Bedrock was encountered at depths ranging from 18.4 to 18.6m.	4.0	N/A

Table 14.37: CSM – Constitution Hill and Church Street to Arran Quay

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Constitution Hill: Western Way to Coleraine Street	300	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A
Church Street: Coleraine Street to Arran Quay	670	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A

Table 14.38: CSM - Finglas Road from St Margaret's Road to Wellmount Road

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
St. Margaret's Road to Mellowes Road	750	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A

Table 14.39: CSM – Finglas Road from Wellmount Road to Ballyboggan Road

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Mellowes Road to Old Finglas Road	1,700	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A
Old Finglas Road to Claremont Lawns / Glasnevin Cemetery	1,100	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A

Table 14.40: CSM – Finglas Road South from St. Vincent's School to Harts Corner

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Claremont Lawns / Glasnevin Cemetery to St. Vincent's School	380	At Grade	0	0	0.5	0.5	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A
Finglas Road South from St. Vincent's School to Hart's Corner	300	At Grade	0	0	0.5	0.5	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A
Prospect Way	300	At Grade	0	0	0	0	Based on desk study information area is underlain by made ground and glacial till	0.5	N/A

14.3.5.1 Environment Type

The environment across the study area has been categorized in accordance with the IGI Guidelines (IGI 2013). It has been classified as:

- Type A environment which corresponds to a passive geological / hydrogeological environment – examples include areas of thick low permeability subsoils, areas underlain by poor aquifers, recharge areas, historically stable geological environments.

14.4 Potential Impacts

This Section presents potential impacts that may occur due to the Proposed Scheme, in the absence of mitigation. This informs the need for mitigation or monitoring to be proposed (refer to Section 14.5). Predicted 'residual' impacts taking into account any proposed mitigation are presented in Section 14.6.

14.4.1 Characteristics of the Proposed Scheme

14.4.1.1 Construction Phase

A detailed description of the Proposed Scheme and construction activities are provided in Chapter 4 (Proposed Scheme Description) and Chapter 5 (Construction).

This Section outlines the key design features, characteristics and construction activities of the Proposed Scheme of relevance to land, soils, geology and hydrogeology.

A Construction Environmental Management Plan (CEMP) is provided in Appendix A5.1 CEMP in Volume 4 of this EIAR.

14.4.1.1.1 Ballymun Road from St. Margaret's Road to Griffith Avenue

- Superficial works will rearrange the traffic layout on the road surface with minor localised excavations of pavement materials to shallow depths of <0.5m;
- Some minor utility diversions and / or protections will be required; and
- Construction Compound B1 will be located in the north-east corner of Santry Cross.

14.4.1.1.2 St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner

- Superficial works will rearrange the traffic layout on the road surface with minor localised excavations of pavement materials to shallow depths of <0.5m;
- The 100m length of road pavement on R108 St. Mobhi Road, south of the River Tolka, where the road will be widened. The footpath on the eastern side will be widened will be widened with shallow excavations of <1m along a narrow strip on the western side;
- The retaining wall at Home Farm Football Club, which is 4m high and 300m long, will be demolished and reconstructed to suit the footpath widening;
- A section of the Tolka Valley Cycleway will be constructed parallel to the River Tolka across open green space;
- Some minor utility diversions and / or protections will be required; and
- Construction Compound B2 will be located on the public road at St. Mobhi Drive.

14.4.1.1.3 Prospect Road, Phibsborough Road from Harts Corner to Western Way

- Superficial works will rearrange the traffic layout on the road surface with minor localised excavations of pavement materials to shallow depths of <0.5m;
- A two-way cycle track will be constructed on the eastern side of the road between Prospect Way and Lindsay Road;
- Construction of two new cycle bridges over the railway lines;
- A new pedestrian / cycle bridge will be constructed over the Royal Canal;
- An underpass will be constructed under R101 North Circular Road at Phibsboro Library; and

- Some minor utility diversions and / or protections will be required.

14.4.1.1.4 Constitution Hill and Church Street to Arran Quay

- The road will be widened by 2m on the western side for an additional bus lane, and cycle tracks will be implemented on both sides of the road between R135 Western Way and Coleraine Street;
- Some minor utility diversions and / or protections will be required; and
- Construction Compound B3 will be located at the Catherine Lane North Junction.

14.4.1.1.5 Finglas Road from St. Margaret's Road to Wellmount Road

- No major works are envisaged within this section with just revised road markings for a new traffic layout and some new footpaths across open green spaces; and
- Construction Compound F1 will be located on the western side of R135 Finglas Road at Mellowes Park in the vicinity of St. Margaret's Road Roundabout.

14.4.1.1.6 Finglas Road from Wellmount Road to Ballyboggan Road

- Superficial works will rearrange the traffic layout on the road surface with minor localised excavations of pavement materials to shallow depths of <0.5m; and
- Construction Compound F2 will be constructed at the R135 Finglas Road / Finglas Place Junction and Construction Compound F3 will be constructed at Claremont Lawns, opposite Glasnevin Cemetery.

14.4.1.1.7 Finglas Road South from St. Vincent's School to Hart's Corner

- From Claremont Lawns / Glasnevin Cemetery to St. Vincent's School, the road will be widened by 3m on the southern side, for an additional bus lane, with the removal of an existing concrete parking area to allow for this widening;
- Full road pavement reconstruction will be required south-east of St. Vincent's School, including demolition of the old concrete road pavement and footpaths which are in poor condition with inadequate kerb heights. Underground pipes will be replaced, as necessary; and
- Construction Compound F3 will be constructed at Claremont Lawns, opposite Glasnevin Cemetery.

14.4.1.2 Operational Phase

The impact assessment for the Operational Phase has been outlined in terms of impact analysis of the Proposed Scheme on the local environment from a land, soils, geology and hydrogeology perspective. This is outlined in Section 14.4.4, Section 14.5.2 and Section 14.6.2.

14.4.2 'Do Nothing' Scenario

In the 'Do Nothing' scenario, the Proposed Scheme would not be implemented, and there would be no resulting impacts on land, soils, geology or hydrogeology along the route of the Proposed Scheme. The impact would therefore be Neutral.

14.4.3 Construction Phase

The potential land, soils, geology and hydrogeology impacts during the Construction Phase for the relevant construction activities described in Section 14.4.1.1 are presented in this Section, along with their impact significance. These potential impacts also relate and interact with other environmental factors which are described within the EIAR. Specific interactions are outlined in Section 14.1.

The Proposed Scheme will have the following potential impacts on land, soils, geology and hydrogeology as discussed below and summarised in Table 14.41:

- Loss or damage of topsoil;
- Excavation of potentially contaminated ground;
- Loss of a future quarry or pit reserve;

- Loss or damage of a proportion of a Geological Heritage Area;
- Loss or damage of a proportion of an aquifer; and
- Change to groundwater regime.

Though the magnitude of the impact may vary depending on the scale of activities and the location of the Proposed Scheme, relative to the impacted important feature, in order to ensure a robust assessment, only the maximum magnitude or 'worst case' of the impact of the Proposed Scheme is considered .

14.4.3.1 Loss and Damage of Topsoil

Topsoil is a non-renewable resource, which if removed or damaged can result in a permanent irreversible negative impact. The potential ways in which this can occur as a result of the Proposed Scheme are as follows:

- There is the potential for materials on-site to be spilled, resulting in the pollution of the topsoil. For example, raw or uncured concrete and grouts, washed down water from exposed aggregate surfaces, cast-in-place concrete from concrete trucks, fuels, lubricants and hydraulic fluids for equipment used on the development site, and bitumen and sealants used for waterproofing concrete surfaces can all potentially impact on soils and groundwater during the Construction Phase;
- These excavated soil materials will be stockpiled using appropriate methods to minimise the impacts of weathering. Materials that are stockpiled incorrectly can be exposed to erosion and weathering which reduces the quality of the resource;
- Excavations (including piling) in areas of contaminated ground during the construction works may mobilise pollution contained in the soils into the nearby topsoil;
- Permanent damage of topsoil through waterlogging, sealing, washout of fines and erosion. This would be due to the trafficking of plant, regrading of slopes, laying of hardstanding surfaces and storage of materials in areas not intended to be paved as part of the Proposed Scheme; and
- Excavation and disposal of topsoil instead of its reuse or reinstatement.

Topsoil will be encountered in numerous areas across the Proposed Scheme, as discussed in Section 14.3.3.3. Where topsoil is stripped to accommodate the works outlined above, all of the above impacts are likely to occur at these locations. Topsoil will be temporarily removed from the Construction Compounds as described earlier This material will be locally stockpiled and replaced when the Construction Compounds are removed. Topsoil will also be disturbed while widening by 2m over a 300m length on the eastern side of R108 St. Mobhi Road, with the removal of large mature conifer trees at Na Fianna GAA Club and Home Farm Football Club. All topsoil will be retained on-site for use in replacement landscaping.

The magnitude of these impacts of the Proposed Scheme on topsoil will be small adverse as it will result in a permanent irreversible loss of a small proportion of locally high fertility topsoil and / or a high proportion of locally low fertility topsoils within the study area.

As the topsoil is of high importance, the potential resulting significance of this permanent small adverse impact will be Slight.

14.4.3.2 Excavation of Potentially Contaminated Land

The excavation of made ground results in the production of excess material that requires placement elsewhere in the Proposed Scheme or removal off site, and / or the mobilisation of possible contaminants. The entirety of the Proposed Scheme will encounter made ground as discussed in Section 14.3.3.1 and Section 14.3.3.3.

Exposure of locations of contamination and excavation of contaminated soil may potentially lead to a risk to the surrounding environment or underlying soil, if not dealt with in an appropriate manner, in accordance with the EPA Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013). The underlying soil could be impacted from the exposure of previous buried hazardous material, in an unlicensed dumping site, for example.

Potential sources of contamination relevant to the Proposed Scheme identified within the study area are detailed in Table 14.27 and include historic quarries and a gravel pit, a tobacco factory, a printing works, copper and brass

works and a match factory along with two Integrated Pollution Control (IPC) licensed facilities and two operational or former petrol stations.

The magnitude of this impact will be small adverse as it will result in the excavation of a small proportion of contaminated land.

As the potential contaminated ground is of medium importance, the potential resulting significance of the permanent small adverse impact will be Slight.

14.4.3.3 Loss of Future Quarry or Pit Reserve

The sterilisation of land through development, or the excavation of soil and rock during construction can diminish future quarry and pit reserves which have been shown to have been utilised in the past in the area, such as the historic quarries on R135 Finglas Road. This can result in a permanent irreversible loss of the in-situ characteristics of the land, soils and geology area.

The magnitude of this impact will be negligible as it will result in an insufficient permanent irreversible change at a local scale to affect the integrity of the land and soils as a potential future quarry or pit reserve above the Do-Nothing scenario.

As the aggregate potential is of medium to high importance, the resulting potential significance of this negligible impact will be Imperceptible and will not be considered further.

14.4.3.4 Loss or Damage of Proportion of Geological Heritage Area

The sealing, contamination or excavation of soil and rock during construction can diminish the value of Geological Heritage Areas. This can result in a permanent irreversible loss of the in-situ characteristics of the land, soils, geology and hydrogeology of the area. The land, soils and geology on a local scale will be negatively impacted by the construction of new pavements and structures along with Construction Compound F3 in the vicinity of the Glasnevin Cemetery CGS.

However, as there are no intended works within the CGS, the magnitude of this impact will be negligible as it will result in an insufficient permanent irreversible change on a local scale to affect the integrity of the CGS.

As Glasnevin Cemetery CGS is of high importance, the resulting potential significance of this negligible impact will be Imperceptible and therefore will not be considered further.

14.4.3.5 Loss or Damage of Proportion of Aquifer

The removal of a proportion of an aquifer can reduce its ability to provide baseflow to groundwater dependant habitats and / or water supplies and will result in an irreversible loss of the in-situ characteristics of the land, soils, geology and hydrogeology resource. Likewise, the mobilisation of contaminants into the aquifer, either through accidental spillage or disturbance of contaminated ground during excavation, will reduce the quality of the groundwater within the aquifer.

The underlying limestone bedrock is defined as a locally important aquifer and though close to the surface in areas, there will be minimal excavation into the limestone rock as part of the Proposed Scheme. The magnitude of this impact will be negligible as it will result in no measurable change which may affect the integrity of the underlying aquifer. As the aquifer is a locally important aquifer of medium importance, the potential resulting significance of this negligible impact will be Imperceptible and will not be considered further.

In addition to the above impact, potential pollutants from routine runoff during construction or mobilisation of pollution from the disturbance of contaminated ground during construction activities (particularly excavations) have the potential to alter the groundwater quality temporarily in the study area. The magnitude of this impact is moderate adverse as it results in a temporary potential medium risk of pollution to groundwater. As the aquifer is a locally important aquifer of medium importance, the resulting potential significance of this temporary moderate adverse impact will be Moderate.

14.4.3.6 Change to Groundwater Regime

Localised pumping of excavations is expected to be required as part of the Construction Phase in order to allow works to be carried out in dry excavations. This could lead to a temporary change in the groundwater levels and flow within the locally important aquifer underlying the Proposed Scheme.

Since the pumping is expected to be limited and localised and temporary, the magnitude of this impact will be considered negligible. As the importance of the locally important aquifer is medium, the resulting potential significance will be Imperceptible and therefore will not be considered further.

Table 14.41: Summary of Potential Construction Phase Impacts

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Loss or Damage of Topsoil									
Alluvium - AlluvMIN	Typically found along current and historic watercourses	River Tolka	Medium	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Slight
Topsoil - BminSW	Shallow well drained (Mainly basic)	North of River Tolka, Bachelors Stream	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate/ Slight
Topsoil - BminDW	Deep well drained (Mainly basic)	North of River Tolka	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate/ Slight
Excavation of Potentially Contaminated Ground									
Contaminated Land	Tobacco Factory	R108 Botanic Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	Printing Works	R108 Botanic Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	Copper and Brass Works	North of the Four Courts	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	Match Factory	Arran Square	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	Gravel Pit	North Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	Quarry	Brookville	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	6 Quarries	Glenhill Road to Ballyboggan Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	Potential oil-filled high tension electricity cable on the Finglas Road	Finglas Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	IPC – Licensed: 33 Botanic Road, Glasnevin, Dublin 9	Glasnevin, Dublin 9	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	IPC – Surrendered: 57 Botanic Road, Glasnevin, Dublin 9	Glasnevin, Dublin 9	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	Various petrol stations along the route from Ballymun to Aran Quay	Various	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Contaminated Land	Non-Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Total Organic Carbon (TOC), Antimony (Sb), Selenium (Se), Sulphate (SO4), Mineral Oil and Molybdenum (Mb).	Whitworth Rd, Royal Canal Bank Rd (R03-CP14, R3-CP07, R3-CP03)	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Contaminated Land	Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Total Organic Carbon (TOC)	North Circular Rd (R3-CP08, R3WS02)	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Loss of Future Quarry or Pit Reserve									
Crushed rock aggregate potential	Moderate potential	River Tolka	Medium	Loss of Future Quarry reserve	Negative	Permanent	Local	Negligible	Imperceptible
Crushed rock aggregate potential	High potential	River Tolka	Medium	Loss of Future Quarry reserve	Negative	Permanent	Local	Negligible	Imperceptible
Crushed rock aggregate potential	Very High potential	River Tolka	High	Loss of Future Quarry reserve	Negative	Permanent	Local	Negligible	Imperceptible
Granular aggregate potential	Moderate potential	River Tolka, Slaney Close	Medium	Loss of Future Quarry reserve	Negative	Permanent	Local	Negligible	Imperceptible
Granular aggregate potential	High potential	River Tolka, north of Smithfield, Slaney Close	Medium	Loss of Future Quarry reserve	Negative	Permanent	Local	Negligible	Imperceptible
Granular aggregate potential	Very High potential	River Tolka	High	Loss of Future Quarry reserve	Negative	Permanent	Local	Negligible	Imperceptible
Loss or Damage of Proportion of Aquifer									
Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Loss or damage of proportion of aquifer through excavation.	Negative	Permanent	Local	Negligible	Imperceptible

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Loss or damage of proportion of aquifer through pollution.	Negative	Temporary	Local	Moderate Adverse	Moderate
Change to Groundwater Regime									
Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Change to groundwater regime	Negative	Temporary	Local	Negligible	Imperceptible
Loss or Damage of Proportion of Geological Heritage Area									
Glasnevin Cemetery (DC004)	This is a very large cemetery of 120 acres dating from 1832. The variety of rock types here and the way they have been worked is unique	Glasnevin	High	Loss or Damage of Proportion of Geological Heritage Area	Negative	Permanent	Local	Negligible	Imperceptible

14.4.4 Operational Phase

14.4.4.1 Contamination

The Operational Phase has the potential to lead to occasional accidental leakage of oil, petrol or diesel, allowing contamination of the surrounding environment. While the likelihood of an accidental spillage may increase in comparison to the Do Nothing scenario, the magnitude of the impact is negligible.

Therefore, the potential significance of the impact will be Imperceptible on any of the land, soils, geology and hydrogeology resources.

14.5 Mitigation and Monitoring Measures

The following sections outline the mitigation and monitoring measures associated with the impacts identified in Section 14.4 for both the Construction and Operational Phases of the Proposed Scheme. A summary of the pre-mitigation and post-mitigation impacts is contained in Table 14.42.

14.5.1 Construction Phase

14.5.1.1 Loss or Damage of Topsoil

Excavated topsoils will be stockpiled by the appointed contractor using appropriate methods to minimise the effects of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff.

All topsoil or subsoil shall be assessed for reuse within the Proposed Scheme by the appointed contractor, ensuring the appropriate handling, processing and segregation of the material. Where practical, the removal of topsoil from the Proposed Scheme will be avoided. All earthworks will be undertaken in accordance with TII's Specification for Road Works (SPW) Series 600 Earthworks (TII 2013) and project-specific earthworks specifications ensuring that all excavated material and imported material is classified using the same methodology to allow maximum opportunity for the reuse of materials on-site.

The impact of the production of excess material for removal off site is discussed in Chapter 18 (Waste & Resources).

14.5.1.2 Excavation of Potentially Contaminated Ground

The appointed contractor will ensure that excavations shall be kept to a minimum, using shoring or trench boxes, where appropriate. For more extensive excavations, a temporary works designer shall be appointed by the appointed contractor to design excavation support measures in accordance with all relevant guidelines that minimises the excavation of contaminated ground.

The appointed contractor will be responsible for regular testing of excavated soils to monitor the suitability of the soil for reuse.

Samples of ground suspected of contamination will be tested for contamination by the appointed contractor during the detailed ground investigation and ground excavated from these areas will be disposed of, to suitably licensed or permitted sites, in accordance with the current Irish waste management legislation.

Any dewatering in areas of contaminated ground shall be designed by the appointed contractor to minimise the mobilisation of contaminants into the surrounding environment.

14.5.1.3 Pollution of Soil and Groundwater

Good construction management practices, as outlined in the Construction Industry Research and Information Association (CIRIA) Control of Water Pollution from Construction Sites – Guidance for consultants and contractors (Masters-Williams *et al*. 2001) will be employed by the appointed contractor to minimise the risk of transmission

of hazardous materials, as well as pollution of adjacent watercourses and groundwater. The construction management of the site will take account of these recommendations to minimise, as far as possible, the risk of soil, groundwater and surface water contamination.

Measures to be implemented by the appointed contractor to minimise the risk of spills and contamination of soils and waters shall include:

- Employing only a competent and experienced workforce, and site-specific training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures;
- Ensure that all areas where liquids (including fuel) are stored, or cleaning is carried out, are in designated impermeable areas that are isolated from the surrounding area and within a secondary containment system (e.g. by a roll-over bund, raised kerb, ramps or stepped access);
- The location of any fuel storage facilities shall be considered in the design of all Construction Compounds. These are to be designed in accordance with relevant guidelines and codes of best practice at the time of construction and will be fully bunded;
- Good housekeeping on-site (daily site clean-ups, use of disposal bins, etc.) will be applied during the entire Construction Phase;
- All concrete mixing and batching activities will be located in areas away from watercourses and drains;
- Potential pollutants will be adequately secured against vandalism in containers in a dedicated secured area;
- Provision of proper containment of potential pollutants according to codes of best practice;
- Thorough control will be implemented during the entire Construction Phase to ensure that any spillage is identified at an early stage and subsequently effectively contained and managed; and
- Spill kits will be provided and will be kept close to the storage area and staff will be trained on how to use spill kits correctly.

An Environmental Incident Response Plan will be implemented by the appointed contractor, which will identify the actions to be taken in the event of a pollution incident. It will address such aspects as containment measures, emergency discharge routes, a list of appropriate equipment and clean-up materials and notification procedures to inform the relevant environmental protection authority (refer to Appendix A5.1 CEMP in Volume 4 of this EIAR).

Sediment control methods are outlined in the Surface Water Management Plan in Appendix A5.1 CEMP in Volume 4 of this EIAR, and these will be implemented by the appointed contractor.

The CEMP also addresses good construction management practices that will be employed to prevent the risk of pollution of existing land, soils, geology and hydrogeology during construction.

Table 14.42: Summary of Predicted Construction Phase Impacts Following the Implementation of Mitigation and Monitoring Measures

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-Mitigation Magnitude	Pre- Mitigation Significance	Post-Mitigation Magnitude	Post-Mitigation Significance
Loss or Damage of Topsoil											
Alluvium - AlluvMIN	Typically found along current and historic watercourses	River Tolka	Medium	Loss or damage of alluvium	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Topsoil - BminSW	Shallow well drained (Mainly basic)	North of River Tolka, Bachelors Stream	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate/ Slight	Negligible	Imperceptible
Topsoil - BminDW	Deep well drained (Mainly basic)	North of River Tolka	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate/ Slight	Negligible	Imperceptible
Excavation of Potentially Contaminated Ground											
Contaminated Land	Tobacco Factory	R108 Botanic Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	Printing Works	R108 Botanic Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	Copper and Brass Works	North of the Four Courts	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	Match Factory	Arran Square	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	Gravel Pit	North Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	Quarry	Brookville	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	6 Quarries	Glenhill Road to Ballybogga n Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-Mitigation Magnitude	Pre- Mitigation Significance	Post-Mitigation Magnitude	Post-Mitigation Significance
Contaminated Land	IPC – Licensed: 33 Botanic Road, Glasnevin, Dublin 9	Glasnevin, Dublin 9	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	IPC – Surrendered: 57 Botanic Road, Glasnevin, Dublin 9	Glasnevin, Dublin 9	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	Various petrol stations along the route from Ballymun to Aran Quay	Various	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	Non-Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Total Organic Carbon (TOC), Antimony (Sb), Selenium (Se), Sulphate (SO4), Mineral Oil and Molybdenum (Mb).	Whitworth Rd, Royal Canal Bank Rd (R03-CP14, R3-CP07, R3-CP03)	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Contaminated Land	Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Total Organic Carbon (TOC).	North Circular Rd (R3-CP08, R3WS02)	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Loss of Future Quarry Reserve											
Crushed rock aggregate potential	Moderate potential	River Tolka	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Crushed rock aggregate potential	High potential	River Tolka	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-Mitigation Magnitude	Pre- Mitigation Significance	Post-Mitigation Magnitude	Post-Mitigation Significance
Crushed rock aggregate potential	Very High potential	River Tolka	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Granular aggregate potential	Moderate potential	River Tolka, Slaney Close	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Granular aggregate potential	High potential	River Tolka, north of Smithfield, Slaney Close	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Granular aggregate potential	Very High potential	River Tolka	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Loss or Damage to Portion of Aquifer											
Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Loss or damage of proportion of aquifer through excavation.	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Loss or damage of proportion of aquifer through pollution.	Negative	Temporary	Local	Moderate Adverse	Moderate	Negligible	Imperceptible
Change to Groundwater Regime											
Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Change to groundwater regime	Negative	Temporary	Local	Negligible	Imperceptible	Negligible	Imperceptible
Loss or Damage to Portion of Geological Heritage Area											
Glasnevin Cemetery (DC004)	This is a very large cemetery of 120 acres dating from 1832. The variety of rock types here and the way they have been worked is unique	Glasnevin	High	Removal or small part of geological heritage site	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible

14.5.2 Operational Phase

With the implementation of the proposed design, no additional mitigation measures for land, soils, geology and hydrogeology are considered necessary for the operation of the Proposed Scheme.

In the Operational Phase, the infrastructure will be maintained by the local authority, and will be subject to their management procedures, to ensure that the correct measures are taken in the event of any accidental spillages, and this will reduce the potential for any impact.

14.6 Residual Impacts

No significant residual impacts have been identified either in the Construction or Operational Phases of the Proposed Scheme, whilst meeting the scheme objectives set out in Chapter 1 (Introduction).

14.6.1 Construction Phase

With the efficacious implementation of the above mitigation measures, there will be no significant residual impacts on land, soils, geology and hydrogeology as a result of the construction of the Proposed Scheme.

14.6.2 Operational Phase

There will be no significant residual impacts on land, soils, geology and hydrogeology as a result of the operation of the Proposed Scheme.

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