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 Tallaght / Clondalkin 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 in 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 the 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 sub-sections for ease of presentation and due to the volume of information available. The sub-sections of the Proposed Scheme are as follows:

- Tallaght to Ballymount;
- Ballymount to Crumlin;
- Crumlin to Grand Canal;
- Grand Canal to Christchurch;
- Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction; and
- Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh.

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 (NRA 2008a).

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);
- European Commission. 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
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 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
Department of Communications, Energy and Natural Resources (DCENR)	Minerals Ireland	A booklet contains a list of all current and prospecting mining facilities

Source	Name	Description
	Historic Mine Sites – Inventory and Risk Classification	Department of the Environment, Climate and Communications

14.2.3.2 Ground Investigation

The details of the 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 Geological Survey of Ireland (GSI) Spatial Resources Map Viewer 'EXT GSI Geotechnical Sites layer' (GSI, 2019a).

Table 14.2: Existing Ground Investigations

GSI Report ID	Title	Year	Author	Location	Scope
R4	Fonthill-Nangor Road realignment	1993	IGSL	Nangor Road	Four cable-tool boreholes
R4098	Residential redevelopment	2002	IGSL	Nangor Road	Two cable-tool boreholes
R81	Blackwood Hodge	1971	The Cementation Co. Ltd, Ireland.	Blackwood Hodge, Dublin	Three percussion boreholes (shell and auger)
R4377	Jaguar Ireland	Unknown	Unknown	Longmile Road	Three percussion boreholes (shell and auger)
R5247	Lidl Development	2003	IGSL	Walkinstown	Three percussion boreholes (shell and auger)
R2937	Texaco	1996	IGSL	Drimnagh Road	Two percussion boreholes (shell and auger)
R5738	Lidl supermarket	Unknown	Unknown	Drimnagh Road, Dublin 12	Four cable percussion boreholes and one trial pit
R7290	Crumlin Hospital	2010	IGSL	Crumlin Road	Six Trial pits
R966	Dolphins Barn Bridge	1981	Geotechnical Consulting Services Ltd.	Dolphins Barn Bridge	Two Boreholes (One wagon drill and Pilcon wayfarer)
R4895	Residential development	Unknown	Unknown	Cork Street	Two cable percussion (shell and auger)
R6196	Cork Street development	Unknown	Unknown	Ardee Street	Two cable percussion (shell and auger) and two rotary coring drilling
R4949	Ardee Street	Unknown	Unknown	Dublin 8, Co Dublin	Five cable percussion (shell and auger)
R5074	Commercial development	Unknown	Unknown	105-109 The Coombe, Dublin 8	Two cable percussion (shell and auger)
R2231	Residential development	1993	IGSL	Patrick Street / Dean Street Dublin	Four percussion boreholes (shell and auger), four rotary drills and one rotary coring.
R863	Patrick Street sewer	1989	IGSL	Patrick Street / Dean Street Dublin	Ten boreholes (unspecified).
R778	Patrick Street development	1989	IGSL	Dean Street / Street Nicholas Place	Percussion boreholes (shell and auger), nine trial pits

GSI Report ID	Title	Year	Author	Location	Scope
R5453	Commercial / residential development	Unknown	Unknown	Belgard Square	Nine cable percussion boreholes (shell and auger)
R4994	New development	Unknown	Unknown	Tallaght, Dublin 24	Five cable percussion boreholes (shell and auger)
R4158	South Dublin County Council offices	Unknown	Unknown	Tallaght, Dublin 24	Six Cable percussion Boreholes (shell and auger)
R2347	Dublin South County Civic Offices	1993	IGSL	Tallaght Town Centre	24 percussion probes (Borros Probes)
R2463	Tallaght RTC	1985	IGSL	Tallaght Town Centre	14 percussion Boreholes (shell and auger) and seven trial pits
R4904	Proposed Scheme	Unknown	Unknown	Greenhills Road	Four cable percussion boreholes
R4402	Residential / commercial development	Unknown	Unknown	Tallaght, Dublin 24	Six cable percussion boreholes (shell and auger)
R115	Industrial estate	1978	Irish Soils Laboratories Ltd.	Walkinstown, Dublin	Six percussion boreholes (shell and auger) and 16 trial pits.
R3819	Commercial development	Unknown	Unknown	Long Mile Road	Three cable percussion boreholes and two rotary coring drilling

The scheme specific ground investigations carried out to inform the Proposed Scheme and EIAR are listed in Table 14.3 and the factual reports provided in Appendix 14.2 Ground Investigation Report in Volume 4 of this EIAR. These provide 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 Connects Route 8 Tallaght / Clondalkin to City Centre Ground Investigation	Causeway	2020	Route 8	4 No. cable percussion boreholes with rotary follow on
Bus Connects Route 9 Tallaght / Clondalkin to City Centre Ground Investigation	Causeway	2020	Route 9	18 No. cable percussion boreholes; 4 No. rotary follow on boreholes 1 No. window sample 11 No. trial pits 10 No. indirect CBR tests

14.2.3.3 Design Information

The design information as provided in Chapter 4 (Proposed Scheme Description) and Chapter 5 (Construction) as well as the Mainline Plan and Profile Drawings (BCIDC-ACM-GEO_HV-0809_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 21 January 2020, 7 July 2021 and 16 January 2023 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 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 is 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 are gathered and assessed. Then, the preliminary CSM is 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 (NRA 2008a) are as follows:

- The magnitude of impacts should be defined in accordance with the criteria provided in the NRA Guidelines (Table 14.4);
- Box 4.1: Criteria for Rating Site Attributes – Estimation of Importance of Soil and Geology Attributes (Table 14.5);
- Box 4.3: Criteria for Rating Site Attributes – Estimation of the Importance of Hydrogeology Attributes (Table 14.6);
- Box 5.1: Criteria for Rating Site Attributes at 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 the same 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: 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 14.5: Criteria for Rating the Importance of Identified Soils and Geological Attributes (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 (County Geological Site) 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 14.6: Criteria for Rating the Importance of Identified Hydrogeological Attributes (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., cSAC or 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 – 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 14.7: Criteria for rating Soil and Geology Impact Significance and Magnitude at EIS 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

Magnitude of Impact	Criteria	Typical Example
		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 5.1 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 Environmental Impacts at EIA Stage (Box 5.4 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

		Magnitude of Impact			
		Negligible	Small	Moderate	Large
	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 extending 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 region 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	Renzinas / Lithosols	Dublin outskirts
Cut	Raised bog cutaway / cutover	Near Wicklow mountains
FenPT	Fenpeat	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 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 1:500,000 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 orientation 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)	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 the 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 aquifers, 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 (GSI 2019b)

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 for the region indicates annual groundwater recharge across the region ranges from approximately 1mm/yr (millimetre per year) to 600mm/yr as shown on 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) and South Dublin County Council (SDCC) also maintain databases 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. Again, 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 or 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
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 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 2021), Google (Google 2021), Bing (Bing 2021) and the Corine Land Cover maps (EPA 2018). The historic land use is based on the following OSI (OSI 2021) 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 Tallaght to Ballymount

The Corine Land Cover 2018 classifies the land use within the study area from Tallaght to Ballymount as discontinuous urban fabric to the west and south of the study area, and industrial and commercial units in the center of the study area. The ground of Technological University (TU) Dublin - Tallaght Campus is classified as green urban areas. The land use between Greenhills Road and the M50 Motorway varies between industrial and commercial units in the south of the study area, discontinuous urban fabric in the center of the study area and green urban areas adjacent to the M50 Motorway.

The OSI 6-inch mapping shows a graveyard is recorded to the south of the existing Saint Maelruain's Church on Blessington Road. The land use from Tallaght to Ballymount is recorded as predominantly agricultural, with what appears to be scattered residential and farm buildings.

The OSI 25-inch mapping shows that the study area from Tallaght to Ballymount remains relatively unchanged, with some minor residential development being recorded in the vicinity of Greenhills and Tallaght, where a burial ground is also recorded directly to the south of the existing TUD Tallaght campus.

A watercourse is recorded flowing east, crossing the line of the Proposed Scheme directly to the north-west of the existing Tallaght Athletics Club.

The 1995 OSI aerial photography imagery shows that significant development is recorded, comprising predominantly commercial and industrial buildings. Residential areas are noted along the Greenhills Road on approach to the M50 motorway.

The 2000 OSI aerial photography imagery shows that the study area appears relatively unchanged.

The 2005 OSI aerial photography imagery shows the construction of Cookstown Way, and ongoing construction is recorded in the study area at Belgard Square West. Construction activities in the study area previously recorded to comprise numerous gravel pits are now recorded as complete. The Luas Red Line light rail line is now recorded as running south along Cookstown Way and terminating on Blessington Road at the south-western end of the study area.

The 2019 Google Maps aerial imagery shows a new section of road is now recorded as running approximately east to west and to the south of TUD Tallaght from the R819 Greenhills Road to the R113 Belgard Road. Some development is recorded in the area previously recorded to comprise numerous gravel pits.

14.3.3.1.2 Ballymount to Crumlin

The Corine Land Cover 2018 classifies the land use of the M50 Motorway as road and rail networks and associated land. The land use east of the M50 Motorway to Walkinstown Roundabout is predominantly industrial and commercial units to the west and north of the study area, green urban areas to the south-east of the study areas and discontinuous urban fabric to the east and north-east of the study area.

The OSI 6-inch mapping shows that the land use is predominantly agricultural, with what appears to be scattered residential and farm buildings. There are numerous gravel pits and one quarry noted along Greenhills Road, near Calmount Avenue and Calmount Road.

An unnamed watercourse is recorded as flowing north at Ballymount Avenue approximately 170m to the south-east of Calmount Road.

The OSI 25-inch mapping shows that the study area to the south-west remains relatively unchanged, with some minor residential development being recorded to the south of the existing Rafter's Lane and in the vicinity of Walkinstown Cross.

The OSI 6-inch Cassini mapping shows a feature recorded as 'Urn Burials (Site of)' recorded approximately 220m to the south of Walkinstown Cross. The unnamed road to the west of Dolphin's Barn is now recorded as Crumlin Road and Walkinstown Road. The majority of the gravel pits to the south-west of the study area are now shown to be disused and recorded as rough pasture. Between the existing R110 Drimnagh Road / R819 Walkinstown Road junction and Dolphin's Barn Bridge significant residential development is recorded on the land surrounding the route of the Proposed Scheme.

The 1995 OSI aerial photography imagery shows the M50 Motorway is now recorded with the R819 Greenhills Road passing over it. Only a small section of the watercourse previously recorded at Ballymount Road is still visible to the south. The majority of the land within the study area previously recorded as comprising gravel pits is now shown to comprise what appears to be commercial and industrial buildings. However, some signs of previous mining or quarrying activities are still visible. A six-arm roundabout is now recorded at Walkinstown Cross, Ballymount Avenue and Calmount Road, and is undergoing construction.

The 2000 OSI aerial photography imagery shows that the study area appears relatively unchanged. Further development of the study area previously recorded to comprise numerous gravel pits is shown, with some ongoing construction being recorded. The unnamed watercourse at Ballymount Road is no longer visible. However, a section of the watercourse running under the M50 Motorway to the south is visible, possibly indicating that further to the north, the watercourse has been culverted.

The 2005 OSI aerial photography imagery shows some minor development throughout the study area. However, the layout of the buildings remains relatively unchanged.

The 2019 Google Maps aerial imagery shows no significant development of the land within the study area.

14.3.3.1.3 Crumlin to Grand Canal

The Corine Land Cover 2018 classifies the land use from Crumlin to Grand Canal as predominantly discontinuous urban fabric, with the exception of a section classified as green urban areas at Eammon Ceannt Park and Pearse College.

The OSI 6-inch mapping shows that the land use is predominantly agricultural, with what appears to be scattered residential and farm buildings. A church and dispensary are shown in Crumlin and Canal View cottages are identified adjacent the Grand Canal.

The OSI 25-inch mapping shows that the study area to the south-west remains relatively unchanged.

A watercourse is recorded as crossing the route of the Proposed Scheme where the unnamed road passes over the Grand Canal to the south-west of Dolphin's Barn at the Camac Bridge. The Camac Bridge to the south-west of Dolphin's Barn is now recorded as Dolphin's Barn Bridge.

The 1995 OSI aerial photography imagery shows that the 38kV and 110kV powerlines previously recorded to the south-west of Drimnagh Castle are no longer visible, and neither is Drimnagh Lodge.

The 2000 and 2005 OSI aerial photography imagery shows some minor development throughout the study area. However, the layout of the buildings remains relatively unchanged.

The 2019 Google Maps aerial imagery shows no significant development of the land within the study area.

14.3.3.1.4 Grand Canal to Christchurch

The Corine Land Cover 2018 classifies the land use from Dolphin Road / Grand Canal to the end point of the Proposed Scheme as continuous urban fabric.

The OSI 6-inch mapping shows that the land use from Grand Canal to Christchurch is mixed residential and industrial. East of the existing R110 Cork Street / Brickfield Lane junction, significant residential development is recorded. Industrial land use noted includes a Brewery, Distillery, Fever Hospital and Chemical Works surrounding the existing R110 Cork Street / R804 Marrowbone Lane junction.

The OSI 25-inch mapping shows that significant residential development is recorded between the existing R110 Cork Street / R804 Marrowbone Lane junction and the R110 Crumlin Road / Herberton Road junction. City Woollen Mills is recorded directly to the south of Vauxhall Avenue, and a Brick Works, including Kilns, is recorded directly to the north of the Proposed Scheme, to the west of the existing Keeper Road. To the south-west of Cork Street, Dolphin's Barn Lane is now recorded as Dolphin's Barn Street, and the eastern-most section of the unnamed road between the Grand Canal and St Mary's Road to the west is now recorded as Crumlin Road.

The OSI 6-inch Cassini mapping shows that to the east of the existing R110 Cork Street / Brickfield Lane junction, the study area remains relatively unchanged. The Maltings, Corporation Scavenging Depot, Tannery and Glue Works, Foundry and Engineering Works, and Dye Works are no longer recorded, and neither is the Bacon Curing Factory. However, no significant changes to the building layout at these locations is noted.

The 1995 OSI aerial photography imagery shows that the study area is predominantly mixed use residential and commercial.

The 2000 and 2005 OSI aerial photography imagery shows some minor development throughout the study area. However, the layout of the buildings remains relatively unchanged.

The 2019 Google Maps aerial imagery shows no significant development of the land within the study area.

14.3.3.1.5 Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

The Corine Land Cover 2018 classifies the land use west of the M50 as discontinuous urban fabric and the land use east of the M50 as industrial and commercial units.

The OSI 6-inch mapping shows that the land use is predominantly agricultural, with what appears to be scattered residential and farm buildings. Industrial land use noted in the study area includes glue manufacturing and a Mill Dam along the Nangor Road. The River Camac crosses the route of the Proposed Scheme at the existing R134 Nangor Road / Park West Avenue junction. A large water feature, approximately 150m long, and recorded as 'Mill Dam' is shown immediately to the north-east of this location, with other significant water features such as ponds, likely associated with the Killeen Paper Mill, being recorded further to the east. A bend in the river is recorded within the vicinity of the Proposed Scheme, approximately 130m to the west of the R134 Nangor Road / Woodford Walk junction. East of the R134 Nangor Road / Woodford Walk junction, the Grand Canal is recorded as running adjacent to the Proposed Scheme for approximately 540m. A small number of pumps and wells are recorded throughout the study area. Three gravel pits are recorded approximately 200m to the west and south-west of the existing R110 Long Mile Road / R112 Walkinstown Road junction.

The OSI 25-inch mapping shows that the study area remains relatively unchanged with minor changes to land boundaries noted.

The 1995 OSI aerial photography imagery shows the construction of the R134 Nangor Road and M50 Motorway to the west, which includes a bridge structure carrying the M50 Motorway over the R134 Nangor Road. It also shows significant residential development to the west of the M50 Motorway and numerous commercial and industrial buildings east of the M50 along the Nangor Road. The only area now recorded as being relatively undeveloped is the north section of the R134 Nangor Road to the east of the M50 Motorway.

The 2000 OSI aerial photography imagery shows some signs of development within the study area with the most significant being in the area between Park West Avenue and the M50 Motorway. This study area is now shown to comprise numerous commercial and / or industrial buildings of varying sizes. The section of the Camac River to the west of the Proposed Scheme appears to have been realigned during the construction of the R134 Nangor Road and is now shown to pass under the M50 Motorway to the east. There are no visible signs of any gravel pits or quarries throughout the study area, with the area of the previously recorded gravel pit to the south-east of St. Gillian's School now being occupied by a large commercial or industrial complex.

The 2005 OSI aerial photography imagery shows that the study area appears relatively unchanged.

The 2019 Google Maps aerial photography imagery shows that the study area is dominated by industrial and commercial units.

14.3.3.1.6 Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

The Corine Land Cover 2018 classifies the land use within the study area east of the M50 Motorway to the junction of Naas Road and Nangor Road as industrial or commercial units. From Naas Road to just west of Walkinstown Road the land use is classified as industrial or commercial units before again becoming discontinuous urban fabric.

The OSI 6-inch mapping shows that the area within this section of the study area comprises predominantly agricultural land with scattered residential and industrial development. Drimnagh Castle is shown at the eastern end of the study area, with a Paper Mill recorded approximately 140m to the north. Drimnagh Lodge is recorded at the eastern end of the existing R134 Nangor Road and Killeen Paper Mills are recorded to the north-west of the R134 Nangor Road / Killeen Road junction. A Glue Manufactory building is also recorded approximately 30m to the north of the study area at Fox and Geese, south and adjacent to the Grand Canal.

The OSI 25-inch mapping shows some subsequent development within the study area. A building described as the Halfway House is recorded immediately to the south-west of the existing R110 Long Mile Road / R819 Walkinstown Road junction. The Paper Mill to the north of Drimnagh Castle shows some minor signs of development and is now recorded as Drimnagh Paper Mill. Some minor development is also recorded at Killeen Paper Mills. The Glue Manufactory at Fox and Geese is no longer shown. However, an unnamed building is still recorded at this location.

Two additional watercourses are recorded as crossing the Proposed Scheme: an unnamed watercourse flowing north at the existing R110 Long Mile Road / R819 Walkinstown Road junction and an unnamed watercourse, also flowing north, approximately 500m to the south-west of the existing R810 Naas Road / R112 and Walkinstown Avenue junction. This second watercourse is then recorded as heading north-west and running adjacent to the existing R810 Naas Road for approximately 200m. The river is now recorded as the Cammock River and shown to flow east toward the Killeen Paper Mills, and a Lock and Water Works are recorded further to the north at the Grand Canal. The area in the vicinity of the three gravel pits previously recorded to the west and south-west of the existing R110 Long Mile Road / R112 Walkinstown Road junction is now recorded as one large gravel pit of approximately 17,000m^2.

Again, some further development is shown within the study area on the OSI 6-inch Cassini mapping. Development is recorded to the south-east of Drimnagh Castle, including residential buildings, a Gown Factory and Lansdowne Park. The area to the west of the existing R810 Naas Road / R112 Walkinstown Avenue junction also shows signs of development, including St. Gillian's School, and significant road widening to the north-east. Power lines (38kV and 110kV) are recorded as crossing the route of the Proposed Scheme, approximately 200m and 500m to the south-west of Drimnagh Castle.

Four additional unnamed watercourses are recorded flowing north on the north side of the Proposed Scheme between the R110 Long Mile Road / R819 Walkinstown Road junction and the R810 Naas Road / R112 Walkinstown Avenue junction. The western-most of these watercourses is recorded as crossing the route of the Proposed Scheme twice where it follows the existing R112 Walkinstown Avenue. All four of the watercourses are marked 'Rises'. The area to the north of the Mill Dam and south of the Grand Canal is now recorded as liable to floods. A gravel pit is recorded to the south-east of St Gillian's School to the west of the existing R810 Naas Road / R112 Walkinstown Avenue junction. The large gravel pit to the south-west of the existing R110 Long Mile Road / R112 Walkinstown Road junction is now recorded as rough pasture, having likely been infilled.

It should be noted that the OSI 1995 aerial photography imagery is in black and white and of poor resolution. However, significant development is recorded throughout the study area in this imagery, comprising numerous commercial and industrial buildings of varying sizes. The 38kV and 110kV powerlines previously recorded to the south-west of Drimnagh Castle are no longer visible, and neither is Drimnagh Lodge. Significant change to the road network throughout the study area is recorded, including the dualling of the R110 Long Mile Road and R810 Naas Road, along with the construction of a new section of the R112 Walkinstown Avenue to the north.

The four watercourses previously recorded between the R110 Long Mile Road / R819 Walkinstown Road junction and the R810 Naas Road / R112 Walkinstown Avenue junction are no longer visible, with the area now comprising numerous commercial and industrial buildings. Of the three other watercourses recorded as crossing the route of the Proposed Scheme, only the Camac River and the unnamed watercourse to the south-west of the R810 Naas Road / R112 Walkinstown Avenue junction are visible. Both of these watercourses appear to have been culverted beneath the route of the Proposed Scheme. The unnamed watercourse previously recorded at the R110 Long Mile Road / R819 Walkinstown Road junction is no longer visible. However, a section is visible approximately 120m to the north, indicating that this watercourse has likely also been culverted beneath the study area.

The 2005 OSI aerial photography imagery shows some minor development throughout the study area. However, the layout of the buildings remains relatively unchanged, with the only significant development being ongoing construction of a residential complex at the western end of the study area. The Luas Red Line light rail line is now recorded as running east along the R810 and R110 Naas Road, coinciding with the route of the Proposed Scheme between Walkinstown Avenue and Nangor Road, and appears to include some realignment works at the R134 Nangor Road / R110 Long Mile Road junction. A new junction is also recorded on the R134 Nangor Road, directly to the north of Willow Road.

The 2019 Google Maps aerial imagery shows no significant development of the land within the study area. Development along both sides of the Proposed Scheme on the R110 Long Mile Road is recorded as predominantly commercial, with two school buildings recorded to the south of Drimnagh Castle.

Further to the west, along the R112 Walkinstown Avenue and the R810 Naas Road, the area surrounding the site is shown to predominantly comprise vehicle distribution depots and car showrooms. To the north of the R810 Naas Road, the study area is shown to comprise various commercial and industrial buildings, including a large brewery depot to the east. There are two petrol stations recorded along the route of the Proposed Scheme, one on the R112 Walkinstown Avenue and another on the R810 Naas Road.

14.3.3.2 Geomorphology and Topography

The geomorphology and topography are 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 Tallaght to Ballymount

The route of the Proposed Scheme begins at the junction of Blessington Road / Cookstown Way which is at approximately 100mOD and falls gradually to approximately 90mOD at the junction at Greenhills Road. The Tymon River runs parallel to the Proposed Scheme through the grounds of TUD Tallaght. There are some areas of hummocky sands and gravels to the south of the study area. As the Proposed Scheme travels north towards the M50 Motorway, the topography falls from 90mOD to 70mOD.

14.3.3.2.2 Ballymount to Crumlin

The route of the Proposed Scheme remains at approximately 70mOD along Greenhills Road until the proposed new intersection of Greenhills Road and Calmount Avenue, where it then falls relatively steeply to 50mOD at Walkinstown Roundabout.

However, the topography immediately either side of Greenhills Road from the junction with Ballymount Road to the junction with the industrial estate to the east of Greenhills Road steeply falls to between 60mOD and 70mOD due to historic quarrying of the sands and gravels. Greenhills Road sits proud of the surrounding area on steep slopes. The sections of the Proposed Scheme that will travel along Calmount Road are therefore at a lower level than the Greenhills Road.

This historic quarrying is associated with the significant geomorphological features of the hummocky sands and gravels in this part of the study area and most notably, the Proposed Scheme intersects the Greenhills Esker immediately to the south of the M50 Motorway.

The Proposed Scheme crosses the Tymon River just north of TUD Tallaght.

14.3.3.2.3 Crumlin to Grand Canal

The topography of the study area remains relatively flat, falling gradually to the north, and reaching approximately 40mOD at the junction of Crumlin Road with Rafters Lane / Raphoe Road and the junction of Kildare Road and Clonard Road. The ground level is between 20mOD and 30mOD when this section of the study area terminates at the Grand Canal. The only mapped geomorphological feature mapped within this section of the study area is a small area of hummocky sands and gravels to the north of the Grand Canal at the junction of South Circular Road and Donore Avenue. According to 'The Rivers of Dublin' (Sweeney 2020), the Proposed Scheme will intersect with some historic culverted, possibly abandoned watercourses, between the junction of Clogher Road and Rutland Avenue and the Grand Canal.

14.3.3.2.4 Grand Canal to Christchurch

The topography within the study area gradually falls from between 20mOD and 30mOD at Dolphin Road to just above 10mOD at Christchurch Place. The topography drops steeply down Winetavern Street to less than 10mOD where the Proposed Scheme will finish at the junction of Winetavern Street and Christchurch Place.

The geomorphology of the study area comprises mega scale glacial lineation's, meltwater channels and deglacial landforms as seen on Figure 14.7 in Volume 3 of this EIAR.

14.3.3.2.5 Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

This section of the Proposed Scheme will begin at Woodford Walk, which according to the OSI 10m contours, is at an elevation between 50mOD and 60mOD. The topography along the Proposed Scheme gradually falls to approximately 50mOD at the roundabout between the M50 Motorway and the junction of Park West Avenue and Nangor Road and continues to fall slightly towards the Naas Road. The junction of Naas Road and Nangor Road is between 40mOD and 50mOD.

The Proposed Scheme will run along the Grand Canal at first and then runs parallel with the River Camac and its tributaries, crossing the river at the junction of Park West Avenue and Nangor Road.

Where the route of the Proposed Scheme will approach the junction with Naas Road, the east of the study area intersects a small area of hummocky sand and gravel.

14.3.3.2.6 Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

The route of the Proposed Scheme will continue to remain relatively flat, remaining between 40mOD and 50mOD up to Walkinstown Road, crossing a tributary of River Camac just east of the junction of Naas Road and Nangor Road.

The study area intersects the same area of hummocky sand and gravel to the north of the Naas Road at the start of a glacial meltwater channel associated with the Camac River. It also intersects hummocky sands and gravels to the south of the Long Mile Road under an area of sports pitches.

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 hard standing materials including road pavements and footways. 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 (Teagasc *et al*. 2017) are presented on Figure 14.8 in Volume 3 of this EIAR and are listed in Table 14.16, 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 Tallaght to Ballymount

From the junction of Blessington Road / Cookstown Way to the junction of the Proposed Scheme with Belgard Road (R113), the study area is underlain by made ground. From the junction of the Proposed Scheme with Belgard Road (R113) to the junction of the Proposed Scheme with Greenhills Road, the study area is underlain by a mixture of topsoil (BminDW and BminPD) and made ground as it passes through TUD Tallaght. There is some alluvium associated with the River Dodder to the south of the study area.

14.3.3.3.2 Ballymount to Crumlin

The start of this section of the study area at the M50 motorway is underlain predominately by topsoil (BminSW, BminDW and BminPD). The remaining section of the study area is underlain by made ground from the junction near Calmount Avenue to Crumlin with exception of a small area of topsoil (BminPD) noted along Bunting Road.

14.3.3.3.3 Crumlin to Grand Canal

The study area from Crumlin to Grand Canal is predominately underlain by made ground. There are areas of topsoil associated with various green areas such as a green between Bunting Road and Somerville Avenue (BminPD), the football pitches (BminSW, BminDW and BminPD) to the north of Crumlin Road between Benbulbin Road and Brickfield Drive, the pitches and allotments between Sundrive Road and Rutland Avenue (BminSW, BminDW and BminPD) and Eammon Ceannt Park (BminSW) to the south-west of the study area.

14.3.3.3.4 Grand Canal to Christchurch

The study area from Grand Canal to Christchurch is underlain by made ground.

14.3.3.3.5 Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

The underlying soils within the study area from Woodford Walk to the M50 Motorway are classified as made ground, with the exception of a small amount of alluvium and topsoil BminPD and BminDW along the Grand Canal. From the M50 Motorway to the junction of Nangor Road and Park West Avenue, the Proposed Scheme is underlain by alluvium associated with the canal and the River Camac. The underlying soils to the north and south of the study area are predominantly topsoil (BminDW and BminPD). From the junction of Nangor Road to Park West Avenue, the underlying soils within the study area are predominately made ground with the section of some small pockets of topsoil.

14.3.3.3.6 Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

The Proposed Scheme from Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh is underlain by made ground. There are some pockets of topsoil (BminSW, BminDW and BminPD) and alluvium associated with the River Camac on the outer edges of the study area. There is a small pocket of topsoil (BminSW) intersected by the Proposed Scheme on the Naas Road.

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	Widespread	Low	Poorly drained and / or low fertility soils
Alluvium - AlluvMIN	Typically found along current and historic watercourses	Typically found along current and historic watercourses	Medium	Moderately drained and / or moderate fertility soils
Topsoil - BminSW	Shallow well drained (Mainly basic) – River Camac, Greenhills Esker, Sundrive Road and Rutland Avenue	River Camac, Greenhills Esker, Sundrive Road and Rutland Avenue	High	Well drained and / or high fertility soils
Topsoil - BminDW	Deep well drained (Mainly basic) - Greenhills Esker from Castletymon Road to where the Calmount Road, Sundrive Road and Rutland Avenue	Greenhills Esker from Castletymon Road to where the Calmount Road, Sundrive Road and Rutland Avenue	High	Well drained and / or high fertility soils
Topsoil - BminPD	Poorly drained (Mainly Basic) - Greenhills Esker from Castletymon Road to where the Calmount Road, Sundrive Road and Rutland Avenue	Greenhills Esker from Castletymon Road to where the Calmount Road, Sundrive Road and Rutland Avenue	Low	Poorly drained and / or low 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 Tallaght to Ballymount

The subsoils encountered within the study area for this section of the Proposed Scheme are predominately glacial tills derived from limestone There is alluvium and gravels associated with the River Dodder to the south of the study area and some alluvium associated with the River Tymon to the east of the study area.

14.3.3.4.2 Ballymount to Crumlin

The subsoils underlying this section of the study area are predominantly gravels derived from limestone from the M50 motorway as far as the Walkinstown Roundabout. There are sections of shallow bedrock along Calmount Avenue and west of Greenhills associated with the historic quarrying in the area. The remaining sections of the study area are underlain by tills derived by limestones. The Proposed Scheme will then intersect the Greenhills Esker which runs south and parallel to the M50 Motorway and comprises gravels.

14.3.3.4.3 Crumlin to Grand Canal

The study area for this section of the Proposed Scheme is predominantly underlain by glacial tills derived from limestone with the exception of some areas of shallow bedrock near Brickfield Drive, Sundrive Road and Eammon Ceannt Park.

14.3.3.4.4 Grand Canal to Christchurch

The beginning of this section of the study area is underlain by glacial till derived from limestone until just east of the junction of Cork Street and Donore Road, with the exception of a small area of gravels to the south-west on the South Circular Road. From just east of Donore Road, the study area is underlain by either made ground (urban) or gravels to the north and glacial till to the south of Saint Luke's Avenue. There is a small section of alluvium and gravels as the Proposed Scheme turns north on Patrick's Street. The remainder of the study area is underlain by made ground (urban) with the exception of some pockets of alluvium and till along the River Liffey.

14.3.3.4.5 Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

The subsoils encountered within the study area for this section of the Proposed Scheme are glacial tills derived from limestone to the south, alluvium associated with the Grand Canal and River Camac and made ground (urban) to the north.

14.3.3.4.6 Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

The subsoils encountered within the study area for this section of the Proposed Scheme are predominately glacial tills derived from limestone. There are gravel and made ground (urban) deposits east of the Nangor Road / Naas Road junction to the R112 Kylemore Road. There is a small area of shallow bedrock on the Naas 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	Widespread	Low	Low value on a local scale
Alluvium - A	Typically found along current and historic watercourses	Typically found along current and historic watercourses	Low	Low value on a local scale
Glacial gravels - GLs	Gravels derived from limestones	Greenhills road to Walkinstown Roundabout	Low	Low value on a local scale
Glacial till - TLs	Till derived from limestones - widespread	Widespread	Low	Low value on a local scale
Rock - Rck	Bedrock outcrop or subcrop - near Brickfield Drive, Sundrive Road and Eammon Ceannt Park.	Near Brickfield Drive, Sundrive Road and Eammon Ceannt Park.	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.

The bedrock encountered within the study area for the Proposed Scheme comprises the Lucan Formation (locally known as Calp Limestone). Bedrock outcrops or subcrops appear in a number of discrete locations, as follows:

- Greenhills Road and Calmount Road area;
- Brickfields, Pearse College and Eammon Ceannt Park in the Crumlin area; and
- North of the junction of Nangor Road and Naas Road.

No major structural bedrock features were identified within the study area.

Table 14.18: Rock Formations Within the Study Area

Formation	Description	Location	Importance	Justification for Importance Rating
Lucan	(Calp) Dark limestone and shale – Carboniferous - widespread	Widespread	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 are presented in Table 14.19 to Table 14.24.

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.

Table 14.19: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Tallaght to Ballymount Section

Strata	General Extent / Location	Top of Strata (mBGL)	Thickness Range (m)
Topsoil	Green areas – including parks, large estates and golf courses	0	0.2 – 0.4
Made Ground	Throughout	0	0.3 – 1.1
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	0.2 – 0.6	5.3
Bedrock	Widespread	5.4	Not proven

Table 14.20: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Ballymount to Crumlin Section

Strata	General Extent / Location	Top of Strata (mBGL)	Thickness Range (m)
Topsoil	Greenhills Road	0	0.10 to 0.60
Made Ground	Greenhills Road	0	0.4 to 6.5
Sands and Gravels	Greenhills Road from M50 to Walkinstown Roundabout	0.4 to 4.8	2.7 to 6.4
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Greenhills Road	0.2 to 0.5	0.2 to 8.0
Bedrock	Greenhills Road	10.5 to 13.05	not proven

Table 14.21: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Crumlin to Grand Canal Section

Strata	General Extent / Location	Top of Strata (mBGL)	Thickness Range (m)
Topsoil	Green areas – including parks, large estates and golf courses	0	0.2 - 0.3
Made Ground	Throughout	0	0.6 – 5.5
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	0.6 – 1.6	2.4 – 3.3
Bedrock	Widespread	4.0 - 5.5	Not Proven

Table 14.22: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Grand Canal to Christchurch Section

Strata	General Extent / Location	Top of Strata (mBGL)	Thickness Range (m)
Made Ground	Throughout	0	1.2 – 3.6

Strata	General Extent / Location	Top of Strata (mBGL)	Thickness Range (m)
Alluvial Deposits	Watercourses	1.2	2.3
Gravels	Cork Street	2.7 – 5.8	Not proven
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	1.5 – 1.8	2.9 – 12.6
Bedrock	Widespread	5.1 – 14.1	Not proven

Table 14.23: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

Strata	General Extent / Location	Top of Strata (mBGL)	Thickness of Strata (m)
Made Ground	Junction of the Long Mile Road and the Naas Road	0	0.6 to 1.2
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Junction of the Long Mile Road and the Naas Road	0.6 to 1.2	1.3 to 4.8
Bedrock	Junction of the Long Mile Road and the Naas Road	4.3 to 5.5	Not proven

Table 14.24: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme Along the Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

Strata	General Extent / Location	Top of Strata (mBGL)	Thickness Range (m)
Made Ground	Throughout	0 to 0.8	0 to 0.8
Sands	Longmile Road	1.9 to 5.1	0 to 3.2
Glacial Till (Brown and Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread	0.8 to 7	N/A
Bedrock	Widespread	Not Proven	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 geology of the region not being known to contain karst features 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 14.25 along with their importance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a).

Table 14.25: Soft Soils Within the Study Area

Feature	Description	Location	Importance	Justification for Importance Rating
Alluvium - AlluvMIN (soils) / A (subsoils)	Typically found along current and historic watercourses	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); 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 14.26 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 at depths ranging from 0.5 to 2.0m 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 not detected in any of the recorded results during the scheme specific GI carried out by Causeway Geotechnical; and
- 9 no. samples were classified as non-hazardous based on limited information as no waste acceptance categorisation was carried out. Further testing is required.

Table 14.26: Summary of Potential Sources of Contaminated Land Adjacent to the Proposed Scheme

Feature	Description	Location	Importance	Justification for Importance Rating
Graveyard	Graveyard (6-inch OSI Mapping)	Blessington Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Old Castle / Pond / Dispensary	Old Castle (6-inch OSI Mapping)	Greenhills Road, Tallaght	Medium	Degree or extent of soil contamination is moderate on a local scale
Service Station (walkover) - Greenhills Road	Considering the underlying soils are highly permeable in the area, the risk of any petrol or diesel spills filtering to under the road are greater.	Greenhills Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Numerous extensive gravel pits and quarries	Greenhills / Calmount Quarries (6-inch OSI Mapping)	Calmount Road / Greenhills Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Several potentially contaminating industries on Greenhills Road between the M50	Industrial (Walkover)	Greenhills Road	Medium	Degree or extent of soil contamination is moderate on a local scale

Feature	Description	Location	Importance	Justification for Importance Rating
Motorway and Walkinstown Roundabout				
Rutland Mills	Industrial (6-inch OSI Mapping)	Rutland Road / Clogher Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Brick works	Industrial (25-inch OSI Mapping)	Crumlin	Medium	Degree or extent of soil contamination is moderate on a local scale
Old Harbour backfilled at north-east corner of the bridge	Backfill (6-inch OSI Mapping)	Dolphin's Barn Bridge	Medium	Degree or extent of soil contamination is moderate on a local scale
Contaminated soils from recent Site Investigations	9 no. samples were classified as non-hazardous based on limited information as no waste acceptance categorisation was carried out. Further testing is required.	Various	Medium	Degree or extent of soil contamination is moderate on a local scale.
Glue Manufactory	Industrial (6-inch OSI Mapping)	Nangor Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Gravel Pit	Quarry (6-inch OSI Mapping)	Long Mile Road	Medium	Degree or extent of soil contamination is moderate on a local scale

A summary of the facilities within the study area along with their importance as determined by the NRA Guidelines Box 4.1 (NRA 2008a) is presented in Table 14.27.

Table 14.27: List of EPA Licensed Facilities Within the Study Area

Name	Description	Location	Importance	Justification for Importance Rating
The Adelaide and Meath Hospital, Dublin	IE - Licensed	Tallaght, Dublin 24., Dublin	Medium	Light industrial usage
INX International Ink Company Limited	IPC - Licensed	50 Cookstown Industrial Estate, Tallaght, Dublin 24, Dublin, 24	Medium	Light industrial usage
Microprint	IPC - Licensed	Airton Industrial Estate, Airton Road, Tallaght, Dublin 24, Dublin	Medium	Light industrial usage
Bimeda Animal Health Limited	IPC - Licensed	Airton Close, Tallaght, Dublin 24, Dublin	Medium	Light industrial usage
APW Enclosures Limited	IE - Surrendered	Airton Road, Tallaght, Dublin 24, Dublin	Medium	Light industrial usage
Galco Steel Limited	IE - Licensed	Ballymount Road, Walkinstown, Dublin 12, Dublin	Medium	Light industrial usage
Hitech Plating	IE - Licensed	Unit D3, Ballymount Industrial Estate, Walkinstown, Dublin 12, Dublin	Medium	Light industrial usage
Irish Printed Circuits Limited	IPC - Licensed	Block B. Unit E, Ballymount Drive, Walkinstown, Dublin 12, Dublin	Medium	Light industrial usage
CCM Limited T/A Kenn Truss	IPC - Surrendered	Greenhills Road, Walkinstown, Dublin 12, Dublin	Medium	Light industrial usage
Plateco ZN Limited	IPC - Licensed	Mulcahy Keane Estate, Dublin 12, Dublin	Medium	Light industrial usage
Our Lady's Hospital for Sick Children	IE - Licensed	Cooley Road, Crumlin, Dublin 12, Dublin	Medium	Light industrial usage
B.G. Flexible Packaging Limited.	IE - Licensed	South Circular Road, Dolphin's Barn, Dublin 8, Dublin	Medium	Light industrial usage
R and A Bailey and Company	IE - Licensed	Nangor House, Nangor Road, Western Estate, Dublin	Medium	Light industrial usage

Name	Description	Location	Importance	Justification for Importance Rating
Packaging Inks and Coatings	IE - Surrendered	Unit 5 Western Industrial Estate, Naas Road, Dublin 12, Dublin	Medium	Light industrial usage
Sun Chemical Inks Ltd.	IE - Licensed	John F. Kennedy Drive, Bluebell, Dublin 12, Dublin	Medium	Light industrial usage
BOC Gases Ireland Limited	IE - Licensed	P.O. Box 201, Bluebell, Dublin 12, Dublin	Medium	Light industrial usage
Heaton Buckley Limited (Dublin)	IPC - Licensed	Robinhood Industrial Estate, Robinhood Road, Off Longmile Road, Dublin	Medium	Light industrial usage
Sherwin-Williams (Ireland) Limited	IPC - Licensed	53 Robinhood Industrial Estate, Dublin 22, Dublin	Medium	Light industrial usage

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 two non-metallic mineral locations within the study area.

14.3.3.10.1 Tallaght to Ballymount

The crushed rock aggregate potential is generally low to the south and north this section of the study area and moderate in the middle.

The alluvium and gravels to the south-east of the study area associated with the River Dodder have a granular aggregate potential of low (alluvium) to very high (gravels).

14.3.3.10.2 Ballymount to Crumlin

The crushed rock aggregate potential for the study area is generally moderate at the M50 with areas of high to very high potential noted around Calmount Road.

There is a small section of very low granular aggregate potential associated with the deposits along the River Tymon at the start of this section. The gravels underlying most of the study area associated with the Greenhills Esker and the areas of quarrying on Greenhills and Calmount Road predominantly have a very high aggregate potential with some areas of low to high.

14.3.3.10.3 Crumlin to Grand Canal

The crushed rock aggregate potential is moderate from Walkinstown Roundabout to approximately the junction of Crumlin Road / Kildare Road and Bangor Road where the potential increases to predominately high along the Proposed Scheme, with some section of very high within the study area. The potential remains at high along Crumlin Road to Dolphin Road but decreases to moderate at approximately the junction of Clogher Road and Rutland Road.

There are no areas of potential granular aggregate within this section of the study area. However, there is one non-metallic locality at Brickfield Drive, the site of a former clay brick pit.

14.3.3.10.4 Grand Canal to Christchurch

The crushed rock aggregate potential is predominately moderate for this section of the study area. However, there are sections of Cork Street and Nicolas Street with low potential. There are small pockets of high to very high potential near the South Circular Road, Dublin Castle and Winetavern Street.

The gravels within this section of the study area, predominately on Cork Street, at the junction with Patrick's Street and Winetavern Street, have a granular aggregate potential of very low to high. There is one non-metallic mineral location in Dolphin House, a former clay brick works.

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 14.28 along with their importance as determined by the Box 4.1 of the NRA Guidelines (NRA 2008a).

14.3.3.10.5 Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

The crushed rock aggregate potential along this section of the study area is typically moderate with sections of high at the start of route before the M50 Motorway and high to very high to the east of the junction of Naas Road and Nangor Road.

The alluvium and gravels associated with the Grand Canal and River Camac where the Proposed Scheme will cross the M50 Motorway have a granular aggregate potential of very low. Additionally, the gravels to the east of the junction of Naas Road and Nangor Road have a granular aggregate potential of low.

14.3.3.10.6 Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

The crushed rock aggregate potential along this section of the study area is moderate, except for some sections of high to very high on the Naas Road and Long Mile Road before Kylemore Road.

There is an area of gravels to the east of the junction of Naas Road and Nangor Road with low granular aggregate potential, and areas of high to very high aggregate potential between the junction of Naas Road and Nangor Road and Kylemore Road.

Table 14.28: GSI Aggregate Potential for the Study Area

GSI Aggregate Potential Type	Potential	Location	Importance	Justification for Importance Rating
Crushed rock aggregate potential	Moderate potential – Walkinstown Roundabout	Walkinstown Roundabout	Medium	Sub-economic extractable mineral resource
Crushed rock aggregate potential	Low potential – Cork Street, Nicholas Street	Cork Street, Nicholas Street	Low	Uneconomically extractable mineral resource
Crushed rock aggregate potential	High potential - South Circular Road, Dublin Castle and Winetavern Street	South Circular Road, Dublin Castle and Winetavern Street	Medium	Extractable mineral resource
Crushed rock aggregate potential	Very high potential - South Circular Road, Dublin Castle and Winetavern Street	South Circular Road, Dublin Castle and Winetavern Street	High	Marginally extractable mineral resource
Granular aggregate potential	Very low potential - at the junction with Patrick's Street and	At the junction with Patrick's Street and Winetavern Street, River Tymon, River Dodder	Low	Uneconomically extractable mineral resource

GSI Aggregate Potential Type	Potential	Location	Importance	Justification for Importance Rating
	Winetavern Street, River Tymon, River Dodder			
Granular aggregate potential	Low potential - at the junction with Patrick's Street and Winetavern Street, River Dodder	At the junction with Patrick's Street and Winetavern Street, River Dodder	Low	Uneconomically extractable mineral resource
Granular aggregate potential	Moderate potential - at the junction with Patrick's Street and Winetavern Street, River Dodder	At the junction with Patrick's Street and Winetavern Street, River Dodder	Medium	Sub-economic extractable mineral resource
Granular aggregate potential	High potential - at the junction with Patrick's Street and Winetavern Street, River Dodder	At the junction with Patrick's Street and Winetavern Street, River Dodder	Medium	Extractable mineral resource
Granular aggregate potential	Very high potential - at the junction with Patrick's Street and Winetavern Street, River Dodder	At the junction with Patrick's Street and Winetavern Street, River Dodder	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 in Volume 3 of this EIAR and detailed in Table 14.29, along with their importance as determined by the NRA Guidelines Box 4.1 (NRA 2008a).

Table 14.29: Geological Heritage Areas

Name (Code)	Description	Importance	Justification for Importance Rating
Greenhills Esker (SD005)	The Greenhills esker includes a large accumulation of sands and gravels	High	Geological feature of high value on a local scale (CGS)
Dublin City Walls (DC002)	Three remaining sections of the medieval city walls of Dublin City	High	Geological feature of high value on a local scale (CGS)
River Poddle (DC011)	A river which flows northwards through Dublin City. Most of its course is diverted underground	High	Geological feature of high value on a local scale (CGS)

14.3.3.12 Aquifer Type and Classification

The GSI Bedrock Aquifer mapping (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 14.30 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 14.30: Aquifer Types Within the Study Area

Aquifer Type	Description	Location	Importance	Justification for Importance Rating
Locally Important Aquifer	Bedrock which is moderately productive only in local zones (Ll) - widespread	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 Tallaght to Ballymount

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges from low to moderate.

14.3.3.13.2 Ballymount to Crumlin

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges is generally moderate. The area around Calmount Road has a very high to extreme rock at surface groundwater vulnerability related to the shallow bedrock and historic quarrying.

14.3.3.13.3 Crumlin to Grand Canal

From Walkinstown Roundabout to approximately the junction of Crumlin Road and Bangor Road the ground water vulnerability of the study area is moderate. The Proposed Scheme then passes through a band of vulnerability of high to extreme rock at surface to just north of the Grand Canal which is related to the shallow and outcropping bedrock discussed previously.

14.3.3.13.4 Grand Canal to Christchurch

The groundwater vulnerability is predominately moderate in this section of the study area. However, the vulnerability is low in the Cork Street area and at Christchurch Place. There is a small section of very high to extreme rock at surface between Christchurch Place and the River Liffey.

14.3.3.13.5 Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges from moderate to extreme rock at surface (shallow rock on the Naas Road).

14.3.3.13.6 Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges from moderate to extreme rock at surface (shallow rock on the Naas Road).

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 14.31 for completeness. Features with an importance ranking of medium or higher are summarised in Table 14.32 and the impact of the Proposed Scheme on these features will be assessed in Section 14.4.

Table 14.31: 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	Widespread	Low	Poorly drained and / or low fertility soils
Soil Fertility	Topsoil - BminPD	Poorly drained (mainly basic) - Poorly drained (Mainly Basic) - Greenhills Esker from Castletymon Road to where the Calmount Road, Sundrive Road and Rutland Avenue	Greenhills Esker from Castletymon Road to Calmount Road, Sundrive Road and Rutland Avenue	Low	Poorly drained and / or low fertility soils
Subsoils quality and significance	Made Ground - Urban	Associated with urban development - widespread	Widespread	Low	Low value on a local scale
Subsoils quality and significance	Alluvium - A	Typically found along current and historic watercourses	Typically found along current and historic watercourses	Low	Low value on a local scale
Subsoils quality and significance	Glacial gravels - GLs	Gravels derived from limestones	Greenhills Road to Walkinstown Roundabout	Low	Low value on a local scale
Subsoils quality and significance	Glacial till - TLs	Till derived from limestones - widespread	Widespread	Low	Low value on a local scale
Subsoils quality and significance	Rock - Rck	Bedrock outcrop or subcrop - near Brickfield Drive, Sundrive Road and Eammon Ceannt Park.	Near Brickfield Drive, Sundrive Road and Eammon Ceannt Park.	Low	Low value on a local scale
Bedrock quality and significance	Lucan	(Calp) Dark limestone and shale -Carboniferous - widespread	Widespread	Low	Low value on a local scale
Soft Soils	Alluvium - AlluvMIN (soils) / A (subsoils)	Typically found along current and historic watercourses	Typically found along current and historic watercourses	Low	Volume of soft soil underlying the route is small and of a local scale
Economic Geology	Crushed rock aggregate potential	Low potential – Cork Street, Nicholas Street	Cork Street, Nicholas Street	Low	Uneconomically extractable mineral resource
Economic Geology	Granular aggregate potential	Very low potential - at the junction with Patrick's Street and Winetavern Street, River Tymon, River Dodder	At the junction with Patrick's Street and Winetavern Street, River Tymon, River Dodder	Low	Uneconomically extractable mineral resource
Economic Geology	Granular aggregate potential	Low potential - at the junction with Patrick's Street and Winetavern Street, River Dodder	At the junction with Patrick's Street and Winetavern Street, River Dodder	Low	Uneconomically extractable mineral resource

Table 14.32: Summary of Land, Soils, Geology and Hydrogeology Features with Medium to Extremely High Importance Within the Study Area

Category	Feature	Description	Location	Importance	Justification
Soil Fertility	Alluvium - AlluvMIN	Typically found along current and historic watercourses	Typically found along current and historic watercourses	Medium	Moderately drained and / or moderate fertility soils
Soil Fertility	Topsoil - BminSW	Shallow well drained (Mainly basic) – River Camac, Greenhills Esker, Sundrive Road and Rutland Avenue	River Camac, Greenhills Esker, Sundrive Road and Rutland Avenue	High	Well drained and / or high fertility soils
Soil Fertility	Topsoil - BminDW	Deep well drained (Mainly basic) - Greenhills Esker from Castletymon Road to where the Calmount Road, Sundrive Road and Rutland Avenue	Greenhills Esker from Castletymon Road to the Calmount Road, Sundrive Road and Rutland Avenue	High	Well drained and / or high fertility soils

Category	Feature	Description	Location	Importance	Justification
Potential Sources of Contamination	Graveyard	Graveyard (6-inch OSI Mapping) - Blessington Road	Blessington Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Old Castle / Pond / Dispensary	Old Castle (6-inch OSI Mapping) - Greenhills Road, Tallaght	Greenhills Road, Tallaght	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Service Station (walkover) - Greenhills Road	Considering the underlying soils are highly permeable in the area, the risk of any petrol or diesel spills filtering to under the road are greater	Greenhills Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Numerous extensive gravel pits and quarries	Greenhills / Calmount Quarries (6-inch OSI Mapping) - Calmount Road / Greenhills Road	Calmount Road / Greenhills Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Several potentially contaminating industries on Greenhills Road between the M50 Motorway and Walkinstown Roundabout	Industrial (Walkover) - Greenhills Road	Greenhills Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Rutland Mills	Industrial (6-inch OSI Mapping) - Rutland Road / Clogher Road	Rutland Road / Clogher Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Brick works	Industrial (25-inch OSI Mapping) - Crumlin	Crumlin	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Old Harbour backfilled at north-east corner of the bridge	Backfill (6-inch OSI Mapping) - Dolphin's Barn Bridge	Dolphin's Barn Bridge	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Glue Manufactory	Industrial (6-inch OSI Mapping) - Nangor Road	Nangor Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Gravel Pit	Quarry (6-inch OSI Mapping) - Long Mile Road	Long Mile Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Contaminated soils from recent Site Investigations	9 no. of samples were classified as non-hazardous based on limited information as no waste acceptance categorisation was carried out. Further testing is required.	Various	Medium	Degree or extent of soil contamination is moderate on a local scale.
Licenced Facility	The Adelaide and Meath Hospital, Dublin	IE - Licensed: Tallaght, Dublin 24., Dublin	Tallaght, Dublin 24., Dublin	Medium	Light industrial usage

Category	Feature	Description	Location	Importance	Justification
Licenced Facility	INX International Ink Company Limited	IPC - Licensed: 50 Cookstown Industrial Estate, Tallaght, Dublin 24, Dublin, 24	50 Cookstown Industrial Estate, Tallaght, Dublin 24, Dublin, 24	Medium	Light industrial usage
Licenced Facility	Microprint	IPC - Licensed: Airton Industrial Estate, Airton Road, Tallaght, Dublin 24, Dublin	Airton Industrial Estate, Airton Road, Tallaght, Dublin 24, Dublin	Medium	Light industrial usage
Licenced Facility	Bimeda Animal Health Limited	IPC - Licensed: Airton Close, Tallaght, Dublin 24, Dublin	Airton Close, Tallaght, Dublin 24, Dublin	Medium	Light industrial usage
Licenced Facility	APW Enclosures Limited	IE - Surrendered: Airton Road, Tallaght, Dublin 24, Dublin	Airton Road, Tallaght, Dublin 24, Dublin	Medium	Light industrial usage
Licenced Facility	Galco Steel Limited	IE - Licensed: Ballymount Road, Walkinstown, Dublin 12, Dublin	Ballymount Road, Walkinstown, Dublin 12, Dublin	Medium	Light industrial usage
Licenced Facility	Hitech Plating	IE - Licensed: Unit D3, Ballymount Industrial Estate, Walkinstown, Dublin 12, Dublin	Unit D3, Ballymount Industrial Estate, Walkinstown, Dublin 12, Dublin	Medium	Light industrial usage
Licenced Facility	Irish Printed Circuits Limited	IPC - Licensed: Block B. Unit E, Ballymount Drive, Walkinstown, Dublin 12, Dublin	Block B. Unit E, Ballymount Drive, Walkinstown, Dublin 12, Dublin	Medium	Light industrial usage
Licenced Facility	CCM Limited T/A Kenn Truss	IPC - Surrendered: GREENHILLS ROAD, WALKINSTOWN, DUBLIN 12, Dublin	Greenhills road, Walkinstown, Dublin 12, Dublin	Medium	Light industrial usage
Licenced Facility	Plateco ZN Limited	IPC - Licensed: Mulcahy Keane Estate, Dublin 12, Dublin	Mulcahy Keane Estate, Dublin 12, Dublin	Medium	Light industrial usage
Licenced Facility	Our Lady's Hospital for Sick Children	IE - Licensed: Cooley Road, Crumlin, Dublin 12, Dublin	Cooley Road, Crumlin, Dublin 12, Dublin	Medium	Light industrial usage
Licenced Facility	B.G. Flexible Packaging Limited.	IE - Licensed: South Circular Road, Dolphin's Barn, Dublin 8, Dublin	South Circular Road, Dolphin's Barn, Dublin 8, Dublin	Medium	Light industrial usage
Licenced Facility	R and A Bailey and Company	IE - Licensed: Nangor House, Nangor Road, Western Estate, Dublin	Nangor Road, Western Estate, Dublin	Medium	Light industrial usage
Licenced Facility	Packaging Inks and Coatings	IE - Surrendered: Unit 5 Western Industrial Estate, Naas Road, Dublin 12, Dublin	Unit 5 Western Industrial Estate, Naas Road, Dublin 12, Dublin	Medium	Light industrial usage
Licenced Facility	Sun Chemical Inks Ltd.	IE - Licensed: John F. Kennedy Drive, Bluebell, Dublin 12, Dublin	John F. Kennedy Drive, Bluebell, Dublin 12, Dublin	Medium	Light industrial usage
Licenced Facility	BOC Gases Ireland Limited	IE - Licensed: P.O. Box 201, Bluebell, Dublin 12, Dublin	P.O. Box 201, Bluebell, Dublin 12, Dublin	Medium	Light industrial usage

Category	Feature	Description	Location	Importance	Justification
Licenced Facility	Heaton Buckley Limited (Dublin)	IPC - Licensed: Robinhood Industrial Estate, Robinhood Road, Off Longmile Road, Dublin	Robinhood Industrial Estate, Robinhood Road, Off Longmile Road, Dublin	Medium	Light industrial usage
Licenced Facility	Sherwin-Williams (Ireland) Limited	IPC - Licensed: 53 Robinhood Industrial Estate, Dublin 22, Dublin	53 Robinhood Industrial Estate, Dublin 22, Dublin	Medium	Light industrial usage
Economic Geology	Crushed rock aggregate potential	Moderate potential – Walkinstown Roundabout	Walkinstown Roundabout	Medium	Sub-economic extractable mineral resource
Economic Geology	Crushed rock aggregate potential	High potential - South Circular Road, Dublin Castle and Winetavern Street.	South Circular Road, Dublin Castle and Winetavern Street.	Medium	Extractable mineral resource
Economic Geology	Crushed rock aggregate potential	Very high potential - South Circular Road, Dublin Castle and Winetavern Street.	South Circular Road, Dublin Castle and Winetavern Street.	High	Marginally extractable mineral resource
Economic Geology	Granular aggregate potential	Moderate potential - at the junction with Patrick's Street and Winetavern Street, River Dodder	at the junction with Patrick's Street and Winetavern Street, River Dodder	Medium	Sub-economic extractable mineral resource
Economic Geology	Granular aggregate potential	High potential - at the junction with Patrick's Street and Winetavern Street, River Dodder	at the junction with Patrick's Street and Winetavern Street, River Dodder	Medium	Extractable mineral resource
Economic Geology	Granular aggregate potential	Very high potential - at the junction with Patrick's Street and Winetavern Street, River Dodder	at the junction with Patrick's Street and Winetavern Street, River Dodder at the junction with Patrick's Street and Winetavern Street, River Dodder	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
County geological site	Greenhills Esker (SD005)	The Greenhills esker includes a large accumulation of sands and gravels	Greenhills Esker	High	Geological feature of high value on a local scale (CGS)
County geological site	Dublin City Walls (DC002)	Three remaining sections of the medieval city walls of Dublin City	Dublin City Walls	High	Geological feature of high value on a local scale (CGS)
County geological site	River Poddle (DC011)	A river which flows northwards through Dublin City. Most of its course is diverted underground	River Poddle	High	Geological feature of high value on a local scale (CGS)

14.3.5 Conceptual Site Model

A tabulated Conceptual Site Model (CSM) was developed based on all publicly available data available along with project specific data that was provided.

The Proposed Scheme is predominantly underlain by made ground over glacial till over limestone bedrock. The relevant subsections of the Proposed Scheme are presented in Table 14.33 to Table 14.38, along with the fill height (average and maximum) cut height (average and maximum) and the soils and geology at each earthwork areas.

Table 14.33: Conceptual Site Model - Tallaght to Ballymount

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max.	Avg.	Max.	Avg.			
Section 1a: Old Blessington Road / Belgard Square South junction	n/a	At Grade	0	0	0	0	Limited GI carried out. Inferred Road pavement and foundation on possible reworked boulder clay/ natural boulder clay. R9TP01 showed stiff reworked boulder clay to 2 mBGL. R9TP02 showed stiff boulder clay to 2.4 mBGL.	0.5	Localised pavement reconstruction / widening works and roundabout construction works.
Section 1b: Tallaght Bus Interchange	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	No widening works - localised junction modifications and Bus Interchange construction with access road.
Section 1c: Blessington Road	60	Fill	0	0	1.5	1	Desk study indicates made ground over glacial till.	0.5	No widening works - localised junction modifications.
Section 1d: Belgard Square West	170	At Grade	0	0	0	0	Inferred Road pavement and foundation on possible reworked boulder clay/ natural boulder clay. R9CP01 had 0.4 m of reworked boulder clay, R9CP02 had highway fill to 0.8 mBGL overlying reworked boulder clay to 1.2 mBGL. Underlying strata is glacial till.	1	No widening works - localised junction modifications.
Section 1e: Belgard Square West / Belgard Square North junction	n/a	Fill	1	0.5	1	0.5	Ground investigation indicates made ground over glacial till. Made ground consisted of "Reworked boulder clay comprising of varying amounts of red brick, wood, plastic, cloth, glass, rubber, carpet, ceramics and concrete were encountered across the chainage concentrated in R9CP05, R9TP05 and R9TP06."	2	New road construction on existing grassed area
Section 1f: Belgard Square North	320	Fill	1	0.5	4	2	Ground investigation indicates made ground. Made Ground encountered to 6.5 mBGL in R9CPGS02 at Greenhills bridge approach embankment. Desk study indicates sand and gravels tend to dominate north of M50	2	Localised pavement reconstruction/ widening works
Section 1g: Belgard Square North / Belgard Square East junction	n/a	Fill	1	0.5	1.5	1	Ground Investigation indicates made ground over glacial till. R9CP05 located at approximately A4240 had approximately 4.8 m of made ground: Soft becoming firm brown sandy gravelly clay with fragments of wood and pieces of cloth and plastic.	0.5	New road construction on existing grassed area

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max.	Avg.	Max.	Avg.			
							Overlying sand and gravels. R9TP08 had approximately 0.5 m of made ground"		
Section 1h: Belgard Square east	150	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction
Section 1i: Belgard Square East / Blessington Road Junction	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction
Section 1j: Blessington Road	70	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction
Section 1k: Belgard Road / Blessington Road junction	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction
Section 1l: Blessington Road – St. Maelruain's Church to Courthouse Square Apartments	450	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction
Section 1m: Main Road	300	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction
Section 1n: Old Greenhills Road	200	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction
Section 1o: Greenhills Road Tallaght	1750	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction. Regraded soil embankments and retaining walls.
Section 1p: Bus Route Parkview	620	Cut	0.9	0.25	0	0	Desk study indicates made ground over glacial till.	0.5	New road construction on existing grassed area. Stabilised earthworks embankments

Table 14.34: Conceptual Site Model - Ballymount to Crumlin

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max.	Avg.	Max.	Avg.			
Section 2a: Greenhills Road, Ballymount	450	Structure	No cut / fill due to existence of structure				Ground investigation indicates made ground. Made Ground encountered to 6.5 mBGL in R9CPGS02 at Greenhills bridge approach embankment. Desk study indicates sand and gravels tend to dominate north of M50	0.5	At grade road widening and pavement reconstruction. It is proposed to erect two new single span pedestrian / cycle bridges located adjacent to the existing Greenhills Bridge. The pedestrian / cycle bridges will be steel warren truss type bridges supported at each end on reinforced concrete abutments either side of the M50 motorway
Section 2b: Ballymount Avenue	450	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction At grade widening of Greenhills Road. New link road from ChA4100 to A4350 linking Greenhills Road with Ballymount Avenue. Stabilised earthworks embankments over existing embankment required. Retaining walls may also be considered at this location.
Section 2c: Calmount Road / Ballymount Avenue junction	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	New road construction on existing grassed area
Section 2d: Calmount Road	800	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction. Retaining walls (7.6m max.)
Section 2e: Greenhills Road and Calmount Avenue	120	Fill	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction. New roundabout junction.
Section 2f: Greenhills Road, Greenhills	400	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening and pavement reconstruction. Retaining walls (7.6m max.)

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max.	Avg.	Max.	Avg.			
Section 2g: Walkinstown Roundabout	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 2h: Link Road – St. Peter's Road to Greenhills Road	60	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 2i: Cromwellsfort Road	50	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 2j: Walkinstown Avenue	50	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction

Table 14.35: Conceptual Site Model - Crumlin to Grand Canal

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max.	Avg.	Max.	Avg.			
Section 3a: Walkinstown Road	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 3b Drimnagh Road	850	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 3c: Bunting Road and St Mary's Road	1,300	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction
Section 3d: Drimnagh Road / Crumlin Road / Kildare Road / St. Mary's Road Junction	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 3e: Crumlin Road	1650	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 3f: Kildare Road	1,350	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max.	Avg.	Max.	Avg.			
Section 3g: Sundrive Road Junction	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction
Section 3h: Clogher Road	1050	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction

Table 14.36: Conceptual Site Model - Grand Canal to Christchurch

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max.	Avg.	Max.	Avg.			
Section 4a: Cork Street, Dolphin's Barn Street, St. Luke's Avenue	1550	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 4b: Dean Street	150	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction
Section 4c: Patrick Street / Kevin Street Upper / New Street South / Dean Street Junction	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 4d: Patrick Street and Nicholas Street	350	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction
Section 4e: Christchurch Cathedral / Nicholas Street junction	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	At grade road widening & localised pavement reconstruction

Table 14.37: Conceptual Site Model - Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Section 5a: New Nangor Road	2,100	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction/ widening works and new road construction on existing grassed area

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Section 5b: Naas Road / Long Mile Road junction	n/a	Structure and At Grade	0	0	0	0	Four boreholes carried out. All encountered paving brick at ground level. Beneath this were both bitmac and concrete of varying thickness likely representing old road surfaces; overlying boulder clay. Limestone rockhead was encountered at depths ranging from 4.50m in R8-CPGS01- R8-CPGS03 to 6.00m in R8-CPGS04. 6.3 Groundwater" Desk study indicates made ground over glacial till.	0.5	The proposed pedestrian and cycle bridge at the Naas Road / New Nangor Road / Long Mile Road junction will also span the LUAS Red Line. The bridge shall be a fully through warren truss type structure. Retaining walls at ramps. Localised pavement reconstruction / widening works and junction modification works.

Table 14.38: Conceptual Site Model – Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max.	Avg.	Max.	Avg.			
Section 6a: Naas Road	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction / widening works and junction modification works.
Section 6b: Naas Road / Walkinstown Avenue Junction	600	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction / widening works and junction modification works.
Section 6c: Walkinstown Avenue	350	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction / widening works and junction modification works.
Section 6d: Walkinstown Avenue / Long Mile Road junction	n/a	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction / widening works and junction modification works.
Section 6e: Long Mile Road	750	At Grade	0	0	0	0	Desk study indicates made ground over glacial till.	0.5	Localised pavement reconstruction / widening works and junction modification works.

14.3.5.1 Environment Type

The environment across the study area has been categorised in accordance with the IGI Guidelines. 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 is presented in Section 14.6.

14.4.1 Characteristics of the Proposed Scheme

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 in Appendix A5.1 in Volume 4 of this EIAR.

14.4.1.1 Tallaght to Ballymount

Works occurring along the Proposed Scheme between Tallaght and Ballymount that are of relevance to land, soils, geology and hydrogeology include:

- The carriageway and pavement will be resurfaced and reconstructed to provide for new alignments;
- Construction of bus interchange building near Belgard Square West;
- Vegetation clearance and landscaping will be completed along the existing verges and roundabouts;
- Landscaping will be completed along the existing Blessington Road central island and verges on Belgard Road and Greenhills Road;
- New full depth construction for bus route and cycle track at Parkview / Treepark Road;
- Landscaping and SUDs features will be completed at Parkview / Treepark Road / Greenhills Road;
- Pavement build up for cycle track at varying levels; and
- Some utility diversions and / or protections are likely to be required.

Construction Compounds will be located at the western end of Old Blessington Road, adjacent to the junction with the N81 Tallaght bypass, at R819 Greenhills Road, immediately south of the junction of Bancroft Park and R819 Greenhills Road, at R819 Greenhills Road, between Birchview Avenue and R819 Greenhills Road, at R819 Greenhills Road, between Treepark Road and R819 Greenhills Road, and at R819 Greenhills Road, to the north of Tymon Lane, south-east of the M50 Motorway.

14.4.1.1 Ballymount to Crumlin

Works occurring along the Proposed Scheme between Ballymount and Crumlin that are of relevance to land, soils, geology and hydrogeology include:

- Vegetation clearance and landscaping will be completed along the existing verge to facilitate carriageway widening and Non-Motorised User (NMU) facilities;
- The carriageway and pavement will be resurfaced and reconstructed to provide for new alignments;
- New full depth construction for three link roads carriageway, a roundabout and new priority junction;
- Two new single span pedestrian / cycle bridges will be constructed either side of the existing Greenhills Road M50 overbridge;
- Carriageway widening to accommodate bus lanes and cycle tracks – Ballymount Avenue and Calmount Road and for bus stop layby on Greenhills Road;
- Protection of existing 1200 diameter Watermain – Calmount Road;
- Vegetation clearance and landscaping along existing carriageway and new alignment to allow for carriageway widening, NMU Facilities and additional cycle tracks – Ballymount Avenue and Calmount Road;

- Access gates and bollards to be removed as part of site clearance – Calmount Road;
- Retaining walls will be constructed along the Calmount Road and retaining walls and embankments will be constructed along the Greenhill Road;
- Landscaping will be completed at Walkinstown Roundabout; and
- Some utility diversions and / or protections are likely to be required.

Construction Compounds will be located at R819 Greenhills Road, outside Tallaght Truck Dismantlers, north-east of the M50 Motorway, and at R819 Greenhills Road, between Ballymount Avenue and R819 Greenhills Road.

14.4.1.2 Crumlin to Grand Canal

Works occurring along the Proposed Scheme between the Crumlin and the Grand Canal that are of relevance to land, soils, geology and hydrogeology include:

- The carriageway and pavement will be resurfaced and reconstructed, to provide for new alignments;
- Carriageway widening to accommodate bus lanes – Walkinstown Road;
- Carriageway widening to accommodate bus gates – Crumlin Road near Raphoe Road junction and HSE Health Centre;
- Built-outs and landscaping at Clonard Road and Bangor Drive;
- Raised tables will be constructed;
- Retaining wall constructed at Long Mile Road / Slievebloom Park Cul-de-Sac
- Landscaping will be carried out at Walkinstown Road / Drimnagh Road junction, Drimnagh Road / Kildare Street junction, Crumlin Road / Rafters Road junction, Crumlin Shopping Centre, Crumlin Road / Parnell Road junction; and
- Some utility diversions and / or protections are likely to be required.

Construction Compounds will be located at Bunting Park, along Bunting Road, at R110 Crumlin Road, immediately west of the junction of Rafter's Road and the R110 Crumlin Road, and at R110 Crumlin Road, immediately east of the junction of Rutland Avenue and the R110 Crumlin Road.

14.4.1.3 Grand Canal to Christchurch

Works occurring along the Proposed Scheme between Grand Canal and Christchurch Place that are of relevance to land, soils, geology and hydrogeology include:

- The carriageway and pavement will be resurfaced and reconstructed to provide for new alignments;
- Landscaping along existing carriageway medians and verges;
- Raised tables will be constructed;
- Consideration of proposed Dolphin's Barn Public Realm Improvement Plan at Dolphin's Barn / South Circular Road junction:
- A new junction arrangement – Junction at Patrick Street / Kevin Street Upper / New Street South / Dean Street, Nicholas Street / Christchurch Place; and
- Some utility diversions and / or protections are likely to be required.

A Construction Compound will be located at Dean Street / R137 Patrick Street.

14.4.1.4 Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction

Works occurring along the Proposed Scheme between Woodford Walk (R113) / New Nangor Road (R134) to Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction that are of relevance to land, soils, geology and hydrogeology include:

- The existing carriageway will be realigned and resurfaced, and cycle tracks will be implemented. The existing footway north of the New Nangor Road will be converted to a cycle track, between Woodford Walk junction and east of the M50 overbridge;

- New full depth carriageway will be constructed for junctions, cycle tracks, footways and carriageway widening;
- Vegetation clearance along existing verges, in particular to facilitate cycleway connections between the Grand Canal Greenway and New Nangor Road;
- Landscaping and SUDs features along existing carriageway medians and verges;
- The River Cammock culvert will be modified at the Oak Road/New Nangor Road junction;
- New traffic signal gantry will be constructed at the New Nangor Road / Naas Road junction;
- A pedestrian and cycle bridge at the Naas Road / Nangor Road / Long Mile Road junction and spanning the Luas Red Line will be constructed with bridge piers and associated retaining walls;
- Retaining walls on New Nangor Road at Western Industrial Estate, Harris Group buildings and green space opposite; and
- Utility diversions and / or protections are likely to be required.

A Construction Compound will be located between R134 New Nangor Road and Killeen Road.

14.4.1.5 Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh

Works occurring along the Proposed Scheme between the Long Mile Road (R110) / Naas Road (R810) / New Nangor Road (R134) junction to Drimnagh that are of relevance to land, soils, geology and hydrogeology include:

- New full depth carriageway will be constructed for cycle tracks, footways and carriageway widening;
- Vegetation clearance and landscaping will be completed along the existing medians and verges to facilitate carriageway and footway widening and NMU facilities;
- New retaining wall will be constructed to accommodate the widened footway –Naas Road / Walkinstown Avenue junction;
- The John F Kennedy Drive / Old Naas Road left turn onto the Naas Road will be removed;
- New cycle tracks will be constructed on both sides of the carriageway – Naas Road, Walkinstown Avenue, Long Mile Road; and
- Some utility diversions and / or protections are likely to be required.

A Construction Compound will be located at R110 Long Mile Road, south of the New Nangor Road / Naas Road / Long Mile Road junction.

14.4.1.6 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 the following Sections.

14.4.2 'Do Nothing' Scenario

In Do Nothing scenario the Proposed Scheme would not to be implemented and there would be no resulting impacts on land, soils, geology and 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 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 the land soils geology and hydrogeology as discussed below and summarised in Table 14.39.

- Loss or damage of topsoil;

- Excavation of potentially contaminated ground;
- Loss of future quarry or pit reserve;
- Loss or damage of proportion of Geological Heritage Area;
- Loss or damage of proportion of aquifer; and
- Change to the groundwater regime.

Though the magnitude of the impact may vary depending on the scale of activities and 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 or Damage of Topsoil

Topsoil is a non-renewable source 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, 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 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 encountered when establishing Construction Compounds at the western end of Old Blessington Road, adjacent to the junction with the N81 Tallaght bypass, at R819 Greenhills Road, immediately south of the junction of Bancroft Park and R819 Greenhills Road, at R819 Greenhills Road, between Birchview Avenue and R819 Greenhills Road, at R819 Greenhills Road, between Treepark Road and R819 Greenhills Road, and at R819 Greenhills Road, to the north of Tymon Lane, south-east of the M50 Motorway.

The magnitude of these impacts of the Proposed Scheme on the topsoil is small adverse as it results 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 resulting significance of this small adverse impact is Moderate/slight.

The impact of the Proposed Scheme on the alluvium is negligible. As these soils are of medium importance the resulting significance of this negligible impact is imperceptible.

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 of this chapter.

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 Land Contamination (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 14.26 and include historic quarries, service stations, a glue manufactory, a graveyard, brick works, Rutlands Mills, an old harbour and several potentially contaminating industries on Greenhills Road .

The magnitude of this impact is small adverse as it results in the excavation of a small proportion contaminated land. As the potential contaminated ground is of medium importance the resulting significance of the permanent small adverse impact is slight.

14.4.3.3 Loss of Future Quarry or Pit Reserve

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 quarries on Calmount 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 is negligible as it results in an insufficient permanent irreversible change on a local scale to affect the integrity of the land and soils above the Do-Nothing scenario. As the aggregate potential is of medium importance the resulting significance of this negligible impact is 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.

Piling works associated with the construction of the M50 overbridge may impact on the Greenhills Esker and result in the localised removal or displacement of underlying soils during construction. The magnitude of this impact is small adverse on the Greenhills Esker as it results in interaction with the county geological site, but the impact is deemed small due to the localised nature of the works. As the county geological site is of high importance the resulting significance of this small adverse impact is slight.

The magnitude of the potential impact on both the Dublin City Walls and the River Poddle county geological sites is negligible as it results in an insufficient permanent irreversible change on a local scale to affect the integrity of the county geological site. As the Dublin City Walls and River Poddle county geological sites are of high importance the resulting significance of this negligible impact is imperceptible and therefore will not be further assessed.

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 results in an irreversible loss of the in-situ characteristics of the land, soils, geology and hydrogeology. 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, where there is anticipated to be minimal excavation into the limestone rock as part of the Proposed Scheme. The magnitude of this impact is negligible as it results 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 resulting significance of this negligible impact is imperceptible and will not be considered further.

In addition to the above impact, potential pollutants from routine run-off 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 significant of this temporary moderate adverse impact is moderate.

14.4.3.6 Change to Groundwater Regime

Localised pumping of excavations may 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, localised and temporary, the magnitude of this impact is considered negligible. As the importance of the locally important aquifer is medium, the resulting significance is imperceptible and therefore will not be considered further.

Table 14.39: Summary of Predicted Construction Phase Impacts

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Loss or damage of topsoil									
Topsoil	Alluvmin	Typically found along current and historic watercourses	Medium	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Slight
Topsoil	BminSW - Shallow well drained (Mainly basic)	River Camac, Greenhills Esker, Sundrive Road and Rutland Avenue	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate/ Slight
Topsoil	BminDW - Deep well drained (Mainly basic)	Greenhills Esker from Castletymon Road to where the Calmount Road, Sundrive Road and Rutland Avenue	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate/ Slight
Excavation of potentially contaminated ground									
Potential Sources of Contamination	Graveyard	Blessington Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Old Castle / Pond / Dispensary	Greenhills Road, Tallaght	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Service Station (walkover) - Greenhills Road	Greenhills Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Numerous extensive gravel pits and quarries	Calmount Road / Greenhills Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	There are several potentially contaminating industries on Greenhills Road between the M50 and Walkinstown Roundabout	Greenhills Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Rutland Mills	Rutland Road / Clogher Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Brick works	Crumlin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Old Harbour backfilled at north east corner of the bridge.	Dolphin's Barn Bridge	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Glue Manufactory	Nangor Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Potential Sources of Contamination	Gravel Pit	Long Mile Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	9 no. of samples were classified as non-hazardous based on limited information as no waste acceptance categorisation was carried out. Further testing is required.	Various	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	The Adelaide and Meath Hospital, Dublin	Tallaght, Dublin 24., Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	INX International Ink Company Limited	50 Cookstown Industrial Estate, Tallaght, Dublin 24, Dublin, 24	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Microprint	Airton Industrial Estate, Airton Road, Tallaght, Dublin 24, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Bimeda Animal Health Limited	Airton Close, Tallaght, Dublin 24, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	APW Enclosures Limited	Airton Road, Tallaght, Dublin 24, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Galco Steel Limited	Ballymount Road, Walkinstown, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Hitech Plating	Unit D3, Ballymount Industrial Estate, Walkinstown, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Irish Printed Circuits Limited	Block B. Unit E, Ballymount Drive, Walkinstown, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	CCM Limited T/A Kenn Truss	Greenhills Road, Walkinstown, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Plateco ZN Limited	Mulcahy Keane Estate, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Our Lady's Hospital for Sick Children	Cooley Road, Crumlin, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Licenced Facility	B.G. Flexible Packaging Limited.	South Circular Road, Dolphin's Barn, Dublin 8, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	R and A Bailey and Company	Nangor House, Nangor Road, Western Estate, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Packaging Inks and Coatings	Unit 5 Western Industrial Estate, Naas Road, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Sun Chemical Inks Ltd.	John F. Kennedy Drive, Bluebell, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	BOC Gases Ireland Limited	P.O. Box 201, Bluebell, Dublin 12, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Heaton Buckley Limited (Dublin)	Robinhood Industrial Estate, Robinhood Road, Off Longmile Road, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licenced Facility	Sherwin-Williams (Ireland) Limited	53 Robinhood Industrial Estate, Dublin 22, Dublin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Loss of future quarry or pit reserve									
Crushed rock aggregate	Moderate to high potential	South Circular Road, Dublin Castle and Winetavern Street.	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible
Crushed rock aggregate	Very high potential	South Circular Road, Dublin Castle and Winetavern Street.	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible
Granular aggregate	Moderate to high potential	At the junction with Patrick's Street and Winetavern Street, River Dodder	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible
Granular aggregate	Very high potential	At the junction with Patrick's Street and Winetavern Street, River Dodder	High	Loss of future quarry or pit 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
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

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
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									
Greenhills Esker (SD005 County Geological Site)	The Greenhills esker includes a large accumulation of sands and gravels	Greenhills	High	Loss or damage of proportion of Geological Heritage Area	Negative	Permanent	Local	Small adverse	Slight
Dublin City Walls (DC002 County Geological Site)	Three remaining sections of the medieval city walls of Dublin City	Dublin City Walls	High	Loss or damage of proportion of Geological Heritage Area	Negative	Permanent	Local	Negligible	Imperceptible
River Poddle (DC011 County Geological Site)	A river which flows northwards through Dublin City; most of its course is diverted underground	A river which flows northwards through Dublin City	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 significant of the impact is imperceptible on any of the land, soils, geology and hydrogeology.

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 the Operational Phases of the Proposed Scheme. A summary of the pre-mitigation and post-mitigation impacts is contained in Table 14.40.

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 re-use within the Proposed Scheme by the appointed contractor ensuring the appropriate handling, processing and segregation of the material. Where practical the removal of soil from the Proposed Scheme will be avoided. All earthworks will be undertaken in accordance with TII 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 offsite 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 ground investigation and ground excavated from these areas will be disposed of to a 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 Loss or damage of proportion of Geological Heritage Area

There are proposed piling works associated with the M50 overbridge which potentially interact with the Greenhills Esker CGS plan area. The Greenhills Esker is noted for being a prominent, striking example of a dry sand and gravel ridge, standing proud of its surrounds. However, there have been developments within the footprint of the Greenhills Esker CGS over previous decades, including the construction of the M50 Motorway and associated link roads. The proposed piling works here will result in minimal excavation works localized around individual pile locations.

The NTA will facilitate site visits by GSI personnel during the construction phase and / or provide relevant information gathered during the construction phase to supplement the GSI's existing County Geological Site Report.

14.5.1.4 Pollution of Soil and Groundwater

Good construction management practices, as outlined in the CIRIA guidance 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 to minimise the risk of spills and contamination of soils and waters 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 and will be fully bunded;
- Good housekeeping at the site (daily site clean-ups, use of disposal bins, etc.) during the entire Construction Phase;
- All concrete mixing and batching activities will be located in areas away from watercourses and drains;
- Potential pollutants to be adequately secured against vandalism;
- Provision of proper containment of potential pollutants according to codes of best practice;
- Thorough control during the entire Construction Phase to ensure that any spillage is identified at early stage and subsequently effectively contained and managed; and
- Spill kit to be provided and to be kept close to the storage area. Staff to 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 shall 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 the existing land, soils, geology and hydrogeology during construction.

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 to be taken in the event of any accidental spillages and this will reduce the potential for any impact.

14.6 Residual Impacts

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.

Table 14.40: 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											
Topsoil	Alluvmin	Typically found along current and historic watercourses	Medium	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Topsoil	BminSW - Shallow well drained (Mainly basic)	River Camac, Greenhills Esker, Sundrive Road and Rutland Avenue	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate/ Slight	Negligible	Imperceptible
Topsoil	BminDW - Deep well drained (Mainly basic)	Greenhills Esker from Castletymon Road to where the Calmount Road, Sundrive Road and Rutland Avenue	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate/ Slight	Negligible	Imperceptible
Excavation of potentially contaminated ground											
Potential Sources of Contamination	Graveyard	Blessington Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Old Castle / Pond / Dispensary	Greenhills Road, Tallaght	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Service Station (walkover) - Greenhills Road	Greenhills Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Numerous extensive gravel pits and quarries	Calmount Road / Greenhills Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	There are several potentially contaminating industries on Greenhills Road between the M50 and Walkinstown Roundabout	Greenhills 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
Potential Sources of Contamination	Rutland Mills	Rutland Road / Clogher Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Brick works	Crumlin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Old Harbour backfilled at northeast corner of the bridge.	Dolphin's Barn Bridge	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Glue Manufactory	Nangor Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Gravel Pit	Long Mile Road	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	9 no. of samples were classified as non-hazardous based on limited information as no waste acceptance categorisation was carried out. Further testing is required.	Various	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	The Adelaide and Meath Hospital, Dublin	Tallaght, Dublin 24., Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	INX International Ink Company Limited	50 Cookstown Industrial Estate, Tallaght, Dublin 24, Dublin, 24	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Microprint	Airton Industrial Estate, Airton Road, Tallaght, Dublin 24, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Bimeda Animal Health Limited	Airton Close, Tallaght, Dublin 24, Dublin	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
Licenced Facility	APW Enclosures Limited	Airton Road, Tallaght, Dublin 24, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Galco Steel Limited	Ballymount Road, Walkinstown, Dublin 12, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Hitech Plating	Unit D3, Ballymount Industrial Estate, Walkinstown, Dublin 12, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Irish Printed Circuits Limited	Block B. Unit E, Ballymount Drive, Walkinstown, Dublin 12, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	CCM Limited T/A Kenn Truss	Greenhills Road, Walkinstown, Dublin 12, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Plateco ZN Limited	Mulcahy Keane Estate, Dublin 12, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Our Lady's Hospital for Sick Children	Cooley Road, Crumlin, Dublin 12, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	B.G. Flexible Packaging Limited.	South Circular Road, Dolphin's Barn, Dublin 8, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	R and A Bailey and Company	Nangor House, Nangor Road, Western Estate, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Packaging Inks and Coatings	Unit 5 Western Industrial Estate, Naas Road, Dublin 12, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Sun Chemical Inks Ltd.	John F. Kennedy Drive, Bluebell, Dublin 12, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	BOC Gases Ireland Limited	P.O. Box 201, Bluebell, Dublin 12, Dublin	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
Licenced Facility	Heaton Buckley Limited (Dublin)	Robinhood Industrial Estate, Robinhood Road, Off Longmile Road, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licenced Facility	Sherwin-Williams (Ireland) Limited	53 Robinhood Industrial Estate, Dublin 22, Dublin	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Loss of future quarry or pit reserve											
Crushed rock aggregate	Moderate to high potential	South Circular Road, Dublin Castle and Winetavern Street.	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Crushed rock aggregate	Moderate to high potential
Crushed rock aggregate	Very high potential	South Circular Road, Dublin Castle and Winetavern Street.	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Crushed rock aggregate	Very high potential
Granular aggregate	Moderate to high potential	At the junction with Patrick's Street and Winetavern Street, River Dodder	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Granular aggregate	Moderate to high potential
Granular aggregate	Very high potential	At the junction with Patrick's Street and Winetavern Street, River Dodder	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Granular aggregate	Very high potential
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	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											

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-mitigation Magnitude	Pre-mitigation Significance	Post-mitigation Magnitude	Post-mitigation Significance
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 of proportion of Geological Heritage Area											
Greenhills Esker (SD005 County Geological Site)	The Greenhills esker includes a large accumulation of sands and gravels	Greenhills	High	Loss or damage of proportion of Geological Heritage Area	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Dublin City Walls (DC002 County Geological Site)	Three remaining sections of the medieval city walls of Dublin City	Dublin City Walls	High	Loss or damage of proportion of Geological Heritage Area	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
River Poddle (DC011 County Geological Site)	A river which flows northwards through Dublin City; most of its course is diverted underground	A river which flows northwards through Dublin City	High	Loss or damage of proportion of Geological Heritage Area	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible

14.6.2 Operational Phase

No significant residual impacts on land, soils, geology and hydrogeology as a result of the operation of the Proposed Scheme.

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).

14.7 References

Bing Maps (2019). Bing Maps. [Online] Available at: https://www.bing.com/maps/

Masters-Williams H, Heap H, Kitts H, Greenshaw L, Davis S, Fisher P, Hendrie M and Owens D (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532D), CIRIA, London

DCENR (2019). Exploration and Mining Viewer. [Online] Available from spatial.dcenr.gov.ie/ExplorationAndMining/SpatialViewer/index.html

EPA (2008). 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 (2011). Strive Report Series No. 100. Evaluating the Influence of Groundwater Pressures on Groundwater-Dependent Wetlands. Strive EPA Programme 2007 – 2013.

EPA (2018). Corine Landcover 2018. [Online] Available from https://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/fb5d2fa9-95fe-4d3f-8aed-e548348a40ea

EPA (2019). EPA Maps. [Online] Available from https://gis.epa.ie/EPAMaps/

EPA (2022). Guidelines on the Information to be contained in Environmental Impact Assessment Reports. May 2022.

European Commission (2017). Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report.

GSI (2014). GSI Minerals Active Quarries Database. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/Minerals/ActiveQuarries2014/FeatureServer

GSI (2016a). Quaternary geology of Ireland – Sediments Map. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/Quaternary/QuaternarySediments16/MapServer

GSI (2016b). Aggregate Potential Mapping - GSI 2016 – Crushed Final Scores. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/APM/APM16_FinalScoresCrushedRockAggregate/MapServer

GSI (2016c). Aggregate Potential Mapping - Pits and Quarry Locations. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/APM/APM16_PitsAndQuarries/MapServer

GSI (2017). Landslide Events GSI 2017. [Online] Available from https://utility.arcgis.com/usrsvcs/servers/6e99fe8736394f389aaf1aac5a407132/rest/services/Landslides/LandslideEvents/FeatureServer

GSI (2018). GSI 100k Bedrock Map. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/Bedrock/Bedrock100k_Seamless_2018/MapServer

GSI (2019a) Geotechnical Viewer. [Online] Available from https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

GSI (2019b) Groundwater Viewer. [Online] Available from https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=bc0dba38f3f5477c8fd400f66b5eedcd

GSI (2019c) Geological Heritage. [Online] Available from https://www.gsi.ie/en-ie/data-and-maps/Pages/Geoheritage.aspx#Nationwide

GSI (2019d). GSI Mineral Localities. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/PublicViewer/MineralLocalities/FeatureServer

GSI (2019e). GSI Groundwater Level Data Viewer. [Online] Available from https://gwlevel.ie/

Google Maps (2019) Google Maps. [Online] Available from http://www.google.com/maps/

IGI (2013) Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environmental Impact Statements.

NMS (2019). National Monuments Service - Archaeological Survey of Ireland. [Online] Available from https://data.gov.ie/dataset/national-monuments-service-archaeological-survey-of-ireland

NPWS (2020). Proposed / Designated NHA, SPA, SAC Sites. [Online] Available from http://webgis.npws.ie/npwsviewer/

NRA (2008a). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

NRA (2008b). Environmental Impact Assessment of National Road Schemes – A Practical Guide.

OSI (2019). Current and historical Ordnance Survey maps and aerial photography available for the study area. [Online] Available from http://map.geohive.ie/mapviewer.html

Sweeney, C. (2020). The Rivers of Dublin.

Teagasc, Agency, E. P. and Ireland, G. S. (2017). Teagasc Soils Data - Surface Soils Classification and Description. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/THIRD_PARTY/TeagascSoils/MapServer

TII (2013) Specification for Road Works Series 600 - Earthworks (including Erratum No. 1, dated June 2013) CC-SPW-00600

Directives and Legislation.

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration

S.I. No. 122/2014 - European Union (Drinking Water) Regulations 2014

S.I. No. 149/2012 - European Communities Environmental Objectives (Groundwater) (Amendment) Regulations 2012

S.I. No. 219/2008 - European Communities (Water Policy) (Amendment) Regulations 2008

S.I. No. 261/2018 - European Union (Water Policy) (Abstractions Registration) Regulations 2018

S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009

S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations 1988

S.I. No. 327/2012 - European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2012

S.I. No. 350/2014 - European Union (Water Policy) Regulations 2014

S.I. No. 366/2016 - European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016

S.I. No. 386/2015 European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2015

S.I. No. 389/2011 - European Communities Environmental Objectives (Groundwater) (Amendment) Regulations 2011

S.I. No. 413/2005 - European Communities (Water Policy) (Amendment) Regulations 2005

S.I. No. 464/2017 - European Union (Drinking Water) (Amendment) Regulations 2017

S.I. No. 722/2003 - European Communities (Water Policy) Regulations 2003

S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010

S.I. No. 93/2010 - European Communities (Water Policy) (Amendment) Regulations 2010

Water Services Acts (2007 to 2017).