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**Chapter 14**  
Land, Soils, Geology  
& Hydrogeology

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## **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 Clongriffin 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:

- Mayne River Avenue to Gracefield Road - Malahide Road; and
- Gracefield Road to Marino Mart / Fairview - Malahide Road.

### 14.2.2 Relevant Guidelines, Policy and Legislation

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

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

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

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

- Environmental Protection Agency (EPA). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA 2017);
- European Commission, Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (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	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.
	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
R5564	Residential development, Donaghmede	2004	IGSL	Donaghmede, Dublin 13, Co. Dublin	Eight Cable Percussion Boreholes
R4356	Residential Development, Balgriffin	Unknown	Unknown	Balgriffin, Dublin 17, Co Dublin	12 Cable Percussion Boreholes
R1089	Ard Na Greine Housing Estate	Unknown	Unknown	Malahide Road, Darndale, Dublin 17	Three Trial Pits
R411	Donnycarney Church, Dublin	1965	The Cementation Company Ltd. Ireland	Donnycarney Church	Three Cable Percussion Boreholes
R2473	Health and Fitness Centre	1995	Muir Associates	Ayrfield, Dublin	10 Trial Pits and 19 Dynamic Probes
R1099	Site Investigations Dublin 17	Unknown	McCarthy and Associates	Dublin 17	13 Trial Pits
R1071	National Building Agency	1976	Unknown	Coolock	Five Trial Pits
R24	Cadburys Ltd	1982	IGSL	Coolock	Two Trial Pits
R5937	Kavanaghs Public House Fairview	2005	IGSL	Baldoyle North	One Cable Percussion Borehole
R6000	City Junction Business Park development	2006	IGSL	Belcamp	Three Cable Percussion Boreholes and Two Trial Pits
R360	Irish Merchants Ltd	1991	IGSL	Malahide Road Industrial Park	Five Trial Pits
R930	GAA stadium	1994	IGSL	Parnell Park, Dublin	Five Cable Percussion Boreholes
R219	Corporation Development	1993	IGSL	Clontarf Road, Dublin	Six Cable Percussion Boreholes and Eight Trail Pits

No scheme-specific ground investigations were carried out to inform the Proposed Scheme as no structures are included within the Proposed Scheme.

#### 14.2.3.3 Design Information

The information listed in Table 14.3 is design information that has been used in the assessment of the baseline conditions.

**Table 14.3: Design Information**

Title	Author	Date	Description
BCID Project A Earthworks Tables	AECOM	September 2020	Earthworks tables to inform the conceptual site model
Preliminary Sources Study Report	AECOM	January 2020	Preliminary Sources Study Report
Plan and Profile Drawings	AECOM	September 2020	Plan and cross section profile drawings of the Scheme
Construction Strategy Report	AECOM	June 2021	Construction strategy report

#### 14.2.3.4 Scheme Walkover

A scheme walkover survey was carried out on 14 January 2020 and 9 July 2021 to inform and verify the review of publicly available datasets.

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

#### **14.2.4 Appraisal Method for the Assessment of Impacts**

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

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

##### **14.2.4.1 Baseline – Initial Assessment**

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

The existing land, soils, geology and hydrogeology conditions in the study area have been interpreted from 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'. However, no ground investigations were required to be carried out for the Proposed Scheme.

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:

- Box 4.1: Criteria for Rating Site Attributes – Estimation of Importance of Soil and Geology Attributes (Table 14.4);
- Box 4.3: Criteria for Rating Site Attributes – Estimation of the Importance of Hydrogeology Attributes (Table 14.5);
- The magnitude of impacts should be defined in accordance with the criteria provided in the NRA Guidelines. This is outlined in (Table 14.6).
- Box 5.1: Criteria for Rating Site Attributes at Environmental Impact Assessment (EIA) Stage – Estimation of Magnitude of Impact on Soil / Geology Attribute (Table 14.7);
- Box 5.3: Criteria for Rating Site Attributes at EIA Stage – Estimation of Magnitude of Impact on Hydrogeology Attributes (Table 14.8); and
- Box 5.4: Rating of Significant Environmental Impacts at EIA Stage (Table 14.9).

The NRA Guidelines criteria uses similar significance terminology as the EPA Guidelines (EPA 2017). However, it has intermediate steps to justify using that terminology:

- Step 1: Quantify the importance of a feature for geology (Box 4.1) and hydrogeology (Box 4.3);

- Step 2: Estimate the magnitude of the impact on the feature from the Proposed Scheme (Box 5.1, Box 5.3); and
- Step 3: Determine the significance of the impact on the feature from the matrix (Box 5.4) based on the importance of the feature and the magnitude of the impact.

**Table 14.4: Criteria for Rating the Importance of Identified Soils and Geological Attributes (Table C2 (IGI 2013) and Box 4.1 (NRA 2008)).**

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 14.5: Criteria for Rating the Importance of Identified Hydrogeological Attributes (Box 4.3 (NRA 2008)).**

Importance	Criteria	Typical Example
<b>Extremely High</b>	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
<b>Very High</b>	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
<b>High</b>	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
<b>Medium</b>	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
<b>Low</b>	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

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

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 consistent with existing or emerging trends
Significant	An impact which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Profound	An impact which obliterates all previous sensitive characteristics

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

Magnitude of Impact	Criteria	Typical Example
<b>Large Adverse</b>	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
<b>Moderate Adverse</b>	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
<b>Small Adverse</b>	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves Removal of small part of geological heritage feature Irreversible loss of small proportion of local high fertility soils and / or high proportion of local low fertility soils Requirement to excavate / remediate small proportion of waste site Requirement to excavate and replace small proportion of peat, organic soils and / or soft mineral soils beneath alignment
<b>Negligible</b>	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
<b>Minor Beneficial</b>	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
<b>Moderate Beneficial</b>	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
<b>Major Beneficial</b>	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 2008))**

Magnitude of Impact	Criteria	Typical Example
<b>Large Adverse</b>	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
<b>Moderate Adverse</b>	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
<b>Small Adverse</b>	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
<b>Negligible</b>	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 (NRA 2009)**

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

#### 14.2.4.4 Mitigation Measures, Residual Impacts and Final Impact Assessment

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

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

## **14.3 Baseline Environment**

### **14.3.1 Introduction**

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

### **14.3.2 Regional Overview**

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

#### **14.3.2.1 Regional Topography and Geomorphology**

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

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

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

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

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

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

#### **14.3.2.2 Regional Soils (Teagasc Classification)**

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

**Table 14.10: Summary of Soil Types Within the Region**

Soil Code	Description	Location
AeoUND	Aeolian undifferentiated	Coast
AlluvMin	Alluvial (min)	Along river courses and meltwater channels
AminDW	Deep well drained mineral soil (mainly acidic)	South towards Bray
AminPD	Mineral poorly drained (mainly acidic)	South towards Bray
AminPDPT	Peaty Gleys Acidic	Near Wicklow mountains
AminSP	Surface water gleys / Ground water gleys shallow	South towards Bray
AminSW	Shallow well drained mineral soil (mainly acidic)	South towards Bray
AminSRPT	Shallow rocky peaty, non-peaty mineral complexes (mainly acidic)	Near Wicklow mountains
BktPT	Blanket Peat	Near Wicklow mountains
BminDW	Deep well drained mineral soil (mainly basic)	North near Swords
BminPD	Mineral poorly drained (mainly basic)	North near Swords
BminPDPT	Peaty gleys basic parent materials basic	Near Wicklow mountains
BminSP	Surface water gleys / groundwater gleys shallow	South towards Newcastle
BminSPPT	Peaty gleys shallow	Near Wicklow mountains
BminSRPT	Lithosols peats	Near Wicklow mountains
BminSW	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
TdIMr	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 1:500,000k Bedrock Geology Map (GSI, 2018) are presented on Figure 14.4 in Volume 3 of this EIAR and have been listed in Table 14.12. The region is predominantly underlain by Carboniferous Limestones. The majority of the Dublin City area was a deep marine basin known as the Dublin Basin where these sedimentary rocks were deposited.

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

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

The structural geology within the region is highly variable and complex. A series of parallel faults running mainly in a north-west to south-east 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
	Courseyan 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 aquifer, corresponding to whether they are major, minor or unproductive resources whereby:

- Regionally Important Aquifers are capable of supplying regionally important abstractions (e.g., large public water supplies), or excellent yields (>400 metres cubed per day (m<sup>3</sup>/d));
- Locally Important Aquifers are capable of supplying locally important abstractions (e.g., smaller public water supplies, group schemes), or good yields (100m<sup>3</sup>/d to 400m<sup>3</sup>/d); and

- Poor Aquifers are capable of supplying small abstractions (e.g., domestic supplies), or moderate to low yields (<100m<sup>3</sup>/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	(LI)
	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	(PI)

#### 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) also maintains a database of groundwater and surface water abstractions. However, this data is not available to the public. The EPA has also launched a register of water abstractions, whereby people who abstract 25m<sup>3</sup> (cubic metres) of water or more per day are required to register their water abstraction. However, this data is not available to the public.

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

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

#### **14.3.2.9 Groundwater Quality and Levels**

Based on professional experience and previous ground investigations in the area, groundwater levels are generally within 5m of the surface in Dublin City and are closer to the surface near rivers and streams. Historical groundwater monitoring is available from a monitoring borehole at the GSI Beggar's Bush Office, Dublin 4 (monitored from 1990 to 2000). Groundwater level monitoring has commenced at Beggar's Bush since August 2018 with the data available online (GSI 2019e). Beggar's Bush lies approximately 2 kilometres (km) 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<sub>3</sub>)), with a high alkalinity (300mg/l to 350mg/l (CaCO<sub>3</sub>)) 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<sub>3</sub>) to 150mg/l (CaCO<sub>3</sub>), alkalinity of <50mg/l (CaCO<sub>3</sub>) 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 2019), Google (Google 2019), Bing (Bing 2019) and the Corine Land Cover maps (EPA 2018). The historic land use is based on the following OSI (OSI 2019) historic aerial imagery and historic maps:

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

##### 14.3.3.1.1 Mayne River Avenue to Gracefield Road - Malahide Road

The Corine Land Cover 2018 classifies the land use from the Malahide Road junction to Gracefield Road as construction sites and discontinuous urban fabric with industrial and commercial units at the Malahide Road Industrial Park.

The OSI 25-inch and 6-inch mapping shows the area within this section of the study area was predominately greenfield with the exception of Coolock Village which has some urbanisation. Notable landmarks at the village include a dispensary and a constabulary barracks. There are also features of significance at Coolock Bridge, where a moat, a graveyard and St Brendan's Well can be found in close proximity. The 25-inch map also shows a pump located west of the road at Newtown House.

The 6-inch Cassini map is mostly similar to the preceding maps with the exception of a poultry farm west of Newtown Bridge.

The 1995 aerial photograph displays a dramatic change in land use to predominantly urban with new residential area being constructed across this section. The Malahide Road has been altered to resemble its present-day form, with the addition of a roundabout outside of Darndale. An industrial park has also been constructed on the outskirts of Darndale in the place of the Transvaal poultry farm seen in the 6-inch Cassini.

Aerial photographs from 2000 and 2005 show increased development around Northern Cross and near the R139, as well as the evolution of the junction in this area. Developments in this area continue up to the present day, with satellite imagery from Google Maps showing the development of apartment blocks at Northern Cross and the new residential area of Belmayne east of this.

##### 14.3.3.1.2 Gracefield Road to Marino Mart / Fairview - Malahide Road

The Corine Land Cover 2018 classifies the land use from Gracefield Road to Marino Mart / Fairview as discontinuous urban fabric with sports and leisure facilities at the Clontarf Golf Course. At Fairview Park the land use is classed as Green urban areas.

The OSI 25-inch and 6-inch mapping shows the area within this section of the study area was predominately greenfield, with the exception of Artane Cottages, Donnycarney Village and from Griffith Avenue to the end of the Proposed Scheme, which is developed. The current housing is shown on the OSI 25-inch mapping. The 25-inch map also shows some features of interest to the south of the section, a well to the north of Marino House and an

electricity substation on the junction of the Malahide Road and the Clontarf Road. The 6-inch map shows a graveyard located north-west of Artane and an old quarry located north-west of Artane House.

The 6-inch Cassini shows significant residential developments at Marino and along the Clontarf Road. New features recorded in the study area include an electricity powerhouse south-west of Artane and a pumping station south of Marion Crescent, stated to belong to the Dublin Corporation. The nearby existence of Fairview Park, which exists in an area of tidal mudflats in the 6-inch and 25-inch maps, demonstrates that this pumping station is part of a land reclamation project in this area. While there is no evidence of the graveyard located near Artane, a ruined church is mentioned in that location. There is also no sign of the electricity substation or the well found near Marino in the 25-inch map.

The 1995 aerial photograph documents the construction of new residential areas in this section, completely altering the landscape. The Clontarf Golf Course has been constructed south of Collins Avenue. One of the most significant developments is the reclamation of land in Dublin Bay, just south of Clontarf Road. The reclaimed land continues east from Fairview Park as far as the Clontarf Garda Station. The 2000 aerial photograph shows that developments are taking place on this reclaimed land, with the construction of the Clontarf Dart Station and the Westwood Club. The subsequent aerial photographs show no significant changes within the study area, nor does the satellite imagery provided by Google Maps.

#### **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 Mayne River Avenue to Gracefield Road - Malahide Road**

At the beginning of the Proposed Scheme at the Malahide Road Junction the topography is approximately 30mOD as the Proposed Scheme running south through the townlands of Darndale and Coolock. The topography plateaus at 30mOD from the Malahide Road Industrial Park to Artane.

The geomorphology of the study area comprises of mega scale glacial lineations, meltwater channels and deglacial landforms as seen on Figure 14.7 in Volume 3 of this EIAR. The Proposed Scheme will intersect the mega scale glacial lineations at Darndale and Coolock. A meltwater channel is seen to underlie the River Mayne.

##### **14.3.3.2.2 Gracefield Road to Marino Mart / Fairview - Malahide Road**

The topography is approximately 30mOD as the Proposed Scheme running south through the townlands of Artane, Donnycarney, Marino and terminating at Fairview Park. The topography plateaus at 30mOD from the Artane Roundabout to Donnycarney where it then falls to 20mOD at Killester and to 10mOD at the Fairview Park where the Proposed Scheme will finish.

The geomorphology of the study area comprises of mega scale glacial lineations, meltwater channels and deglacial landforms as seen on Figure 14.7 in Volume 3 of this EIAR. The Proposed Scheme will intersect the mega scale glacial lineations at Donnycarney. A meltwater channel and deglacial landform comprised of hummocky sand and gravel underlies the River Santry.

#### **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 footpaths. However, there are topsoil and other soils present within the study area for which there are a number of classifications on the Teagasc Soil Map (Teagasc *et al.* 2017). The main soils within the study area, as classified by Teagasc (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 Mayne River Avenue to Gracefield Road - Malahide Road

North of the Malahide Road junction an area of alluvium is present along the River Mayne. Between Mayne River Avenue and Belcamp Lane, the soil is a mixture of deep and poorly well drained mineral (mainly basic). From the Belcamp Lane to Artane, the soils encountered are mainly made ground, with pockets of deep and poorly well drained mineral (mainly basic) at Coolock. Alluvium is present south of the Malahide Industrial Park along the River Santry.

Topsoils are present in urban parks and landscaped areas such as gardens and green verges.

#### 14.3.3.3.2 Gracefield Road to Marino Mart / Fairview - Malahide Road

From the Gracefield Road to Marino the soils encountered are made ground, with areas of deep and poorly well drained mineral (mainly basic) at Marino. There are also marine sands and sediments underlying Fairview Park.

Topsoils are present in urban parks and landscaped areas such as gardens and green verges.

**Table 14.16: Soils Within the Study Area**

Soil Type	Notes / Description	Location	Importance	Justification for Importance Rating
Made Ground - Made	Associated with urban development	Widespread	Low	Poorly drained and / or low fertility soils
Topsoil - BminPD	Poorly drained (Mainly Basic)	Between Belcamp and Darndale and in pockets at Coolock and Marino.	Low	Poorly drained and / or low fertility soils
Alluvium - AlluvMIN	Typically found along current and historic watercourses	Along the River Mayne and River Santry.	Medium	Moderately drained and / or moderate fertility soils
Marine Sediments - MarSed	Typically found along the coast	At Clontarf Road.	Medium	Moderately drained and / or moderate fertility soils
Marine Sands - MarSands	Typically found along the coast	At Clontarf Road.	Medium	Moderately drained and / or moderate fertility soils
Topsoil - BminSW	Shallow well drained (Mainly basic)	Between Belcamp and Darndale and in pockets at Coolock and Marino.	High	Well drained and / or high fertility soils
Topsoil - BminDW	Deep well drained (Mainly basic)	Between Belcamp and Darndale and in pockets at Coolock and Marino.	High	Well drained and / or high fertility soils

#### 14.3.3.4 Subsoil Deposits (GSI Quaternary Classification)

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

The main subsoils encountered across the study area include made ground (urban), alluvial deposits and glacial tills derived from limestones.

#### 14.3.3.4.1 Mayne River Avenue to Gracefield Road - Malahide Road

North of the Malahide Road junction a linear deposit of alluvium is present along the River Mayne. From the Mayne River Avenue to Artane Roundabout the subsoils encountered are glacial tills derived from limestone. A small pocket of gravels derived from limestone is located near Blunden Drive and alluvium is present south of the Malahide Industrial Park along the River Santry.

#### 14.3.3.4.2 Gracefield Road to Marino Mart / Fairview - Malahide Road

From the Artane Roundabout to Clontarf Road the subsoils encountered are glacial till with alluvium present south of Artane associated with the River Naniken and at Donnycarney associated with the River Wad at Donnycarney bridge. Windblown sands and dunes are encountered at the south-western end of Fairview Park and Made Ground is recorded in the centre and to the north-eastern end of the park.

**Table 14.17: Subsoils Within the Study Area**

Subsoil Type	Description	Location	Importance	Justification for Importance Rating
Made Ground - Urban	Associated with urban development	South of Clontarf Road	Low	Low value on a local scale
Glacial till – GLS	Gravels derived from limestones	Blunden Drive	Low	Low value on a local scale
Alluvium – A	Typically found along current and historic watercourses	Along River Mayne, River Santry, south of Artane and west of Donnycarney.	Low	Low value on a local scale
Glacial till – TLs	Till derived from limestones	Widespread	Low	Low value on a local scale
Windblown sands – Wsd	Windblown sands and dunes	At Clontarf Road.	Medium	Medium 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 underlying bedrock of the study area is predominantly comprised of the Lucan Formation, Tober Colleen Formation and Malahide Formation. A summary of the bedrock geology along the Proposed Scheme is presented in Table 14.18.

##### 14.3.3.5.1 Mayne River Avenue to Gracefield Road - Malahide Road

The Proposed Scheme will begin at the Malahide Road Junction and is underlain by the Malahide Formation to Coolock. From Coolock to Artane the bedrock encountered comprises the Tober Colleen Formation.

The bedrock within this section of the study area is folded. A synclinal axis is noted within the Tober Colleen Formation from Artane to Coolock while an anticlinal axis is noted within the Malahide Formation at the Malahide Road Junction.

##### 14.3.3.5.2 Gracefield Road to Marino Mart / Fairview - Malahide Road

From Artane to Fairview Park the bedrock encountered comprises the dark calp limestone of the Lucan Formation.

**Table 14.18: Rock Formations Within the Study Area**

Formation	Description	Location	Importance	Justification for Importance Rating
Lucan	(Calp) Dark Limestone and shale - Carboniferous	Between Artane and Clontarf Road.	Low	Low value on a local scale
Tober Colleen Formation	Calcareous shale, limestone conglomerate - Carboniferous	Between Coolock and Artane	Low	Low value on a local scale
Malahide Formation	Argillaceous bioclastic limestone, shale – Carboniferous	Between Belcamp and Coolock.	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 are presented in Table 14.19 to Table 14.20.

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 from Mayne River Avenue to Gracefield Road**

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Topsoil	Green areas – including parks, large estates and golf courses	0.0	0.2 to 0.4
Made Ground	Not found at all locations	0.0 to 0.4	0.0 to 1.0
Glacial Till (Brown Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread along the Proposed Scheme	0.2 to 1.4	0.5 to 2.5
Glacial Till (Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread along the Proposed Scheme	0.7 to 3.9	Not proven
Bedrock	Not encountered	N/A	N/A

**Table 14.20: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme from Gracefield Road to Marino Mart / Fairview**

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Topsoil	Green areas – including parks, large estates and golf courses	0.0	0.15 to 0.6
Glacial Till (Brown Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread along the Proposed Scheme	0.15 to 0.6	2.5 to 5.0
Glacial Till (Black Boulder Clay with lenses of fluvioglacial sands and gravels)	Widespread along the Proposed Scheme	2.65 to 5.6	1.5 to 3.0
Bedrock	Encountered in one location	6.5 to 8.5	N/A

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

**Table 14.21: 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	Along River Mayne, River Santry, south of Artane and west of Donnycarney.	Low	Volume of soft soil underlying the study area is small and of a local scale.
Marine Sediments- MarSed	Typically found along the coast	Marino Crescent.	Low	Volume of soft soil underlying the study area is small and of a local scale.
Wind-blown Sands and dunes - Wsd	Typically found along the coast	Marino Crescent.	Low	Volume of soft soil underlying the study area is small and of a local scale.

#### 14.3.3.9 Contaminated Land

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

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

- CORINE land cover mapping (EPA 2018);
- Teagasc soil map (Teagasc *et al.* 2017);
- EPA (EPA 2019);
- OSI mapping (OSI 2019);
- The design information as listed in Table 14.3; 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 14.22 along with their importance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a).

**Table 14.22: Summary of Potential Sources of Contaminated Land Adjacent to the Proposed Scheme**

Feature	Description	Location	Importance	Justification for Importance Rating
Earth mounds containing construction and demolition waste.	During the walkover it was noted that there were a number of small mounds of earth containing construction and demolition waste on the north-eastern and south-western corners of the junction of Malahide Road and the R139 at Clarehall. The mounds of earth extended down the Malahide Road between R139 and Belcamp Lane.	Malahide road between R139 and Belcamp Lane.	Medium	Degree or extent of soil contamination is moderate on a local scale
Petrol Stations	A number of petrol stations were identified during the walkover along the Malahide Road	Tesco Clarehall; Malahide Road Retail Park; opposite Danieli Road in Artane and just north of Collins Avenue in Donnycarney,	Medium	Degree or extent of soil contamination is moderate on a local scale
Historical Electrical Substation	25-inch mapping	North of Fairview Park - adjacent to Proposed Scheme (less than 20m)	Medium	Degree or extent of soil contamination is moderate on a local scale
Historical Quarry	6-inch mapping	Approximately 175m west of the Proposed Scheme at Thorndale Drive.	Medium	Degree or extent of soil contamination is moderate on a local scale
Historical Dispensary	6-inch Cassini and 25-inch mapping	Located at Coolock Village opposite St Brendan's Church.	Medium	Degree or extent of soil contamination is moderate on a local scale
Historical Poultry Farm	6-inch Cassini mapping	At the north-east corner of the Malahide Road Industrial Park.	Medium	Degree or extent of soil contamination is moderate on a local scale
Historical Graveyard	6-inch and 25-inch mapping	Located at St John's Church north of the River Santry east of the Propose Scheme.	Medium	Degree or extent of soil contamination is moderate on a local scale
Historical Graveyard	6-inch and 25-inch mapping	Located north of Pinebrook Rise west of the Proposed Scheme.	Medium	Degree or extent of soil contamination is moderate on a local scale
Historical Pumping Station	6-inch Cassini	50m south of Marino Crescent Park across the Clontarf 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 14.23.

**Table 14.23: List of EPA Licensed Facilities Within the Study Area**

Name	Description	Location	Importance	Justification for Importance Rating
Wood-Pinecraft Limited	Licensed Industrial Pollution Prevention and Control (IPPC) Facility	Malahide Road Industrial Park - 230m west of the Proposed Scheme	Medium	Light industrial usage
Crown Paints Ireland Ltd.	Licensed Industrial Emissions Licence (IEL) Facility	Malahide Road Industrial Park - 50m west of the Proposed Scheme	Medium	Light industrial usage
Mondelez Ireland Production Ltd.	Licensed IEL Facility	Malahide Road Industrial Park - 270m west of the Proposed Scheme	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 no non-metallic mineral locations within the study area.

#### 14.3.3.10.1 Mayne River Avenue to Gracefield Road - Malahide Road

The crushed rock aggregate potential is predominately low within this section of the study area. Moderate potential for crushed rock aggregate is encountered at the junction with Malahide Road Junction, around Coolock and Blunden Drive.

The granular aggregate potential varies from very low to moderate potential within this section of the study area. An area of very low granular potential is found along the River Mayne. Areas of low potential are associated with the areas of alluvium found along the River Mayne and the River Santry. Areas of moderate granular aggregate potential are encountered at the Malahide Road Junction and between Coolock to Artane.

#### 14.3.3.10.2 Gracefield Road to Marino Mart / Fairview - Malahide Road

The crushed rock aggregate potential is predominately low within this section of the study area. Moderate potential for crushed rock aggregate is encountered north of Donnycarney and Marino to Fairview Park. There are areas of high potential for crushed rock aggregate north of Donnycarney and east of Marino.

The granular aggregate potential varies from very low to very high potential within the study area. An area of very low granular aggregate potential is located west of Donnycarney along the River Wad. An area of low granular aggregate potential is associated with the River Naniken and River Wad. Areas of moderate granular aggregate potential are located east of the R107 around Copeland Grove and Clontarf Golf and Bowling Club. High granular aggregate potential is identified from Nazareth House to Marino Mart. Very high granular aggregate potential is located around Marino to the west of the Malahide Road.

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

**Table 14.24: GSI Aggregate Potential for the Study Area**

GSI Aggregate Potential Type	Potential	Location	Importance	Justification for Importance Rating
Crushed rock aggregate potential	Low potential	Widespread	Low	Uneconomically extractable mineral resource
Crushed rock aggregate potential	Moderate potential	North of Northern Cross, at Coolock, at Donnycarney and Marino.	Medium	Sub-economic extractable mineral resource
Crushed rock aggregate potential	High potential	At Donnycarney and east of Marino.	Medium	Extractable mineral resource
Granular aggregate potential	Very Low potential	Along the River Mayne and at the end of the River Wad.	Very Low	Uneconomically extractable mineral resource
Granular aggregate potential	Low potential	Along the River Mayne, River Santry, the River Naniken and the River Wad.	Low	Uneconomically extractable mineral resource
Granular aggregate potential	Moderate potential	North of Northern Cross, at Coolock and east of Marino.	Medium	Sub-economic extractable mineral resource
Granular aggregate potential	High potential	Between Casino Park and Clontarf Road.	Medium	Extractable mineral resource
Granular aggregate potential	Very High potential	West of R107 between Casino Park and Brian Road.	High	Marginally extractable mineral resource

#### 14.3.3.11 Geological Heritage Areas

There are no Geological Heritage Areas (GSI 2019c) within the study area.

#### 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 14.25 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 14.25: 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 (LI)	Widespread	Medium	Locally important aquifer which supplies the local area
Poor Aquifer	Bedrock which is generally unproductive except for local zones (PI)	Between Coolock and Danieli Road.	Low	Low yielding aquifer

#### 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 Mayne River Avenue to Gracefield Road - Malahide Road

From the Malahide Road Junction through to Coolock groundwater vulnerability is low. It increases to medium vulnerability at Coolock.

#### 14.3.3.13.2 Gracefield Road to Marino Mart / Fairview - Malahide Road

Groundwater vulnerability is low at Artane where it then rises to moderate, high and extreme vulnerability approaching Donnycarney where bedrock outcrops indicate that the rock is shallow at these locations. From Donnycarney to Marino Mart the groundwater vulnerability is generally moderate along the Proposed Scheme. Areas of low groundwater vulnerability are noted to the west of the Proposed Scheme and high groundwater vulnerability to the east.

#### 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 14.26 for completeness. Features with an importance ranking of medium or higher are summarised in Table 14.27 and the impact of the Proposed Scheme on these features will be assessed in Section 14.4.

**Table 14.26: Summary of Land, Soils, Geology and Hydrogeology Features with Low Importance Within the Study Area**

Category	Feature	Description	Location	Importance	Justification
Soil Fertility	Made Ground – Made	Associated with urban development	Widespread	Low	Poorly drained and / or low fertility soils
Soil Fertility	Topsoil – BminPD	Poorly drained (mainly basic)	Between Belcamp and Darndale and in pockets at Coolock and Marino.	Low	Poorly drained and / or low fertility soils
Subsoil's quality and significance	Made Ground – Urban	Associated with urban development	South of Clontarf Road	Low	Low value on a local scale
Subsoil's quality and significance	Alluvium – A	Typically found along current and historic watercourses	Along River Mayne, River Santry, south of Artane and west of Donnycarney.	Low	Low value on a local scale
Subsoil's quality and significance	Glacial till – GLS	Gravels derived from limestones	Blunden Drive	Low	Low value on a local scale
Subsoil's quality and significance	Glacial till – TLs	Till derived from limestones	Widespread	Low	Low value on a local scale
Bedrock quality and significance	Lucan	(Calp) Dark limestone and shale – Carboniferous	Between Artane and Clontarf Road.	Low	Low value on a local scale
Bedrock quality and significance	Tober Colleen Formation	Calcareous shale, limestone conglomerate - Carboniferous	Between Coolock and Artane	Low	Low value on a local scale
Bedrock quality and significance	Malahide Formation	Argillaceous bioclastic limestone, shale - Carboniferous	Between Belcamp and Coolock.	Low	Low value on a local scale
Soft Soils	Alluvium - AlluvMIN (soils) / A (subsoils)	Typically found along current and historic watercourses	Along River Mayne, River Santry, south of Artane and west of Donnycarney.	Low	Volume of soft soil underlying the route is small and of a local scale.
Soft Soils	Marine Sediments - MarSed	Typically found along the coast	At Clontarf Road.	Low	Volume of soft soil underlying the route is small and of a local scale.
Soft Soils	Wind-blown Sands and dunes - Wsd	Typically found along the coast	Marino Crescent.	Low	Volume of soft soil underlying the study area is small and of a local scale.
Aquifer	Poor Aquifer	Bedrock which is generally unproductive except for local zones (PI)	Between Coolock and Danieli Road.	Low	Low yielding aquifer
Economic Geology	Crushed rock aggregate potential	Low potential	Widespread	Low	Uneconomically extractable mineral resource
Economic Geology	Granular aggregate potential	Low potential	Along the River Mayne, River Santry, south of Artane and west of Donnycarney.	Low	Uneconomically extractable mineral resource

**Table 14.27: 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	Along the River Mayne and River Santry.	Medium	Moderately drained and / or moderate fertility soils
Soil Fertility	Topsoil - BminSW	Shallow well drained (mainly basic)	Between Belcamp and Darndale and in pockets at Coolock and Marino.	High	Well drained and / or high fertility soils
Soil Fertility	Topsoil – BminDW	Deep well drained (mainly basic)	Between Belcamp and Darndale and in pockets at Coolock and Marino.	High	Well drained and / or high fertility soils
Soil Fertility	Marine Sediments – MarSed	Typically found along the coast	At Clontarf Road.	Medium	Moderately drained and / or moderate fertility soils
Soil Fertility	Marine Sands – MarSands	Typically found along the coast	At Clontarf Road.	Medium	Moderately drained and / or moderate fertility soils
Subsoil's quality and significance	Windblown sands – Wsd	Windblown sands and dunes	At Clontarf Road.	Medium	Medium Value on a local scale
Aquifer	Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Locally important aquifer which supplies the local area
Economic Geology	Crushed rock aggregate potential	Moderate potential	North of Northern Cross, at Coolock, at Donnycarney and Marino.	Medium	Sub-economic extractable mineral resource
Economic Geology	Crushed rock aggregate potential	High potential	At Donnycarney and east of Marino.	Medium	Extractable mineral resource
Economic Geology	Granular aggregate potential	Moderate potential	North of Northern Cross, at Coolock and east of Marino.	Medium	Sub-economic extractable mineral resource
Economic Geology	Granular aggregate potential	High potential	Between Casino Park and Clontarf Road.	Medium	Extractable mineral resource
Economic Geology	Granular aggregate potential	Very High potential	West of R107 between Casino Park and Brian Road.	High	Marginally extractable mineral resource
Industry	Wood-Pinecraft Limited	Possible source of contamination from licensed facility	Malahide Road Industrial Park - 230m west of the Proposed Scheme	Medium	Light industrial usage
Industry	Crown Paints Ireland Ltd.	Possible source of contamination from licensed facility	Malahide Road Industrial Park - 50m west of the Proposed Scheme	Medium	Light industrial usage
Industry	Mondelez Ireland Production Ltd.	Possible source of contamination from licensed facility	Malahide Road Industrial Park - 270m west of the Proposed Scheme	Medium	Light industrial usage
Potential Contaminated Land	Earth mounds containing construction and demolition waste.	During the walkover it was noted that there were a number of small mounds of earth containing construction and demolition waste on the north-eastern and south-western corners of the junction of Malahide Road and the R139 at Clarehall. The mounds of earth extended down the Malahide Road between R139 and Belcamp Lane.	Malahide road between R139 and Belcamp Lane.	Medium	Medium value on a local scale

Category	Feature	Description	Location	Importance	Justification
Potential Contaminated Land	Petrol Stations	A number of petrol stations were identified during the walkover along the Malahide Road: Tesco Clarehall; Malahide Road Retail Park; opposite Danieli Road in Artane and just north of Collins Avenue in Donnycarney,	Tesco Clarehall; Malahide Road Retail Park; opposite Danieli Road in Artane and just north of Collins Avenue in Donnycarney,	Medium	Medium value on a local scale
Potential Contaminated Land	Historical Electrical Substation	25-inch mapping - North of Fairview Park - adjacent to Proposed Scheme (less than 20m)	North of Fairview Park - adjacent to Proposed Scheme (less than 20m)	Medium	Medium value on a local scale
Potential Contaminated Land	Historical Quarry	6-inch mapping – Approximately 175m west of the Proposed Scheme at Thorndale Drive.	Approximately 175m west of the Proposed Scheme at Thorndale Drive.	Medium	Medium value on a local scale
Potential Contaminated Land	Historical Dispensary	6-inch Cassini and 25-inch mapping – Located at Coolock Village opposite St Brendan’s Church.	Located at Coolock Village opposite St Brendan’s Church.	Medium	Medium value on a local scale
Potential Contaminated Land	Historical Poultry Farm	6-inch Cassini mapping – At the north-east corner of the Malahide Road Industrial Park.	At the north-east corner of the Malahide Road Industrial Park.	Medium	Medium value on a local scale
Potential Contaminated Land	Historical Graveyard	6-inch and 25-inch mapping – Located at St John’s Church north of the River Santry east of the Propose Scheme.	Located at St John’s Church north of the River Santry east of the Propose Scheme.	Medium	Medium value on a local scale
Potential Contaminated Land	Historical Graveyard	6-inch and 25-inch mapping – Located north of Pinebrook Rise west of the Proposed Scheme.	Located north of Pinebrook Rise west of the Proposed Scheme.	Medium	Medium value on a local scale
Potential Contaminated Land	Historical Pumping Station	6-inch Cassini – 50m south of Marino Crescent Park across the Clontarf Road.	50m south of Marino Crescent Park across the Clontarf Road.	Medium	Medium value on a local scale

### **14.3.5 Conceptual Site Model**

A Conceptual Site Model (CSM) was developed based on all publicly available data.

The Proposed Scheme is predominantly underlain by made ground over alluvium over glacial till over limestone bedrock. The relevant subsections of the Proposed Scheme are presented in Table 14.28 to Table 14.29 along with the fill height (average and maximum) cut height (average and maximum) and the soils and geology at each earthwork area.

**Table 14.28: Conceptual Site Model - Mayne River Avenue to Gracefield Road**

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Belmayne-Malahide Road Shopping Centre (Ch A3050 to A4500)	1,450	At Grade	0	0	0	0	Road pavement and foundation on boulder clay	0.5	Localised pavement reconstruction works, and roundabout reconstruction works.
Malahide Road Shopping Centre to St Brendan's Drive (Ch A4500 to A5600)	1,100	At Grade	0	0	0	0	Road pavement and foundation on boulder clay	0.5	Localised pavement reconstruction works.

**Table 14.29: Conceptual Site Model - Gracefield Road to Marino Mart / Fairview**

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Malahide Road Artane: St Brendan's Drive to Kilmore Road (Ch A5600 to A6550)	950	At Grade	0	0	0	0	Road pavement and foundation on boulder clay	0.5	Localised pavement reconstruction works, and roundabout reconstruction works.
Kilmore Road to Casino Park (Ch A6550 to A7750)	1200	At Grade	0	0	0	0	Road pavement and foundation on boulder clay	0.5	Localised pavement reconstruction works. Widening into DCC park
Casino Park to Clontarf Road (Ch A7750 to A8730)	980	At Grade	0	0	0	0	Road pavement and foundation on boulder clay	0.5	Localised pavement reconstruction works. Widening into private property, boundary reinstatement as per existing

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

#### 14.4.1.1 Mayne River Avenue to Gracefield Road - Malahide Road

- The construction activities in this section will include reconstitution, widening and resurfacing of both the roads and the footpaths, new kerbs, additional signage, new road marking and traffic lights, new street furniture and landscaping works. Boundary walls, fences and gates will be constructed where required.
- A new bus turnaround facility is proposed to be built at Priorswood Road.
- The existing roundabout at Gracefield Road / Malahide Road and Blunden Drive to be converted to a signalised junction.
- The main construction compound has been identified in this section within the green area between Buttercup Park and Malahide Road. The Construction Compound will be used to store materials, provide welfare and storage facilities for construction personnel.
- Some minor utility diversions and / or protections will be required.

#### 14.4.1.2 Gracefield Road to Marino Mart / Fairview - Malahide Road

- The main construction activities at this section will include reconstitution, widening and resurfacing of both the roads and the footpaths, new kerbs, additional signage, new road marking and traffic lights, new bus stops, new street furniture and landscaping works. Boundary walls, fences and gates will be constructed where required.
- Some minor utility diversions and / or protections will be required.

#### 14.4.1.3 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 the Do Nothing scenario the Proposed Scheme would not be implemented and there would be no resulting impacts on the 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 14.30:

- Loss or damage of topsoil;
- Excavation of potentially contaminated ground;
- Loss of future quarry or pit reserve;
- Loss or damage of proportion of aquifer; and
- Change to 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 resource which if removed or damaged can result in a permanent irreversible negative impact. The potential ways in which this can occur as a result of the Proposed Scheme are as follows:

- There is the potential for materials on site to be spilled resulting in the pollution of the topsoil. For example, raw or uncured concrete and grouts, washed down water from exposed aggregate surfaces, cast-in-place concrete from concrete trucks, fuels, lubricants and hydraulic fluids for equipment used on the development site, 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.
- 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 the above impacts are likely to occur at these locations. Topsoil will be encountered when establishing Construction Compound CL1 which will be located at the green area between Buttercup Park and Malahide Road.

The magnitude of these impacts of 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 permanent small adverse impact is slight.

The impact of the Proposed Scheme on the alluvium, marine sediments and marine sands 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 Ground**

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

Exposure of locations of contamination and excavation of contaminated soil may potentially lead to a risk to the surrounding environment or underlying soil if not dealt with in an appropriate manner in accordance with the Environmental Protection Agency guidance on Land Contamination. 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 14.22 and include stockpiles of made ground, petrol stations, old burial grounds and the historic electrical substation in Fairview.

The magnitude of this impact is small adverse as it results in the excavation of a small proportion of 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. This can result in a permanent irreversible loss of the in-situ characteristics of the land, soils and geology area. There are no notable existing or historic quarries with the study area of the Proposed Scheme.

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 to high 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 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.

#### **14.4.3.5 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 14.30: Summary of Potential Construction Phase Impacts

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
<b>Loss or Damage of Topsoil</b>									
Topsoil	BminSW & DW	Between Belcamp and Darndale and in pockets at Coolock and Marino.	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate / Slight
Alluvium	AlluvMIN	Along the River Mayne and River Santry.	Medium	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible
Marine Sediments	MarSed	At Clontarf Road.	Medium	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible
Marine Sands and Gravels	MarSands	At Clontarf Road.	Medium	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible
Windblown sands	Wsd	At Clontarf Road.	Medium	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible
<b>Excavation of Potentially Contaminated Ground</b>									
Potential Contaminated Land	Earth mounds containing construction and demolition waste.	Malahide Road between R139 and Belcamp Lane.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Contaminated Land	Petrol Stations	Tesco Clarehall; Malahide Road Retail Park; opposite Danieli Road in Artane and just north of Collins Avenue in Donnycarney,	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Historical Electrical Substation	North of Fairview Park - adjacent to Proposed Scheme (less than 20m)	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Contaminated Land	Historical Quarry	Approximately 175m west of the Proposed Scheme at Thorndale Drive.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Contaminated Land	Historical Dispensary	Located at Coolock Village opposite St Brendan's Church.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Potential Contaminated Land	Historical Poultry Farm	At the north-east corner of the Malahide Road Industrial Park.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Contaminated Land	Historical Graveyard	Located at St John's Church north of the River Santry east of the Propose Scheme.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Contaminated Land	Historical Graveyard	Located north of Pinebrook Rise west of the Proposed Scheme.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Contaminated Land	Historical Pumping Station	50m south of Marino Crescent Park across the Clontarf Road.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licensed Facilities	Wood-Pinecraft Limited	Malahide Road Industrial Park - 230m west of the Proposed Scheme	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licensed Facilities	Crown Paints Ireland Ltd.	Malahide Road Industrial Park - 50m west of the Proposed Scheme	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licensed Facilities	Mondelez Ireland Production Ltd.	Malahide Road Industrial Park - 270m west of the Proposed Scheme	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight
<b>Loss of Future Quarry or Pit Reserve</b>									
Crushed rock aggregate	Moderate to high potential	North of Northern Cross, at Coolock, at Donnycarney and Marino.	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible
Crushed rock aggregate	High potential	At Donnycarney and east of Marino.	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible
Granular aggregate	Moderate potential	North of Northern Cross, at Coolock and east of Marino.	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible
Granular aggregate	High potential	Between Casino Park and Clontarf Road.	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Granular aggregate potential	Very High potential	West of R107 between Casino Park and Brian Road.	High	Marginally extractable mineral resource	Negative	Permanent	Local	Negligible	Imperceptible
<b>Loss or Damage of Proportion of Aquifer</b>									
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	Negligible	Imperceptible
<b>Change to Groundwater Regime</b>									
Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Change to groundwater regime	Negative	Temporary	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 14.31.

### **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 topsoil 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 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 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 the Construction Compound. 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 will address such aspects as containment measures, emergency discharge routes, a list of appropriate equipment and clean-up materials and notification procedures to inform the relevant environmental protection authority. Refer to Appendix A5.1 CEMP in Volume 4 of this EIAR.

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

The CEMP also addresses good construction management practices that will be employed to prevent the risk of pollution of 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 are 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 or hydrogeology as a result of the construction of the Proposed Scheme.

**Table 14.31: 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
<b>Loss or Damage of Topsoil</b>											
Topsoil	BminSW	Between Belcamp and Darndale and in pockets at Coolock and Marino.	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Moderate / Slight	Negligible	Imperceptible
Alluvium	AlluvMIN	Along the River Mayne and River Santry.	Medium	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Topsoil	Deep well drained (Mainly basic)	Between Belcamp and Darndale and in pockets at Coolock and Marino.	High	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Marine Sediments	MarSed	At Clontarf Road.	Medium	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Marine Sands and Gravels	MarSands	At Clontarf Road.	Medium	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Windblown sands	Wsd	At Clontarf Road.	Medium	Loss or damage of fertile soil	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
<b>Loss of Future Quarry or Pit Reserve</b>											
Crushed rock aggregate	Moderate to high potential	North of Northern Cross, at Coolock, at Donnycarney and Marino.	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Crushed rock aggregate	Very high potential	At Donnycarney and east of Marino.	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Granular aggregate	Moderate potential	North of Northern Cross, at Coolock and east of Marino.	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Granular aggregate potential	Very High potential	Between Casino Park and Clontarf Road.	High	Marginally extractable mineral resource	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Granular aggregate potential	Very High potential	West of R107 between Casino Park and Brian Road.	High	Marginally extractable mineral resource	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
<b>Loss or Damage of Proportion of Aquifer</b>											
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

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	Loss or damage of proportion of aquifer through pollution.	Negative	Temporary	Local	Moderate Adverse	Moderate	Negligible	Imperceptible
<b>Change to Groundwater Regime</b>											
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
<b>Excavation of Potentially Contaminated Ground</b>											
Licensed Facilities	Wood-Pinecraft Limited	Malahide Road Industrial Park - 230m west of the Proposed Scheme	Medium	Excavation of contaminated ground	Negative	Temporary	Local	Small adverse	Slight	Negligible	Imperceptible
Licensed Facilities	Crown Paints Ireland Ltd.	Malahide Road Industrial Park - 50m west of the Proposed Scheme	Medium	Excavation of contaminated ground	Negative	Temporary	Local	Small adverse	Slight	Negligible	Imperceptible
Licensed Facilities	Mondelez Ireland Production Ltd.	Malahide Road Industrial Park - 270m west of the Proposed Scheme	Medium	Excavation of contaminated ground	Negative	Temporary	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Contaminated Land	Earth mounds containing construction and demolition waste.	Malahide road between R139 and Belcamp Lane.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Contaminated Land	Petrol Stations	Tesco Clarehall; Malahide Road Retail Park; opposite Danieli Road in Artane and just north of Collins Avenue in Donnycarney,	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Historical Electrical Substation	North of Fairview Park - adjacent to Proposed Scheme (less than 20m)	Medium	Excavation of contaminated ground	Negative	Temporary	Local	Negligible	Slight	Negligible	Imperceptible

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-mitigation Magnitude	Pre-mitigation Significance	Post-mitigation Magnitude	Post-mitigation Significance
Potential Contaminated Land	Historical Quarry	Approximately 175m west of the Proposed Scheme at Thorndale Drive.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Contaminated Land	Historical Dispensary	Located at Coolock Village opposite St Brendan's Church.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Contaminated Land	Historical Poultry Farm	At the north-east corner of the Malahide Road Industrial Park.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Contaminated Land	Historical Graveyard	Located at St John's Church north of the River Santry east of the Proposed Scheme.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Contaminated Land	Historical Graveyard	Located north of Pinebrook Rise west of the Proposed Scheme.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Contaminated Land	Historical Pumping Station	50m south of Marino Crescent Park across the Clontarf Road.	Medium	Excavation of contaminated ground	Negative	Permanent	Local	Small adverse	Slight	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).

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