Greater Dublin Drainage

Irish Water

Environmental Impact Assessment Report: Volume 3 Part A of 6

Chapter 18 Soils and Geology

June 2018

Contents

18. Soils and Geology 1
18.1 Introduction 1
18.2 Methodology 3
18.2.1 Introduction 3
18.2.2 Guidelines 3
18.2.3 Application of Methodology 3
18.2.4 Study Area 4
18.2.5 Baseline Data Collection 5
18.2.6 Technical Limitations 9
18.3 Baseline Environment 9
18.3.1 Introduction 9
18.3.2 Regional Overview 10
18.3.3 Site Specific Information 11
18.3.4 Conceptual Site Model 23
18.4 Characteristics of the Proposed Project 25
18.4.1 Activities/Environment Matrix 25
18.5 Impact of the Proposed Project – Construction Phase 25
18.5.1 Proposed Abbotstown Pumping Station and the Proposed Wastewater Treatment Plant 26
18.5.2 Construction Phase Impacts for the Proposed Pipeline Routes (Terrestrial) 28
18.5.3 Proposed Outfall Pipeline Route (Marine Section) and Tunnel Bore Machine and Dredge Section 30
18.6 Impact of the Proposed Project – Operational Phase 33
18.7 Mitigation Measures 33
18.7.1 Introduction 33
18.7.2 Construction Phase 33
18.7.3 Operational Phase 38
18.7.4 Summary of Residual Impacts 38
18.8 Monitoring 41
18.9 Reinstatement 41
18.10 Difficulties Encountered in Compiling Required Information 41
18.11 References 41

18. Soils and Geology

This Chapter assesses the potential impacts on soils and geology during the Construction Phase and Operational Phase of the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project). Ground Investigations involving the drilling of boreholes and geophysical surveys were used to establish the baseline soils and geology of the areas beneath the proposed orbital sewer route, Abbotstown pumping station site, Wastewater Treatment Plant site and outfall pipeline route. Based on the results of these surveys, along with historical information and publicly available information, the impact the Proposed Project will have on the soils and geology environment has been assessed by classifying the importance of the relevant attributes and quantifying the likely magnitude of any impacts on these attributes. The Institute of Geologists of Ireland's (2013) *Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environmental Impact Statements* were followed in the preparation of this Chapter.

The general ground conditions across the Proposed Project area consist of the following:

- **Topsoil;**
- **Made ground;**
- **Alluvial estuarine deposits;**
- **Marine deposits;**
- **Glacial tills derived from limestone; and**
- **Fluvio-glacial sands and gravels.**

The bedrock geology beneath the Proposed Project area is mainly carboniferous limestones.

Based on the proposed construction methodology, the main impacts would be on agricultural soils across the Proposed Project area, the sterilisation of any potential aggregate or bedrock resources, encountering soft ground, encountering potentially contaminated soils, encountering soft marine sediments and impacting upon the marine environment and ecology at the location of the proposed outfall pipeline route (marine section), which is within the Baldoyle Bay proposed Natural Heritage Area/Special Area of Conservation/Special Protection Area, Ireland's Eye Special Area of Conservation and Rockabill to Dalkey Island Special Area of Conservation.

The impacts above will be mitigated through the proper management of the infrastructure during the Construction Phase and Operational Phase in the form of Construction Environmental Management Plans and the operating plans for the proposed Wastewater Treatment Plant/proposed outfall pipeline route (marine section) including the outfall discharge location. Excavations shall be kept to a minimum across the alignment using microtunnelling. Where possible, excavated materials shall be reused on-site to minimise the amount of materials requiring disposal off-site. Best practice methods shall be employed during the construction of the proposed outfall pipeline route (marine section) to minimise impacts on soils and geology in the marine environment.

18.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) considers and assesses the of the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project) on soils and geology. Measures to mitigate any likely significant adverse impacts of the Proposed Project on soils and geology near the Proposed Project are proposed within this Chapter.

This Chapter sets out the methodology (Section 18.2), describes the baseline environment (Section 18.3) and summarises the main characteristics of the Proposed Project which are of relevance for soils and geology (Section 18.4). The likely significant impacts of the Proposed Project on soils and geology are described (Section 18.5 and Section 18.6). Measures are proposed to avoid and/or mitigate any likely significant impacts (Section 18.7) and predicted residual impacts are described (Section 18.7.4). The Chapter concludes with a set

of recommendations for monitoring (Section 18.8) and details of any reinstatement that will be required (Section 18.9).

The Proposed Project will form a significant component of a wider strategy to meet future wastewater treatment requirements within the Greater Dublin Area as identified in a number of national, regional and local planning policy documents. The plant, equipment, buildings and systems associated with the Proposed Project will be designed, equipped, operated and maintained in such a manner to ensure a high level of energy performance and energy efficiency.

The table below includes a summary of the Proposed Project elements. A full description of the Proposed Project is detailed within Volume 2 Part A, Chapter 4 Description of the Proposed Project of this EIAR.

Proposed Project Element	Outline Description of Proposed Project Element
Proposed Wastewater Treatment Plant (WwTP)	• WwTP to be located on a 29.8 hectare (ha) site in the townland of Clonshagh (Clonshaugh) in Fingal. • 500,000 population equivalent wastewater treatment capacity. • Maximum building height of 18m. • Sludge Hub Centre (SHC) to be co-located on the same site as the WwTP with a sludge handling and treatment capacity of 18,500 tonnes of dry solids per annum. • SHC will provide sustainable treatment of municipal wastewater sludge and domestic septic tank sludges generated in Fingal to produce a biosolid end-product. • Biogas produced during the sludge treatment process will be utilised as an energy source. • Access road from the R139 Road, approximately 400m to the southern boundary of the site. • Egress road, approximately 230m from the western boundary of the site, to Clonshaugh Road. • A proposed temporary construction compound to be located within the site boundary.
Proposed Abbotstown pumping station	• Abbotstown pumping station to be located on a 0.4ha site in the grounds of the National Sports Campus at Abbotstown. • Abbotstown pumping station will consist of a single 2-storey building with a ground level floor area of 305m^2 and maximum height of 10m and a below ground basement 17m in depth with floor area of 524m^2 incorporating the wet/dry wells. • The plan area of the above ground structure will be 305m^2 and this will have a maximum height of 10m. • A proposed temporary construction compound to be located adjacent to the Abbotstown pumping station site.
Proposed orbital sewer route	• The orbital sewer route will intercept an existing sewer at Blanchardstown and will divert it from this point to the WwTP at Clonshagh. • Constructed within the boundary of a temporary construction corridor. • 13.7km in length; 5.2km of a 1.4m diameter rising main and 8.5km of a 1.8m diameter gravity sewer. • Manholes/service shafts/vents along the route. • Odour Control Unit at the rising main/gravity sewer interface. • Proposed temporary construction compounds at Abbotstown, Cappoge, east of Silloge, Dardistown and west of Collinstown Cross to be located within the proposed construction corridor.
Proposed North Fringe Sewer (NFS) diversion sewer	• The NFS will be intercepted in the vicinity of the junction of the access road to the WwTP with the R139 Road in lands within the administrative area of Dublin City Council. • NFS diversion sewer will divert flows in the NFS upstream of the point of interception to the WwTP. • 600m in length and 1.5m in diameter. • Operate as a gravity sewer between the point of interception and the WwTP site.
Proposed outfall pipeline route (land based section)	• Outfall pipeline route (land based section) will commence from the northern boundary of the WwTP and will run to the R106 Coast Road. • 5.4km in length and 1.8m in diameter. • Pressurised gravity sewer. • Manholes/service shafts/vents along the route. • Proposed temporary construction compounds (east of R107 Malahide Road and east of Saintdoolaghs) located within the proposed construction corridor.
Proposed outfall pipeline route (marine section)	• Outfall pipeline route (marine section) will commence at the R106 Coast Road and will terminate at a discharge location approximately 1km north-east of Ireland's Eye. • 5.9km in length and 2m in diameter. • Pressurised gravity tunnel/subsea (dredged) pipeline. • Multiport marine diffuser to be located on the final section. • Proposed temporary construction compounds (west and east of Baldoyle Bay) to be located within the proposed construction corridor.

Proposed Project Element	Outline Description of Proposed Project Element
Proposed Regional Biosolids Storage Facility	• Located on an 11ha site at Newtown, Dublin 11. • Maximum building height of 15m. • Further details and full impact assessment are provided in Volume 4 Part A of this EIAR.

The total Construction Phase will be approximately 48 months, including a 12 month commissioning period to the final Operational Phase. The Proposed Project will serve the projected wastewater treatment requirements of existing and future drainage catchments in the north and north-west of the Dublin agglomeration, up to the Proposed Project's 2050 design horizon.

Please note that the soils and geology impact assessment of the proposed RBSF aspect of the Proposed Project is addressed in Chapter 7 Land and Soils in Volume 4 Part A of this EIAR.

18.2 Methodology

18.2.1 Introduction

The following section outlines the legislation and guidelines considered, and the adopted methodology for preparing this Chapter.

18.2.2 Guidelines

This Chapter has been prepared using the following guidelines:

- *Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environmental Impact Statements* (Institute of Geologists of Ireland (IGI) 2013);
- *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements* (Environmental Protection Agency (EPA) 2003);
- *Guidelines on the Information to be contained in Environmental Impact Statements* (EPA 2002);
- *Revised Guidelines on the Information to be contained in Environmental Impact Statements* (EPA 2015a);
- *Advice Notes for Preparing Environmental Impact Statements* (EPA 2015b); and
- *Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA 2017).

Where there are differences between the documents, the most recent versions are used.

18.2.3 Application of Methodology

The potential impact of the Proposed Project on the soils and geology environment has been assessed by classifying the importance of the relevant attributes and quantifying the likely magnitude of any impact on these attributes.

This impact assessment methodology is in accordance with the *Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements* (IGI 2013).

The document outlines a 13-step methodology which is divided across four distinct elements:

- Initial Assessment;
- Direct and Indirect Site Investigation;
- Mitigation Measures, Residual Impacts and Final Impact Assessment; and
- Completion of the Soils, Geological and Hydrogeological Sections of the EIAR.

The initial assessment of the Proposed Project area is outlined in Section 18.3 and presents a description of the past and present uses of the land across the alignment which may have a bearing on the Proposed Project. This section also describes the nature of the ground conditions beneath the alignment, which includes, but is not limited to, the route, structures and lands which will be accessed both temporarily and permanently for the construction of the Proposed Project based on both site specific and neighbouring site investigation data, obtained from available sources as described below.

Section 18.3.3 provides discussion on the data available from the site specific investigations carried out in August 2013 and April 2015. This, along with other sections from within Section 18.3, looks at the regional setting of the Proposed Project and corresponds to the second element of the methodology, direct and indirect site investigation.

The outcome from examining this available data is a Conceptual Site Model (CSM), which is outlined in Section 18.3.4 The CSM is a summary of geological conditions along the alignment which considers the impact of the Proposed Project. Based on the derived CSM, the area across the Proposed Project is classified as generally a Type A environment (passive geological environments – areas of thick low permeability subsoils), but with localised areas, such as around Huntstown Quarry, being classed as Type C (manmade dynamic hydrogeological environment, nearby groundwater abstraction, and quarrying activities) and Portmarnock and the two golf courses as Type E (groundwater dependent ecosystem – wetlands and nearshore area) based on the criteria outlined in the guidelines. It should be noted that this Chapter looks at soils and geology only. hydrology and hydrogeology are dealt with in Chapter 17 Hydrology and Hydrogeology in Volume Part A.

Section 18.4 outlines the characteristics of the Proposed Project. A Feature Importance ranking, based on Table C2 ‘Criteria for Rating Site Importance of Geological Features (NRA 2008)’ from the *Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environmental Impact Statements* (IGI 2013), has been assigned to each feature affected by the Proposed Project. Section 18.5 and Section 18.6 lists the possible impacts associated with the construction of the proposed pipeline routes.

Section 18.7 outlines the avoidance, remedial and mitigation measures associated with the works in accordance with the above methodology.

This Chapter has interactions with the following chapters in Volume 3 Part A of this EIAR:

- Chapter 4 Description of the Proposed Project;
- Chapter 9 Biodiversity (Marine);
- Chapter 10 Biodiversity (Marine Ornithology);
- Chapter 13 Traffic and Transport;
- Chapter 14 Air Quality, Odour and Climate;
- Chapter 15 Noise and Vibration;
- Chapter 17 Hydrology and Hydrogeology; and
- Chapter 20 Waste.

18.2.4 Study Area

The soils and geology study area for the Proposed Project extends 100m either side of the proposed orbital sewer route and outfall pipeline route (land based section and marine section), and within 2km of the proposed Abbotstown pumping station and the proposed WwTP.

18.2.5 Baseline Data Collection

Introduction

In order to identify and quantify the potential impacts of the Construction Phase and Operational Phase of the Proposed Project, it is first necessary to undertake a detailed study of the existing (baseline) geological environment of the study area. The existing soils and geology conditions in the area have been interpreted from both desk study information and from project-specific site investigation.

A windshield survey of the site was carried out in February 2012. Site walkovers were carried out at various stages, particularly during the site investigation works.

Statutory consultation was carried out in 2013. A list of the consultees is included in Appendix 1 of the *Greater Dublin Drainage EIS Scoping Stage – Consultation Brief* (Jacobs Tobin 2013), and a list of the responses as included in Appendix A2.1 of this EIAR.

While there was an extensive list of statutory consultees, the following bodies would be particularly relevant to this Chapter:

Local Authorities

- Fingal County Council (FCC)

Government Departments

- Department of Communications, Climate Action and Environment (DoCCAE);
- Department of Housing, Planning and Local Government; and
- Department of Agriculture, Food and the Marine.

State/Semi-State Organisations

- An Bord Pleanála;
- EPA;
- Geological Survey of Ireland (GSI);
- Iarnród Éireann;
- Marine Institute;
- National Parks and Wildlife Service (NPWS);
- Office of Public Works;
- Teagasc; and
- Transport Infrastructure Ireland.

Please note that department names have changed during the development of this Chapter, and consultation may be addressed to a previous, superseded name. The names which these departments are referred to currently are provided.

Consultation with these relevant bodies, along with the other specialists on the Proposed Project team, is ongoing since 2013.

Desk Study Information

The following sources of information were reviewed in order to evaluate the soils and geological environment near the Proposed Project:

- Current and historical Ordnance Survey maps (1837-1842 and 1888-1913) available for the study area (1:2,500 and 1:10,560 scales), 2017;
- Aerial photography (2012 and 2016) of the study area;
- Aerial imagery from Google (imagery from 2001 to 2015) and Bing, accessed in 2017;
- McConnell, B, Philcox, M. and Geraghty, M. (2001) *Geology of Meath* 1:100,000 scale Bedrock Geology Map Series, Sheet 13, Meath, GSI;
- Geological maps of the site area produced by the GSI (2017) including:
    - Quaternary Maps (GSI);
    - Bedrock Mapping;
    - National Landslide Database (GSI);
    - Karst Database (GSI);
    - INFOMAR Seabed Mapping;
- Historic Mine Sites - Inventory and Risk Classification;
- British Geological Survey (BGS) 1:250,000 Offshore Bedrock Map;
- Teagasc and the EPA Irish Soil Information System (Teagasc and the EPA 2017);
- Corine Land Cover datasets, (European Environment Agency 2006);
- *The Peatlands of Ireland* (An Foras Talúntais 1981);
- Irish Soil Information System, 1:250,000 (Teagasc 2014);
- Directory of Active Quarries, Pits and Mines in Ireland (GSI, 3rd Edition, 2001);
- Records from Planning Departments of Local Authorities, Assessment of Quarries under Section 261A, Control of Quarries, Planning and Development Act (2000-2010);
- State Mining and Prospecting Facilities (published twice annually by Exploration and Mining Division of the former Department of Communications, Energy and Naturall Resources (DCENR)(now the DoCCAE);
- Historic Mine Sites – Inventory and Risk Classification (EPA and GSI);
- Concrete Products Directory (Irish Concrete Federation);
- Proposed Natural Heritage Areas (pNHAs)/ Natural Heritage Areas (NHA) Sites (NPWS);
- NPWS;
- County Geological Sites (CGS) and Geological Heritage Areas (GHAs) (Local Authority Planning Office/Heritage Officers);
- Mining Heritage Trust of Ireland (old mining sites);
- Office of Licensing and Guidance, EPA;
- Local Authorities (Waste Management Section);
- Historical Maps (Ordnance Survey of Ireland/National Library of Ireland);
- Atlas of Ireland (Royal Irish Academy);
- Exploration and Mining Division of the DCENR;
- FCC Unregulated Landfill Data; and
- EirGrid. Dublin North Fringe 220kV Reinforcement Project Site Selection Review of Constraints, April 2011.

Historic Ground Investigations

Ground investigation (GI) data from previous projects within the study area included:

- N2 National Road GI (2001);
- M50 Motorway/N2 National Road Junction (2006);
- M50 Motorway/N3 National Road Junction (2006);
- Metro North (2008);
- Stockhole Lane to Cherryhound Road (2008); and
- Ballymun/M50 Motorway Junction (2008).

GI reports held by the GSI for the study area were sourced and details are as follows:

- Bord Gáis North Eastern Pipeline (GSI Report 717);
- Sports Campus Ireland (GSI Report 4534);
- Industrial/Commercial Development, Cappoge (GSI Report 4446);
- Fingal Effluent Sewer (GSI Report 6329);
- Ballymun Business Park (GSI Report 4265);
- Woodlawn Industrial Estate (GSI Report 6432);
- Woodlawn Industrial Estate (GSI Report 1475);
- Residential Development, Belcamp (GSI Report 6502);
- Residential Development, Portmarnock (GSI Report 5788); and
- Portmarnock Railway Station (GSI Report 4285).

Project Specific Information

Preliminary GIs were commissioned for the EIA Report and details of these are as follows:

- Techworks Marine, Greater Dublin Drainage Scheme, FCC, TW/12/PRJ007, 19 September 2012 (Environmental Monitoring Buoy Deployment);
- Techworks Marine, Greater Dublin Drainage Scheme, Hydrographic Survey Report GEO13_GDD, FCC, TW/13/PRJ-012, 30 May 2013;
- Techworks Marine, Greater Dublin Drainage Scheme, Sub-bottom Analysis, FCC, TW/13/PRJ-012, 14 June 2013;
- Apex Geoservices, Summary Report on the Bathymetric and Geophysical Data Integration for the Greater Dublin Drainage Scheme for Techworks Marine, Report No. AGL13110, 2 August 2013;
- IGSL Ltd., Greater Dublin Drainage Scheme Preliminary Ground Investigation Contract – Phase 1, Report No. 16695, August 2013;
- Causeway Geotech, *Greater Dublin Drainage Ground Investigation – Phase 2 Terrestrial Investigation*, Report No. 14-645, April 2015;
- Apex Geoservices, Report on the Geophysical Investigation for Greater Dublin Drainage Scheme, Offshore Portmarnock, Dublin for Irish Water, Report No. AGL 15060_01, 1 December 2015;
- Causeway Geotech, Greater Dublin Drainage – Offshore Site Investigation of Outfall Pipeline, Report No. 15-664, January 2016; and
- Apex Geoservices, Report on the Geophysical Investigation for GDDP Portmarnock Golf Course, Dublin for Tobin Consulting Engineers and Irish Waters, Report No. AGL 15247_02, 18 February 2016.

The GI factual reports are included in Appendix A18.1.

A preliminary terrestrial site investigation was carried out in the context of the Alternative Sites Assessment (refer to Chapter 5 Consideration of Alternatives in Volume 2 Part A of this EIAR) along the Proposed Project. A number of land parcels were considered for the proposed WwTP locations and two possible outfall locations for the proposed outfall pipeline route by IGSL Ltd. between January 2013 and May 2013 and included the following:

- 17 trial pits;
- 22 cable percussive boreholes;
- 16 rotary core follow on, in selected cable percussive boreholes;
- 8 standpipes within the boreholes with rotary core follow on; and
- Geophysical surveys in three areas including 2D resistivity and seismic surveys.

The phase 2 site investigation was carried out by Causeway Geotech between November 2014 and February 2015. A total of 32 boreholes were constructed as part of the GI along the final alignment of the proposed pipeline routes. The boreholes were drilled with various techniques. Specifically:

- The method of light cable percussion boring (shell and auger) was used for the drilling of six boreholes (BH117, 120, 122, 134, 135 and 138). The boreholes were completed either at the predefined depth or on refusal;
- The method of rotary drilling was selected for the drilling of 12 boreholes (BH106–116 and 119). The boreholes were completed to the scheduled depth;
- A combination of the previous two methods was selected for the drilling of 14 boreholes (BH118, 121, 123–128, 130–133, 137 and 139). The boreholes were constructed using light cable percussion boring until refusal was met. After this point, rotary follow-on drilling was used; and
- The exploratory holes also included 13 trial pits (TP101–110 and 112–114) which were excavated to a maximum depth of 4.50m.

An offshore preliminary GI was carried out by ABCO/Causeway Geotech from 30 July 2015 to 22 August 2015. Additional land based works were carried out between 30 September 2015 and 5 October 2015. These works consisted of:

- 3 overwater boreholes, drilled off a jack-up barge (BH03, BH05 and BH08);
- Cable percussion boring through overburden;
- Rotary follow-on drilling by Geobor S wireline coring techniques to target completion depths within bedrock strata;
- 10 vibrocore seabed sediment sampling locations, completed off a jack-up barge; and
- 1 borehole drilled onshore at Portmarnock Beach by cable percussion boring with rotary follow-on drilling (BH01).

Geophysical Surveys

The Techworks Marine and Apex Geophysics investigations were carried out in relation to the offshore environment and the design of the proposed outfall pipeline route (marine section). Two phases of geophysical surveying were carried out in 2012 and 2015.

Phase I of the geophysical investigation was conducted by Techworks and Apex Geoservices Ltd. and included a bathymetric survey along with Sparker and CHIRP Seismic Data retrieval. Sparker and CHIRP both refer to the signal source used during seismic profiling. The Sparker operates at lower frequencies (500–2,000Hz) and is typically used where deeper penetration is required. The CHIRP system is a sub-bottom profiler that in contrast to the Sparker transmits across a sweep of higher frequencies (2–7kHz per pulse).

Phase II of the geophysical investigation was carried out by APEX Geoservices Ltd, and was a combined marine and terrestrial geophysical investigation. The marine investigation consisted of a multichannel analysis of surface waves (MASW), sub-bottom profiler single channel seismic reflection and seismic refraction surveys. The terrestrial investigation consisted of MASW and seismic refraction surveying.

The objectives of the geophysical GIs were to map the type and the thickness of the sediment layers, determine sediment stiffness, map the depth to bedrock, map variation in bedrock type and rock quality and determine engineering parameters. By using the data from the site investigation, this model was ground truthed and is presented in the Apex Geophysical Report (December 2015) contained in Appendix A18.1.

Drawings showing the locations of the GIs and the long section of the proposed pipeline routes are included in Appendix A18.2.

18.2.6 Technical Limitations

The data included in the geological assessment includes existing data from earlier investigations into the region as well as dedicated field surveys commissioned for the Proposed Project. The data collected provides a comprehensive geological dataset along the route of the Proposed Project.

The data points provide valuable information on the soils and geology environment at point locations. Between each point, the data are assessed by conservative interpretation. While soils and geology can vary, the exploratory locations have been selected following the completion of the comprehensive baseline data collection. This review was completed by studying local geological maps, aerial photography, historic GI and completing site walkovers to provide an understanding of the soils and geology. The location and the spacing of the exploratory locations was chosen in order to gain an understanding of the ground conditions. The GI findings for the majority of cases compared favourably with the baseline data collection desk study.

Based on the comparability of the GI and the baseline data collection, the information is deemed sufficient to complete the soils and geology evaluation.

18.3 Baseline Environment

18.3.1 Introduction

This Section describes the soils and geology within the study area. A regional overview is provided in terms of the geomorphology, topography, soils and solid geology of the local area followed by subsections identifying the Feature Importance ranking, in accordance with the IGI guidelines, of the agricultural soils, superficial deposits, bedrock geology, soft and unstable ground, contaminated land, karst solution features, mineral and aggregate resources and geological heritage sites within the study area.

When examining the baseline environment of the study area, the Proposed Project has been divided into its main elements for ease of presentation and due to the volume of information available.

The regional baseline soils and geology environment is presented on Figure 18.1 Subsoils and Figure 18.2 Bedrock Geology.

In Section 18.3.4, a CSM is presented on Drawing Nos. 32102902-2100 to 32102902-2108 and summarised in Table 18.5. The CSM plots the GI data within the study area along the existing ground level against the invert levels and chainage of the proposed pipeline routes. Table 18.4 presents additional information for each section of the project.

18.3.2 Regional Overview

The Proposed Project is generally located along the southern fringe of Fingal in north County Dublin, between Blanchardstown and Baldoyle, and in the marine environment off north County Dublin, between Baldoyle Bay and Ireland's Eye. This Section will discuss the following aspects of the region surrounding the Proposed Project: geomorphology and topography, soils and subsoils, and bedrock geology.

Regional Geomorphology and Topography

The western side of the Proposed Project area displays a gently undulating topography with an average elevation of approximately 50 metres above Ordnance Datum (mOD) with localised topographical highs generally synonymous with outcropping rock or near surface bedrock. There is a gradual drop in elevation across the Proposed Project area from west to east approaching the coast. Moving offshore, water depths in this area range from 0m to 25m Lowest Astronomical Tide. The seabed is gradually sloping eastward and is generally sandy in nature with varying depth to bedrock.

The landscape of north County Dublin 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, albeit only to a small extent in this area, since the ice sheet retreat.

The Proposed Project area intercepts a number of rivers and associated tributaries as outlined in Chapter 17 Hydrology and Hydrogeology in Volume 3 Part A of this EIAR.

The coastline in the vicinity of the proposed outfall pipeline route (marine section) is characterised by sandy beaches.

The Admiralty Charts for the area around Howth (Sheet 1415) show the water depth increases eastwards from Velvet Strand to a depth of up to 25m north of Ireland's Eye.

Regional Soils and Subsoils

The soils of north County Dublin are described in the National Soil Survey of Ireland (NSS) publication *Soil Associations of Ireland and Their Land Use Potential* (NSS 1980). The general soil map of Ireland published by the NSS (An Foras Talúntais) shows the area to be underlain by grey brown podzolics and gleys. Grey brown podzolics are leached soils which are characteristic of the flat to undulating topography of the area. The podzolics and gleys are usually formed from the calcareous parent material of limestone and shale of Irish Sea origin.

The soils in this area include topsoil, made ground, alluvium, marine deposits and drift. Drift is a general term applied to all mineral material (clay, silt, sand, gravel and boulders) transported by a glacier and deposited directly by, or from, the ice, or as fluvio-glacial deposits deposited by water from the ice. It generally applies to deposits laid down during the Pleistocene (Quaternary) glaciations. Drift can also be included under Holocene (Quaternary) deposits.

The drift geology of the area principally reflects the depositional process of the last glaciation. Typically, during the ice advance, boulder clays were deposited subglacially 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 sheet from the region, granular fluvio-glacial deposits were laid down in places by melt waters discharging from the front of the glacier. The drift geology of the area is shown in Figure 18.1 Subsoils (Sheet 1 of 3) Blanchardstown to Clonshagh to Figure 18.1 Subsoils (Sheet 3 of 3) Portmarnock to Marine Outfall

Location. Boulder Clay is expected to be encountered across the Proposed Project area. Limited urbanisation is noted along the alignment. Some pockets of made ground may be encountered in previously developed areas. More detail is provided in the site specific sections of this Chapter.

Alluvial deposits such as sands and silts are anticipated to be associated with any existing or historic rivers and their tributaries along the alignment, such as close to the Sillogue Stream or the Mayne River.

The ground conditions offshore are expected to be made up of marine sediments (8m to 20m thick) overlying glacial till on bedrock (Calp limestone).

Regional Bedrock Geology

The 1:100,000 GSI bedrock geology maps indicate that the majority of the study area is underlain by carboniferous limestone at depth. More specifically, it is shown to comprise of the Tober Colleen, Waulsortian, Lucan and Malahide Formations, which are described as calcareous shale, limestone conglomerate, massive unbedded lime-mudstone, dark limestone and shale (Calp) and argillaceous bioclastic limestone and shale respectively. The bedrock geology of the area is shown in Figure 18.2 Bedrock Geology Clonshagh to Blanchardstown (Sheet 1 of 3) to Figure 18.2 Bedrock Geology Portmarnock to Marine Outfall Location (Sheet 3 of 3). A series of parallel faults running mainly in a north-west to south-east direction are indicated in this region between Blanchardstown and Dublin Airport. Additional faulting is indicated in a north-north-west to south-south-east direction with associated fold axes running in a north-east to south-west direction.

Portmarnock Beach is underlain by the Malahide Formation. This formation is described as argillaceous bioclastic limestone and shale.

Ireland's Eye, which is located to the south of the proposed outfall pipeline route (marine section), is underlain by older Cambrian rocks of the Bray Group comprising Greywacke, Quartzite and Slate type rocks. The GSI maps indicate the presence of a fault near the proposed outfall pipeline route (marine section) trending in a north-west to south-east direction.

The BGS 1:250,000 offshore map indicates that the area between Portmarnock Beach and the proposed outfall pipeline route (marine section) is underlain by carboniferous rocks comprising mudstone, sandstone and limestones.

18.3.3 Site Specific Information

Geomorphology and Topography

The proposed orbital sewer route (with a total length of approximately 13.7km) will pass through mostly agricultural land as well as traversing a number of existing roads including the N2 National Road and the M1 Motorway. The topography along the proposed orbital sewer route rises from the Tolka River Valley, at approximately 40mOD, to in excess of 84mOD in the vicinity of the R122 Road (chainage 6,200m), before gradually dropping towards the proposed WwTP site at Clonshagh to the ground level of the order of 44mOD. The proposed orbital sewer route along this section will traverse the Santry River and the Mayne River at chainages 8,310m and 10,560m respectively. The proposed WwTP will be located in open agricultural land where the topography on the site slopes in a west to east direction from 45.00mOD to 39.00mOD with a central elevation of approximately 42.30mOD. The Cuckoo Stream (a tributary of the Mayne River) lies immediately north of the proposed WwTP site with the Mayne River itself approximately 400m south of the proposed WwTP site.

The proposed NFS diversion sewer will run for 600m from the R139 Road northwards into the proposed WwTP across mainly agricultural land. The topography along this route generally has a rising profile, from 36.30mOD

at the point of interception to approximately 40.20mOD at the main gate of the proposed WwTP and 44.50mOD at the inlet works. The proposed NFS diversion sewer will cross the Mayne River at chainage 0,050m.

The 5.4km proposed outfall pipeline route (land based section) from the proposed WwTP at Clonshagh to the R106 Coast Road will be routed in an easterly direction towards the coast between Baldoyle and Portmarnock through predominantly agricultural land. The topography along the proposed outfall pipeline route (land based section) is generally a falling profile from 39.00mOD at the boundary fence of the proposed WwTP to 4.00mOD at the R106 Coast Road. The proposed outfall pipeline route (land based section) will cross the Cuckoo Stream and a tributary of the Mayne River at chainages 0,050m and 4,100m, respectively.

The proposed outfall pipeline route (marine section) will extend for 5.9km and will include a multiport marine diffuser. The proposed outfall pipeline route (marine section) will commence in open fields west of the R106 Coast Road, north of Baldoyle, and will be routed in a north-east direction across Baldoyle Estuary to the public car park immediately north of Portmarnock Golf Club, where it will turn in an easterly direction terminating approximately 1km north-east of Ireland's Eye. The topography along this route generally has a falling profile from 9.00mOD at the R106 Coast Road to 2.80mOD in the green area at chainage 1,010m and -22.84mOD at the discharge location north-east of Ireland's Eye.

Agricultural Soils and Superficial Deposits

Superficial deposits refer to geological deposits associated with the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 2.6 million years from the present (British Geological Survey 2018).

The Irish Soil Information System[1] project has developed a national association soil map for Ireland, providing information on soil types and properties across Ireland.

Superficial deposits were established based on the Irish National Soil Map 1:250,000, the Teagasc Subsoil Map and relevant GI information along the proposed road development.

A summary of the superficial deposits are presented in Table 18.1. Made ground can be expected in shallow isolated pockets wherever urban development is encountered, be it for roads, services, site levelling or other means.

Proposed Abbotstown Pumping Station

The proposed site for the proposed Abbotstown pumping station is in a grassed and lightly forested area close to St. Francis' Hospice. The expected soil types in this area are described as grey-brown podzolics and gleys according to the NSS General Soils Map of Ireland.

The GSI subsoils map shown in Figure 18.1 Subsoils Blanchardstown to Clonshagh (Sheet 1 of 3) indicates that the subsoils are glacial tills derived from carboniferous limestone. BH108 was located within the proposed footprint of the proposed Abbotstown pumping station.

Proposed Orbital Sewer Route (Blanchardstown to Clonshagh)

The land along the proposed orbital sewer route is mainly occupied by agricultural fields, small wooded areas and a golf course. The expected soil types along this section are described as grey-brown podzolics and gleys according to the NSS General Soils Map of Ireland.

[1] The Irish Soil Information System project has developed a national association soil map for Ireland at a scale of 1:250,000. The project is co-funded by Teagasc and the EPA Science, Technology and Research & Innovation for the Environment (STRIVE) programme (Teagasc and the EPA 2018)

The GSI subsoils map shown in Figure 18.1 Subsoils Blanchardstown to Clonshagh (Sheet 1 of 3) to Figure 18.1 Subsoils Portmarnock to Proposed Outfall Location (Sheet 3 of 3) indicates that the subsoils are glacial tills derived from carboniferous limestone. Areas of made ground are shown at Cappoge, Coldwinters, the M50 Motorway Ballymun interchange and Dardistown while rock outcrops and fluvio-glacial sands and gravels are present at Abbotstown and Balseskin.

Proposed Wastewater Treatment Plant and North Fringe Sewer Diversion Sewer at Clonshagh

The proposed WwTP site is currently being used for agricultural purposes. The expected soil types in this section are described as grey-brown podzols and gleys on the NSS General Soils Map of Ireland.

The GSI subsoils map shown in Figure 18.1 Subsoils Blanchardstown to Clonshagh (Sheet 1 of 3) to Figure 18.1 Subsoils Portmarnock to Proposed Outfall Location (Sheet 3 of 3) indicates that the subsoils are glacial tills derived from carboniferous limestone. Based on these maps, no areas of made ground, rock outcrops or limestone sands and gravels are expected to be encountered. However, an unregulated landfill is noted to the north of the R139 Road in Figure 18.3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3) to Figure 18.3 Route Constraints Portmarnock to Marine Outfall Location (Sheet 3 of 3), and in this location, there is a possibility of encountering made ground. Mitigation measures SOIL CONST 2 to SOIL CONST 4 in Section 18.7.2 detail the mitigation measures in place to manage the excavation and handling of potentially contaminated soils.

The results of the preliminary GI indicate that the soil profile comprises topsoil overlying glacial till with lenses of fluvio-glacial granular deposits overlying limestone bedrock at depth. Made ground was not identified in any of the preliminary site investigation locations in this area.

Proposed Outfall Pipeline Route (Land Based Section)

According to the NSS General Soils Map of Ireland, the expected soil types along the proposed outfall pipeline route (land based section) are described as grey-brown podzolics and gleys. The GSI subsoils map shown in Figure 18.1 Subsoils Blanchardstown to Clonshagh (Sheet 1 of 3) to Figure 18.1 Subsoils Portmarnock to Proposed Outfall Location (Sheet 3 of 3) indicates that the subsoils are glacial tills derived from carboniferous limestone. Undifferentiated alluvial deposits have been mapped within the site boundaries between the townlands of Drumnigh and Maynetown. It is likely that some soft ground may be encountered in those areas.

Proposed Outfall Pipeline Route (Marine Section)

The offshore BGS sea sediment mapping (1:250,000) of the study area indicates it is underlain by undifferentiated Holocene sediments comprised mainly of sand. The site investigation was carried out in August 2015. A total of four boreholes (BH01, BH03, BH05 and BH08) and 10 vibrocores (BHV02 to BHV11) were undertaken as part of the GI. BH01 was drilled on the beach at Portmarnock near the proposed launch point for the proposed outfall pipeline route (marine section), while the rest of the boreholes and each of the vibrocores were located offshore, along the proposed outfall pipeline route (marine section).

The subsoils along the proposed outfall pipeline route (marine section) are comprised as follows:

- Marine deposits: granular deposits, comprising medium to very dense sands and gravels. The marine deposits extend from ground level (2.29mOD) to 12.9m depth (-10.61mOD) onshore and from seabed level (-14mOD at BH08) up to 6.2m depth (-20.2mOD) offshore; and
- Glacial till: stiff to very stiff grey sandy gravelly Clay, frequently with low cobble content and occasional bands of sand or gravel. The thickness of the glacial till varies from 2.2m to 12.2m. Generally, it is recorded around -11mOD.

Table 18.1: Superficial Deposits Within Study Area

Strata*	General Extent / Location	Proposed Abbotstown Pumping Station	Proposed Orbital Sewer Route	Proposed WwTP and NFS Diversion Sewer	Proposed Outfall Pipeline Route (Land Based Section)	Proposed Outfall Pipeline Route (Marine Section)
		Thickness Range (mbgl)				
Topsoil	Widespread	0–0.5	0.0–0.2	0–0.5	0–0.4	-
Made ground	Local pockets likely	Possible	Variable	Possible	Variable	-
Alluvial/estuarine deposits	Mainly Portmarnock	Possible	Possible	Possible	0–14	-
Marine deposits (sands and gravels)	Proposed outfall pipeline route (marine section) only	-	-	-	-	4.0–12.9
Glacial till derived from limestone	Widespread	0.5–2.8	0.2–3.7	0.5–16.5	0.4–5.1	1.6–12.2
Fluvio-glacial sands and gravels	Clonshagh WwTP, Portmarnock	-	-	5.5–7.0	05–1.5	-

*Strata indicated may not be present at all locations along the Proposed Project

Bedrock Geology

The underlying bedrock geology was determined based on the Bedrock Geology 1:100,000 online mapping (GSI) and relevant GIs along the route of the Proposed Project and is presented in Figure 18.2 Bedrock Geology Clonshagh to Blanchardstown (Sheet 1 of 3) to Figure 18.2 Bedrock Geology Portmarnock to Proposed Outfall Location (Sheet 3 of 3).

The underlying bedrock of the Proposed Project is predominantly carboniferous limestones comprising the Lucan, Tober Colleen, Waulsortian and Malahide Formations. Formation descriptions and their expected locations within the Proposed Project area are summarised in Table 18.2.

Proposed Abbotstown Pumping Station

The 1:100,000 GSI bedrock geology map (Sheets 13 and 16) of the area indicates that the underlying bedrock is comprised of carboniferous limestone of the Tober Colleen Formation.

During the project-specific GI, weathered bedrock was encountered in BH107 at 1.2m BGL. Intact unweathered limestone was encountered at 2.5m BGL. This was described as medium-strong thinly to thickly laminated dark-grey argillaceous limestone with bedding dipping sub-horizontally up to 40°. Associated jointing and calcite veining was also observed.

Proposed Orbital Sewer Route

The 1:100,000 GSI bedrock geology map (Sheets 13 and 16) of the area indicates that the underlying bedrock along the proposed orbital sewer route is comprised of the Lucan, Tober Colleen, Waulsortian and Malahide Formations (see Figure 18.2 Bedrock Geology Clonshagh to Blanchardstown (Sheet 1 of 3) to Figure 18.2 Bedrock Geology Portmarnock to Proposed Outfall Location (Sheet 3 of 3) and Table 18.2).

A number of bedrock faults and fold axes are indicated along the alignment of the proposed orbital sewer as shown on Figure 18.2 Bedrock Geology (Sheet 1 of 3) Clonshagh to Blanchardstown to Figure 18.2 (Sheet 3 of 3) Bedrock Geology Portmarnock to Marine Outfall Location.

Weathered bedrock was encountered in a number of boreholes along the alignment at depths ranging from 0.8m to 8.5mBGL. Intact unweathered limestone was encountered at 1.0mBGL to 11.5mBGL.

The bedrock encountered along the alignment was generally described as medium-strong thinly to thickly laminated dark-grey argillaceous limestone with bedding dipping sub horizontally up to 40°. Associated jointing and calcite veining was also observed.

Proposed Wastewater Treatment Plant and North Fringe Sewer Diversion Sewer at Clonshagh

The 1:100,000 GSI bedrock geology map (Sheets 13 and 16) of the area indicates that the underlying bedrock of the proposed WwTP site is comprised of the Lucan Formation to the West and the Tober Colleen Formation to the east, with the proposed NFS diversion sewer underlain entirely by the Tober Colleen Formation.

A synclinal bedrock fold axis is indicated on Figure 18.2 Bedrock Geology Clonshagh to Blanchardstown (Sheet 1 of 3) to Figure 18.2 Bedrock Geology Portmarnock to Proposed Outfall Location (Sheet 3 of 3) to the north-west of the proposed WwTP site, trending in a north-east to south-west direction.

Bedrock was not encountered in this location during the project-specific GI to 18mBGL.

Proposed Outfall Pipeline Route (Land Based Section)

The 1:100,000 GSI bedrock geology map (Sheets 13 and 16) of the area indicates that the underlying bedrock along the proposed outfall pipeline route (land based section) is the Tober Colleen Formation at the western end of the proposed outfall pipeline route (land based section) to Kinsealy, where the Waulsortian Formation is present for a small section of the route. The remainder of this proposed outfall pipeline route (land based section) is underlain by the Malahide Formation, as illustrated in Figure 18.2 Bedrock Geology Blanchardstown to Clonshagh (Sheet 2 of 3) and Figure 18.2 Bedrock Geology Portmarnock to Proposed Outfall Location (Sheet 3 of 3).

An anticlinal bedrock fold axis is shown on the geological maps in this area, trending north-east to south-west as can also be seen in Figure 18.2 Bedrock Geology Blanchardstown to Clonshagh (Sheet 2 of 3) and Figure 18.2 Bedrock Geology Portmarnock to Proposed Outfall Location (Sheet 3 of 3).

BH131 and BH132 both encountered limestone at depths of 4.5mbgl to 5.6mbgl. The limestone was described as argillaceous and carbonaceous, respectively, with thinly laminated bedding, dipping from 40 to 50^{o}

BH139 was completed near the R106 Coast Road at Portmarnock and was 78.4m deep. This borehole encountered bedrock from 16mBGL. The descriptions of the rock encountered appear consistent with the Malahide Formation.

Proposed Outfall Pipeline Route (Marine Section)

The 1:1,000,000 GSI bedrock geology map indicates that the onshore section of the proposed outfall pipeline route (marine section) is underlain predominantly by the Malahide Formation from within the Carboniferous Period. The BGS 1:250,000 geology map for the area indicates that the alignment of the proposed outfall pipeline route (marine section) will be underlain by carboniferous limestone.

The GSI has mapped a single fault trending in a north-west to south-east direction to the west of Ireland's Eye, as shown in Figure 18.2 Bedrock Geology Portmarnock to Proposed Outfall Location (Sheet 3 of 3). This intersects the alignment of the proposed outfall pipeline route (marine section) at approximately chainage 4,300m to 4,400m.

The bedrock recovered during the offshore GI is described as dark-grey argillaceous limestone varying from 8.7m to 16.8m Below Seabed Level. The top of the limestone is recorded as being weak and partially to highly weathered. The rock encountered at greater depths is defined as medium-strong to strong and unweathered to largely unweathered limestone. Rock types varying from limestone, siltstone, sandstone to mudstone were

encountered in BH05 and may be associated with nearby faulting based on the heavily fractured nature of the recovered core.

Summary of Bedrock Geology

Table 18.2 summarises the different rock formations expected within the study area.

Table 18.2: Rock Formations within the Study Area in Increasing Age

Geological Period	Formation	Description	General Extent/Location
Carboniferous	Lucan	Dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey.	Located to the western side of the proposed WwTP site. Not encountered anywhere else.
	Tober Colleen	Dark-grey, calcareous, commonly bioturbated mudstones and subordinate thin micritic limestones.	Encountered in all study areas.
	Waulsortian	Dominantly pale-grey crudely bedded or massive limestones.	Proposed orbital sewer route and Kinsealy, in the proposed outfall pipeline route (land based section)
	Malahide	The lower part of the formation is composed of calcareous shales, siltstones and sandstones, and occasional thin limestones at its base.	Proposed orbital sewer route, Kinsealy to Portmarnock and the proposed outfall pipeline route (marine section).

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. As the Proposed Project area is underlain predominantly by carboniferous limestone, the risk of karst was assessed based on an analysis of desk study information such as the GSI Karst Database and site specific intrusive and non-intrusive site investigation.

The GSI Karst Database was consulted, and no karst features were indicated as being present within the study area. The geophysical surveys and site investigation information for the Proposed Project do not indicate the presence or potential presence of karst across the Proposed Project area.

As such, the risk of karst is deemed negligible and will not be further assessed.

Soft and/or Unstable Ground

Soft deposits consist of peat, alluvium or very soft cohesive material. Construction on these soils may undergo settlement or other undesirable ground movements. Where identified, special measures may be required such as excavation and replacement or other ground improvement measures. Various sources of information were consulted in establishing these areas along the study area and include:

- Teagasc subsoil map, produced by Teagasc, EPA and GSI;
- GSI database of historical landslides;
- EPA subsoil mapping;
- GI data; and
- Site Walkover.

The Teagasc subsoil map outlined locations of soft soil within the study area, and the GSI database shows no recorded landslide events within the study area.

The following sections outline where soft and/or unstable ground such as alluvial deposits are expected to be encountered across the alignment and has assigned a Feature Importance ranking based on Table C2 ‘Criteria for Rating Site Importance of Geological Features (NRA 2008)’ from the *Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environmental Impact Statements* (IGI 2013).

Proposed Abbotstown Pumping Station

There is no indication from the publicly available data or the site specific site investigation that soft ground is present at the proposed Abbotstown pumping station site.

Proposed Orbital Sewer Route

Alluvial deposits and organic deposits are expected at the Santry River, which flows through Silloge Park Golf Club at chainage 8,310. This is shown on Figure 18.1 Subsoils Blanchardstown to Clonshagh (Sheet 1 of 3) to Figure 18.1 Subsoils Portmarnock to Proposed Outfall Location (Sheet 3 of 3). A further crossing of the Mayne River occurs at chainage 10+560 at the location of BH123.

There is no indication from the publicly available data that soft ground is present at any other location along this section of the route, nor were any soft soils encountered during the GI.

Proposed Wastewater Treatment Plant and North Fringe Sewer Diversion Sewer at Clonshagh

There is no indication from the publicly available data or from the preliminary GI that soft ground is present at the proposed WwTP site.

Proposed Outfall Pipeline Route (Land Based Section)

The alignment is expected to cross the Cuckoo Stream twice at chainage 0+050 and 4+100 and may encounter localised soft alluvial or organic deposits at these locations.

Loose sands and soft silts are present on the Portmarnock spit, and based on the presence of estuarine deposits on the GSI soil maps, soft ground is expected between the townlands of Drumnigh and Maynetown. Estuarine deposits are typically associated with low energy environments and may comprise clay, silt, sand and gravels, as well as organic material.

Proposed Outfall Pipeline Route (Marine Section)

Based on the soil descriptions and the *in situ* testing, some soft sediments were encountered in the marine sediments.

Table 18.3: Geological Feature Importance for Soft Soils Within the Study Area

Feature	Description	Feature Importance Ranking	Criteria
Santry River	Crossing at watercourse	Low	Volume of soft soil underlying the alignment is small on a local scale.
Cuckoo Stream	Crossing at watercourse	Low	Volume of soft soil underlying the alignment is small on a local scale.
Portmarnock	Alluvial/estuarine deposits	Low	Volume of soft soil underlying the alignment is small on a local scale.

Contaminated Land

Various sources of information were consulted in assessing the study area for locations of potential contaminated land:

- CORINE land cover mapping;
- Teagasc soil map;
- EPA IPPC and IEL records;
- GI data; and
- All affected Local Authorities.

The EPA introduced the system of Integrated Pollution and Prevention Control licencing in 2004 to control the emissions, including air, water, waste and noise, from various industrial activities and to ensure that the

responsible sectors use the best available technology. Many of these have been replaced by Industrial Emissions Licenses over recent years.

There are no sites within the study area that have been granted a Waste Water Discharge Licence.

In 1996, the EPA began licensing certain activities in the waste sector which include landfills, transfer stations, hazardous waste disposal and other significant waste disposal and recovery activities. It has been determined, from consultation with FCC during the initial site assessment phase of the works in 2012, that there are two known historical (or legacy) landfills within the study area. Figure 18.3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3) to Figure 18.3 Route Constraints Portmarnock to Proposed Outfall Location (Sheet 3 of 3) indicates the locations of contaminated land related hazards across the study area.

Proposed Abbotstown Pumping Station

Abbotstown graveyard is shown on Figure 18. 3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3) and is located at chainage 1+200, approximately 170m to the north-east of the proposed Abbotstown pumping station site, approximately 30m from the proposed construction corridor (40m width) (50m from the centreline of the proposed orbital sewer route). It is unlikely that contaminated ground associated with this graveyard will be encountered during the construction of the proposed Abbotstown pumping station due to its distance from the alignment.

Proposed Orbital Sewer Route

There are two historical landfill sites located at Balseskin and Ballymun which the proposed orbital sewer route will pass through, requiring possible excavation of contaminated ground. The landfills are shown on the constraints map in Figure 18. 3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3). Mitigation measures SOIL CONST 2 to SOIL CONST 4 in Section 18.7.2 detail the mitigation measures in place to manage the excavation and handling of potentially contaminated soils.

There are two Industrial Emissions Licenses attached to the power station at the entrance to Huntstown quarry (P0777-02 and P0483-04). The quarry is shown in Figure 18. 3 Route Constraints (Sheet 1 of 3) Blanchardstown to Clonshagh. The alignment of the proposed orbital sewer route does not encroach on these licenced facilities.

There are two graveyards in close proximity to this section of the proposed orbital sewer route. The previously mentioned Abbotstown graveyard is shown on Figure 18. 3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3), approximately 30m from the proposed construction corridor (40m width) (50m from the centreline of the proposed orbital sewer route), and Dardistown Cemetery is also shown on Figure 18. 3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3) at chainage 12+050, approximately 40m from the proposed orbital sewer route (130m from its centreline).

Based on the available information, it is unlikely that contaminated ground associated with these graveyards will be encountered during the construction of the proposed orbital sewer route due to their relative distance.

Proposed Wastewater Treatment Plant and North Fringe Sewer Diversion Sewer at Clonshagh

An unregulated landfill is located along the northern side of the R139 Road and the proposed NFS diversion sewer is shown to pass through this area. During the works, any excavations will be monitored for the presence of waste, and any excavated materials will be disposed of to an appropriate disposal facility. Mitigation measures SOIL CONST 2 to SOIL CONST 4 in Section 18.7.2 detail the measures in place to manage the excavation and handling of potentially contaminated soils.

Proposed Outfall Pipeline Route (Land Based Section)

There is a graveyard at Kinsealy approximately 220m north of the proposed outfall pipeline route (land based section) as shown on Figure 18. 3 Route Constraints Blanchardstown to Clonshagh (Sheet 2 of 3). Based on the available information, it is unlikely that contaminated ground will be encountered during the construction of the proposed outfall pipeline route (land based section) due to its relative distance.

Proposed Outfall Pipeline Route (Marine Section)

Based on the samples recovered from the vibrocoring, there is no evidence of elevated contaminants within the shallow sediments.

Mineral/Aggregate Resources

Various datasets were consulted in establishing the economic geology of the study area including:

- GSI: Aggregate Potential Mapping;
- GSI: mineral localities; and
- EPA: active mine sites.

A detailed description of how the Aggregate Potential Mapping was developed is available on the GSI Website (https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=ee8c4c285a49413aa6f1344416dc9956) and states the following:

> *"The Aggregate Potential Mapping (APM) of Ireland was carried out by the Geological Survey Ireland (GSI) Minerals Section. The six-year term of the project run from Nov. 1st, 2007 to Oct. 31st, 2013."*

See Figure 18. 3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3) to Figure 18.3 Route Constraints Portmarnock to Proposed Outfall Location (Sheet 3 of 3) for details.

The existence of high or very high Aggregate Potential within the study area will result in a loss of available aggregate. However, such potential is beneficial during construction as material can be sourced on-site, removing the need to import suitable/acceptable material during the Construction Phase in its place.

No active metallic mines exist today in the study area. There is no record of underground mining in the area. Therefore, there would be a low risk of underground structure collapse due to underground excavations. As such, this assessment does not consider this feature any further.

Proposed Abbotstown Pumping Station

The area of the proposed Abbotstown pumping station is described as having a very low potential for Granular Aggregate, but a high potential for Crushed Rock Aggregate according to the Aggregate Potential Mapping data from the GSI. However, given the site's proximity to Connolly Hospital and the M50 Motorway, it is unlikely to be developed.

Proposed Orbital Sewer Route

There is one active quarry within the 100m buffer of the proposed orbital sewer route. Huntstown Quarry, shown on Figure 18. 3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3), is located directly adjacent to the route to the north-east of Blanchardstown. There are currently no plans to extend the footprint of the Huntstown Quarry. There is also a small quarry less than 300m to the south of the route at Balseskin.

There are also a number of historic quarries and sand and gravel pits within 1km of the route. It is not envisaged that the proposed orbital sewer route will affect any of the historical quarries or pits identified due to their distance from the alignment.

The alignment of the proposed orbital sewer route is described as having a very low potential for Granular Aggregate, but a high potential for Crushed Rock Aggregate according to the Aggregate Potential Mapping data from the GSI near the Blanchardstown end of the alignment. However, from Balseskin to Clonshagh, the area is described as having a low potential for Crushed Rock Aggregate and a moderate potential for Granular Aggregate located around the Silloge Golf Course. However, given the site's current land use, it is unlikely to be developed for aggregate extraction.

Proposed Wastewater Treatment Plant and North Fringe Sewer Diversion Sewer at Clonshagh

There are no active or historic quarries or sand and gravel pits within the proposed WwTP site.

The area around the proposed WwTP was not assigned a Granular Aggregate potential. The site was described as having a low potential for Crushed Rock Aggregate.

Proposed Outfall Pipeline Route (Land Based Section)

According to the GSI database, there are no active or historic quarries or sand and gravel pits within the proposed outfall pipeline route (land based section).

There is one area of very high potential for Crushed Rock Aggregate, but this is centred around St. Doolaghs/Balgriffin, located to the south of the alignment.

Proposed Outfall Pipeline Route (Marine Section)

According to the GSI database, there are no active or historic quarries or sand and gravel pits within this area.

There are no data on Aggregate Potential for offshore areas. However, given the presence of aggregate sources onshore, it would not be economically viable or practical to attempt to extract aggregates from the seabed.

Geological Heritage Areas

The Irish Geological Heritage Programme is a partnership between the GSI and the NPWS. The programme was developed to identify and document the geological heritage and protect and conserve it. Consultation was conducted with the GSI in order to identify all geological heritage sites within the study area.

Proposed Abbotstown Pumping Station

There are no GHAs or CGS within this area.

The absence of a GHA or GCS results in there being a negligible impact to geological heritage for this area.

Proposed Orbital Sewer Route

As confirmed by consultation with the GSI, the existing quarry at Huntstown is the only county geological heritage site within the 100m study area. This will not be impacted by the construction of the proposed orbital sewer route.

Proposed Wastewater Treatment Plant and North Fringe Sewer Diversion Sewer at Clonshagh

There are no GHAs or CGS within this area.

The absence of a GHA or GCS results in there being a negligible impact to geological heritage for this area.

Proposed Outfall Pipeline Route (Land Based Section)

Feltrim Quarry is located 2.5km to the north of the route at Kinsealy.

The absence of a GHA or GCS and the distance of Feltrim Quarry in relation to the proposed outfall pipeline route (land based section) results in there being a negligible impact to geological heritage for this section of the proposed outfall pipeline route (land based section).

Proposed Outfall Pipeline Route (Marine Section)

Ireland's Eye is a CGS due to the presence of well exposed outcrops of Cambrian greywacke, sandstone and quartzite along the cliffs and inland as outcrops.

These works are not expected to impact upon the CGS due to the distance from Ireland's Eye to the proposed outfall pipeline route (marine section).

Summary of Features of Geological Feature Importance

A summary of the geological features found within the study area are presented below in Table 18.4. A Feature Importance ranking based on Table C2 'Criteria for Rating Site Importance of Geological Features (NRA 2008)' from the *Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environmental Impact Statements* (IGI 2013) has been assigned to each feature.

Table 18.4: Summary of Geological Features

ID	Feature Name/ID	Description/Location	Feature Importance Ranking	Criteria
Agricultural soils				
Whole alignment	Agricultural soils	Topsoils and upper soils across the whole alignment	High	Well drained and/or high fertility soils
Bedrock/aggregate resources				
Proposed Abbotstown pumping station and WwTP, Some crossings	Rock excavation	Excavation of bedrock for proposed Abbotstown pumping station and WwTP	Low	Uneconomically extractable resource
Soft ground				
Proposed pipeline routes (terrestrial)	Soft ground: poorly drained, low fertility soils	Excavate and replace soft soils beneath formation	Low	Volume of soft soils underlying the route is small on a local scale
Contaminated land				
Proposed pipeline routes (terrestrial) – Possibility along whole alignment	Contaminated ground	Belcamp lane, Balseskin and Ballymun historic landfills.	High	Large recent landfill site for mixed waste
Quarry resources				
Huntstown Quarry	Large existing quarry	Loss of future quarry reserves due to pipeline within 100m of the quarry	High	Moderately sized existing quarry or pit
Marine sediments				
Marine sediments/soft ground	Marine sediments	Proposed outfall pipeline (marine section) vibration of sediments	Medium	Volume of soft soils underlying the route is moderate on a local scale
Marine environment and ecology				
Marine sediments	Marine sediments	Mobilisation of sediments into the water column through the dredging process. Disturbance of seabed.	Medium	Attribute has a medium quality significance

18.3.4 Conceptual Site Model

A CSM was developed based on the GI data. The model includes the factual data within the study area that was gathered during the GIs. The information is presented on Planning Drawing Nrs 32102902-2100 to 32102902-2108 in plan and profile format with the profile illustrating the existing and proposed ground levels, earthwork sections, local GI logs and geophysical data along the centreline of the Proposed Project. See also Appendix A18.1 for all GI data.

The proposed pipeline routes are predominantly underlain by glacial till overlying carboniferous limestone at depth. The proposed pipeline routes will be located at an average depth range of 2 to 3m BGL. Table 18.5 describes the CSM of the site area.

Table 18.5: Conceptual Site Model

Feature/Location	Ground Level (mOD)		Invert (mOD)		Chainage	Construction Method	Ground Conditions
	Max	Min	Max	Min			
Proposed Abbotstown pumping station	54.61		51.98	39.87	Sec-1 1+000	See Section 4.6.2 of Chapter 4 Description of the Proposed Project in Volume 3 Part A of this EIAR	Glacial tills over limestone at 52.99mOD.
Proposed orbital sewer route	84.14	54.61	82.14	51.98	Sec-1 0+000 to Sec-1 13+600	See Section 4.5.10	Glacial tills over limestone at approx. 2.5mBGL at some locations. Some made ground.
Proposed WwTP and NFS diversion sewer at Clonshagh	44.24	35.5	41.35	33.04	Sec-1 13+700 to Sec-2 0+000	See Section 4.4.9	Glacial tills over fluvio-glacial gravels to 7.0mbgl. Bedrock not encountered.
Proposed outfall pipeline route (land based section)	35.5	9	33.04	1.53	Sec-2 0+000 to Sec-2 5+379	See Section 4.5.10	Glacial tills over limestone at approx. 4.5mBGL at some locations.
Proposed outfall pipeline route (marine section)	3.22	−22.84	−5.68	−25.8	Sec-4 0+000 to Sec-4 5+900	See Section 4.5.10	Marine sediments over glacial tills over rock. Rock from −15mOD to −22.7mOD.

Importance of Features

According to the NPWS website there are no pNHAs, Special Areas of Conservation (SACs) or Special Protection Areas (SPAs) along the proposed orbital sewer route and outfall pipeline route (land based section). However, Baldoyle Bay, which is located at the end of the onshore section of the proposed outfall pipeline route (marine section), is a pNHA and SAC due to the following features of interest:

- Mudflats and sandflats not covered by seawater at low tide;
- *Salicornia* and other annuals colonising mud and sand;
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); and
- Mediterranean salt meadows (*Juncetalia maritimae*).

Baldoyle Bay is also an SPA, as is Ireland's Eye.

Ireland's Eye SAC is also classified as such due to the existence of the perennial vegetation of stony banks and the vegetated sea cliffs of the Atlantic and Baltic coasts. Finally, the Rockabill to Dalkey Island SAC is also included due to the existence of reefs and harbour porpoise (*Phocoena phocoena*).

The construction activities may generate the following, which could impact upon the protected areas:

- Noise and vibration;
- Suspended sediments; and
- Disturbance and/or loss of habitats.

Further details on these areas are presented in Chapter 9 Biodiversity (Marine), Chapter 10 Biodiversity (Marine Ornithology) and Chapter 11 Biodiversity (Terrestrial and Freshwater Aquatic) in Volume 3 Part A of this EIAR and in Section 18.5.3 of this Chapter.

Environment Type

The environment along the alignment is varied and falls into a number of different categories in accordance with the Environment Types outlined in the IGI Guidelines. The following areas of note were identified:

- Type A environment – passive geological/hydrogeological environments – areas of thick low-permeability subsoils – Proposed Abbotstown Pumping Station, Proposed Orbital Sewer Route, Proposed WwTP and North Fringe Sewer; Proposed Outfall Pipeline Route and
- Type C environment – man-made dynamic hydrogeological environment. Nearby groundwater abstraction, and quarrying activities – Proposed Orbital Sewer Route near Huntstown Quarry.

18.4 Characteristics of the Proposed Project

A description of the Proposed Project and construction activities are provided in Chapter 4 Description of the Proposed Project in Volume 2 Part A of this EIAR.

This section of the EIAR outlines the key design features and the characteristics and activities of the Proposed Project of relevance to soils and geology. The potential impacts related to the Construction Phase are provided in Section 18.5 and the potential impacts related to the Operational Phase are provided in Section 18.6.

18.4.1 Activities/Environment Matrix

Assessments are required by the Activities/Environment Matrix in the IGI (2013) guidelines relating to the Proposed Project activities.

The following table outlines the required activities, considering the environmental type and also different activities which will be undertaken on-site during construction and operation, and the investigations, assessments and surveys which have been carried out to consider those activities.

Table 18.6: Details of Works Required Under the IGI (2013) Guidelines and How They Were Undertaken On-Site

Work Required under Activity and Type Class (based on IGI Guidelines)	Details of Works Completed on the Site
Earthworks	
Invasive site works to characterise nature, thickness, permeability and stratification of soils and subsoils	Site specific site investigation carried out across the proposed pipeline routes, WwTP and proposed temporary construction compounds.
Excavation of materials above the water table	
Site works to fully characterise the bedrock geology and in order to define the resource volume/weight according to the Pan European Reserves and Resources Reporting Committee Reporting Standard, e.g. trenching, drilling, geophysics	Site specific site investigation carried out across the proposed pipeline routes, WwTP and proposed temporary construction compounds.

18.5 Impact of the Proposed Project – Construction Phase

The potential soils and geology impacts during the Construction Phase are presented in this Section.

The key design features of relevance to avoid or reduce impacts to soils and geology features have been grouped as:

- **Proposed Abbotstown pumping station and the proposed WwTP**: This incorporates the SHC and includes the proposed Abbotstown pumping station, proposed WwTP and NFS diversion sewer at Clonshagh;

- **Proposed pipeline routes (terrestrial)**: These include the proposed orbital sewer route and the proposed outfall pipeline route (land based section); and
- **Proposed outfall pipeline route (marine section) and outfall location (microtunnelled section and dredged section)**: The entire length of the proposed outfall pipeline route (marine section) from the R106 Coast Road to 1km north-east of Ireland's Eye.

Construction methodologies for the various elements of the Proposed Project are presented in Chapter 4 Description of the Proposed Project in Volume 2 Part A of this EIAR.

18.5.1 Proposed Abbotstown Pumping Station and the Proposed Wastewater Treatment Plant

The proposed construction methodologies for the proposed WwTP and the proposed Abbotstown pumping station are outlined in Section 4.4.9 and 4.6.2 of Chapter 4 Description of the Proposed Project in Volume 2 Part A of this EIAR, respectively.

The potential construction impacts of the proposed Abbotstown pumping station and proposed WwTP on the Geological Features identified are listed below:

- Compression of substrata;
- Loss of agricultural land;
- Loss of solid geology;
- Earthworks haulage; and
- Impact on surrounding ground.

Compression of Substrata

Construction may result in increased loading on underlying soils which could affect the current characteristics of the ground. However, given the general nature of these soils (over consolidated glacial tills), the significance of this potential impact is deemed to be Imperceptible.

Loss of Agricultural Land and Overburden

It is expected that much of the topsoil and overburden at the proposed Abbotstown pumping station and the proposed WwTP sites will be excavated to allow for construction of the proposed Abbotstown pumping station and proposed access roads.

Given the relatively small quantity of topsoil which will be removed, it is not considered to be a resource of any regional significance. It is also anticipated that all of the excavated topsoil may be reused in landscaping throughout the site where possible.

The significance of this potential impact is Imperceptible.

Loss of Solid Geology

Excavation of rock will be required to construct the proposed Abbotstown pumping station. The excavated material may be reused elsewhere on the development if it can be shown to economically fulfil an appropriate engineering specification, such as pipe bedding or capping material.

The quantity of rock which will be removed is small and this is considered to be a small adverse impact. It is also of low importance, and there are readily available alternative sources of similar bedrock available. Therefore, this has been described as having an Imperceptible impact upon the local environment.

Earthworks Haulage

During earthworks construction, heavily loaded large earthmoving vehicles will travel through the proposed Abbotstown pumping station site, causing ground vibrations, unwanted compaction and disturbance of natural ground of unfinished road surfaces. This will also result in increased traffic on the roads to and from the proposed Abbotstown pumping station site. Increased noise, dust and vibration will also be generated.

Details in relation to the disposal of these soils is discussed in Chapter 20 Waste in Volume 3 Part A of this EIAR.

These works are expected to have a low importance given the volume of the material for removal is low on a local scale. The magnitude of the impact of this activity would be small adverse. The significance of the potential impact is Imperceptible.

Impact on Surrounding Ground

Soil and rock excavation has the potential to induce movement and settlement of surrounding ground. The breaking or blasting of the bedrock could result in ground vibrations and destabilisation of existing slopes and existing rock slopes, with impacts felt in the immediate vicinity of the works.

These works may also give rise to excessive noise and vibration impacts and may result in the generation of dust.

These works are expected to have a low importance given the soils in question are generally over-consolidated glacial tills. The magnitude of the impact of this activity would be small adverse. The significance of the potential impact is Imperceptible.

Summary of Proposed Abbotstown Pumping Station and Wastewater Treatment Plant Construction Impacts

The following table summarises the predicted impacts during the Construction Phase.

Table 18.7: Summary of Impacts on Geological Attributes at the Proposed Abbotstown Pumping Station and the Proposed Wastewater Treatment Plant

Feature	Importance		Magnitude of Impact		Significance of Impact
	Ranking	Justification	Ranking	Justification	
Compression of substrata	Low	Boulder clays – poorly drained, low fertility soils.	Small adverse	Removal of soils and replacement with structure will not impact on the characteristics of the soils	Imperceptible
Loss of agricultural land and overburden	High	Well drained and/or high fertility soils	Small adverse	Loss of a small proportion of local high fertility soils	Imperceptible
Loss of solid geology	Low	Attribute has a low value on a local scale	Small adverse	Excavation of approx.12.5m of rock Loss of small proportion of future quarry reserves	Imperceptible
Earthworks haulage	Low	Volume of material for removal is low on a local scale	Small adverse	Limited excavation and disposal	Imperceptible
Impacts on surrounding ground	Low	Soils are generally overconsolidated glacial tills.	Small adverse	Movements expected to be minimal due to underlying ground conditions	Imperceptible

18.5.2 Construction Phase Impacts for the Proposed Pipeline Routes (Terrestrial)

Section 4.5.10 of Chapter 4 Description of the Proposed Project in Volume 3 Part A of this EIAR outlines the construction methodology for the proposed orbital sewer route and the proposed outfall pipeline route (land based section).

The construction impacts of the proposed orbital sewer route and outfall pipeline route (land based section) on the Geological Attributes identified are listed below:

- Loss of agricultural land;
- Loss of solid geology;
- Excavation of soft mineral soils beneath the route;
- Earthworks haulage;
- Contaminated ground;
- Loss of future quarry reserves; and
- Impact of excavation on surrounding ground.

Loss of Agricultural Land

It is anticipated that the temporary removal of fertile soil along the proposed orbital sewer route and outfall pipeline route (land based section) will have a small adverse impact to the quality, drainage characteristics and uses of important agricultural land during the Construction Phase. The fertile soil (topsoil) will be temporarily stockpiled and reinstated over the completed pipeline installation.

Given the temporary disturbance, limited solely to the Construction Phase, this is considered to have a small adverse impact.

The significance of the potential impact is Moderate/Slight.

Loss of Solid Geology

Excavation of rock will be required to construct the proposed orbital sewer route and outfall pipeline route (land based section) in some limited locations. The excavated material may be reused elsewhere on the Proposed Project if it can be shown to economically fulfil an appropriate engineering specification, such as pipe bedding, backfill for the excavations or sub-base to roads.

Given the relatively small quantity of rock which will be removed, it is considered to be a small adverse impact that does not have any regional significance.

The significance of the potential impact is Slight.

Excavation of Soft Mineral Soils Beneath the Route

Limited soft soils will require excavation and replacement when encountered at the base of excavations for the proposed orbital sewer route and outfall pipeline route (land based section). These are expected to be localised and minor in extent.

Given the relatively small quantity of soils which will be removed, it is considered to be a small adverse impact that does not have any regional significance.

The significance of the potential impact is Imperceptible.

Earthworks Haulage

During construction, heavily loaded large earthmoving vehicles will travel through the site, causing ground vibrations, unwanted compaction and disturbance of natural ground of unfinished road surfaces. This will also result in increased traffic on the roads to and from the site.

Details in relation to the disposal of these soils is discussed in Chapter 20 Waste in Volume Part A of this EIAR.

These works are expected to have a low importance given the volume of the material for removal is low on a local scale. The magnitude of the impact of this activity would be small adverse. The significance of the potential impact is Imperceptible.

Contaminated Ground

Contaminated ground, if encountered, will require excavation and removal off-site to a suitably licensed waste facility during the construction of the proposed orbital sewer route and outfall pipeline route (land based section). It is expected that this will occur along the section of the route which passes through the two historical unregulated landfills (Ref L1 and Ref L3 on Figure 18.3 Route Constraints Blanchardstown to Clonshagh (Sheet 1 of 3) and Figure 18.3 Route Constraints Blanchardstown to Clonshagh (Sheet 2 of 3).

The volume of contaminated material to be excavated is small in the context of the local area. However; there is potential for mobilisation of contaminants during the construction, which would have a small adverse impact on the geological features.

The significance of the potential impact is Moderate/Slight.

Details in relation to the disposal of these soils is discussed in Chapter 20 Waste in Volume 3 Part A of this EIAR.

Loss of Future Quarry Reserves

The impact of the proposed orbital sewer route and outfall pipeline route (land based section) on the future quarry reserves is considered to be small adverse, since there will only be a very small loss of potential aggregate reserves from the overall region.

The significance of the potential impact is Moderate/Slight.

Impact on Surrounding Ground

Soil and rock excavation has the potential to induce movement and settlement of surrounding ground. The breaking or blasting of the bedrock could result in ground vibrations with affects felt in the immediate vicinity of the works.

Excavations within a wide corridor through generally undeveloped lands would have a small adverse impact.

The significance of the potential impact is Imperceptible.

Summary of Construction Phase Impacts for Proposed Pipeline Routes (Terrestrial)

The following table summarises the Construction Phase impacts of the proposed orbital sewer route and outfall pipeline route (land based section).

Table 18.8: Impacts on Geological Attributes for Proposed Pipeline Routes (Terrestrial)

Feature	Importance		Magnitude of Impact		Significance of Impact
	Ranking	Justification	Ranking	Justification	
Loss of agricultural land	High	Well drained high fertility soils	Small adverse	Loss of topsoils will be temporary	Moderate/Slight
Loss of solid geology	Medium	Sub-economic outcrops of limestone at Balseskin and Abbotstown	Small adverse	Proportion of any possible aggregate reserves lost is small.	Slight
Excavation of soft mineral soils	Low	Volume of soft alluvial soil at the stream located in the Silloge Golf Course is small on a local scale	Small adverse	Only a small proportion of soft mineral soils beneath the route will require excavation	Imperceptible
Earthworks haulage	Low	Volume of soft alluvial soil requiring removal and disposal is small on a local scale.	Small adverse	Excavation and disposal will be limited.	Imperceptible
Contaminated ground: Large recent landfill site for mixed wastes, historic and operational graveyards	High	Excavation and removal of material from the Balseskin and Ballymun historic landfills for mixed wastes Degree or extent of soil contamination is significant on a national or regional scale	Small adverse	The proportion of waste excavated and transport off-site for disposal will be small. Requirement to excavate/remediate small proportion of the former landfill.	Moderate/Slight
Loss of future quarry reserves	High	Loss of future quarry reserves due to location of pipeline within 100m of the Huntstown Quarry boundary, sterilising development of the quarry in that direction. Moderately sized existing quarry	Small adverse	Only a small proportion of potential aggregate resources would be lost from the region	Moderate/Slight
Impacts on surrounding ground	Low	Soils are generally over consolidated glacial tills.	Small adverse	Excavation depths are small, typically <2.5m.	Imperceptible

18.5.3 Proposed Outfall Pipeline Route (Marine Section) and Microtunnelled and Dredge Section

Section 4.5.10 outlines the construction methodology for the proposed outfall pipeline route (marine section).

The proposed construction impacts of the construction of the proposed outfall pipeline route (marine section). and associated proposed temporary construction compound no. 9 and no. 10 on the Geological Attributes identified are listed below:

- Loss of land;

- Earthworks haulage;
- Impact on surrounding ground;
- Loss of solid geology;
- Mobilisation of sediment;
- Contaminated sediment; and
- Impact of excavation on surrounding sediments.

Loss of Land

It is anticipated that the removal of fertile soil for the construction of proposed temporary construction compound no. 9 and no. 10 will have a small adverse impact to the quality, drainage characteristics and uses of important agricultural land during the Construction Phase temporarily. Additionally, the seabed will be impacted, but this is considered to have a low importance.

Given the temporary disturbance to the site, limited solely to the Construction Phase, and the location of proposed temporary construction compound no. 9 and no. 10, this is considered to have an imperceptible impact.

Earthworks Haulage

During construction of proposed temporary construction compound no. 9 and no. 10, heavily loaded large earthmoving vehicles will travel through the sites, causing ground vibrations, unwanted compaction and disturbance of natural ground of unfinished road surfaces. Spoil generated from the TBM will also require the disposal of approximately 17,000m^3 of crushed soils and rock off-site.

This will also result in increased traffic on the roads to and from proposed temporary construction compound no. 9 and no. 10.

Details in relation to the disposal of these soils is discussed in Chapter 20 Waste in Volume 3 Part A of this EIAR.

These works are expected to have a low importance given the volume of the material for removal is low on a local scale. The magnitude of the impact of this activity would be small adverse. The significance of the potential impact is Imperceptible.

Impact on Surrounding Ground

Soil and rock excavation and the action of the TBM have the potential to induce movement and settlement of surrounding ground. The breaking or blasting of the bedrock could result in ground vibrations with affects felt in the immediate vicinity of the works.

These works may give rise to excessive noise and vibration impacts and may result in the generation of dust. Further details of these will be addressed in Chapter 14 Air Quality, Odour and Climate and Chapter 15 Noise and Vibration in Volume 3 Part A of this EIAR.

The significance of the affected features would be considered as low, given these would be the glacial tills and bedrock beneath the site. Through appropriate design and construction methods, the magnitude of impacts due to the construction of proposed temporary construction compound no. 9 and no. 10 and the action of the TBM will be considered to be small adverse. The significance of the potential impact is Imperceptible

Loss of Solid Geology

The proposed microtunnelled section is anticipated to run through the limestone bedrock in the area beneath Portmarnock Estuary. The extracted material may be reused elsewhere on the Proposed Project if it can be shown to economically fulfil an appropriate engineering specification, such as pipe bedding or capping material. The affected geological feature has been identified as sub-economic limestone present beneath the site and would have a low importance.

Given the relatively small volume of rock (16,500m^3) which will be removed due to the construction of the tunnel shaft and the actual tunnelling operation, it is considered to be a small adverse impact that is not of regional significance. The significance of the impact would be classed as Imperceptible.

Details in relation to the disposal of these soils is discussed in Chapter 20 Waste in Volume 3 Part A of this EIAR.

Mobilisation of Contaminated Sediment

There is the possibility that the sediments to be excavated during the Construction Phase may be contaminated and may have an impact on the pNHA, SACs and SPAs.

While this is considered important, the magnitude of the impact is small adverse as the sediment testing carried out to date shows no evidence of contamination. However, this does not rule out the possibility of encountering isolated hotspots of contamination along the route.

The construction of the TBM section may have impacts on the overlying sediments.

Given the sensitive nature of the environment, this is considered as having a high importance, but given the nature of the ground conditions and the proposed construction methods, it is classified as having a small adverse impact. The overall impact would be described as Moderate/Slight.

Summary of Construction Phase Impacts from Proposed Outfall Pipeline Route (Marine Section)

The following table summarises the likely Construction Phase impacts for the TBM and dredged sections.

Table 18.9: Impacts on Geological Attributes for the Proposed Outfall Pipeline Route (Marine Section)

Feature	Importance		Magnitude of Impact		Significance of Impact
	Ranking	Justification	Ranking	Justification	
Loss of land	Low	Seabed soils	Small adverse	Loss of seabed sediment only temporary.	Imperceptible
Earthworks haulage	Low	Volume of material requiring excavation and removal off-site is small	Small adverse	Excavation footprint minimised through construction practices.	Imperceptible
Impacts on surrounding ground	Low	Soils are generally glacial tills or intact rock at depth.	Small adverse	Tunnelling through glacial tills and/or intact rock would not result in substantial ground movements.	Imperceptible
Loss of solid geology	Low	Sub-economic outcrops of limestone	Small adverse	Results in an impact on the attribute but of insignificant magnitude impact either use or integrity. 16,500m^3	Imperceptible

Feature	Importance		Magnitude of Impact		Significance of Impact
	Ranking	Justification	Ranking	Justification	
Mobilisation of contaminated sediments during excavation	High	No evidence of contaminated sediments. However, there is the possibility of encountering significant contamination on a local scale.	Small adverse	Based on ground conditions and testing results, there should be limited mobilisation of those sediments.	Moderate/Slight

18.6 Impact of the Proposed Project – Operational Phase

The predicted impacts associated with the Operational Phase of the Proposed Project are outlined in Table 18.10. The Operational Phase of the proposed pipeline routes will have an overall neutral long-term impact on the soils and geology along the routes.

All potential impacts on soils and geology from the Operational Phase of the Proposed Project will be of Slight significance The impacts on the identified Geological Attributes are listed in Table 18.10.

Table 18.10: Impacts on Geological Attributes for the Operational Phase

Feature	Importance		Magnitude of Impact		Significance of Impact
	Ranking	Justification	Ranking	Justification	
Agricultural land: Well drained and/or highly fertile soils	High	Well drained, high fertility soils	Small adverse	Potential for leakage or spillage of wastewater during the Operational Phase. Loss of a small proportion of local high fertility soils	Slight
Inert soil and subsoil strata	Low	Poorly drained, low fertility soils	Small adverse	Potential for leakage or spillage of wastewater during the Operational Phase. Loss of a small proportion of local low fertility soils	Slight

18.7 Mitigation Measures

18.7.1 Introduction

This Section describes the mitigation measures to reduce or avoid potential impacts, where possible, for both the Construction Phase (Section 18.7.2) and Operational Phase (Section 18.7.3) of the Proposed Project. The mitigation strategy outlined in this section will be incorporated by the appointed contractor into the future design proposals for the Proposed Project. The strategy will be incorporated into the overall Construction Environmental Management Plan (CEMP) by the appointed contractor and approved by Irish Water.

18.7.2 Construction Phase

The mitigation measures for the potential construction impacts are provided below.

General

SOIL CONST 1 – Regulatory Compliance: The adopted construction techniques will comply with the requirements of statutory bodies (Building Control Amendment Regulations, Health Service Executive

Inspections, Irish Water inspections and compliance with Employers Requirements), and construction will be completed in accordance with the CEMP.

SOIL CONST 2 – Ground Contamination: Good housekeeping (e.g. daily site clean-ups and use of disposal bins) will be carried out on the sites during construction, and the proper use, storage and disposal of all substances and their containers will help prevent soil contamination. For all activities involving the use of potential pollutants or hazardous materials, there will be a requirement to ensure that material such as concrete, fuels, lubricants and hydraulic fluids will be carefully handled and stored to avoid spillages. Potential pollutants shall also be adequately secured against vandalism and will be provided with proper containment according to codes of best practice. Any spillages will be immediately contained and contaminated soil removed from the site and disposed of in a licenced waste facility.

SOIL CONST 3 – Ground Contamination: Excavations in made ground will be monitored by an appropriately qualified person to ensure that any hotspots of contamination encountered are identified, segregated and disposed of appropriately. Any identified hotspots shall be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure that the hotspot does not cross-contaminate clean soils elsewhere throughout the sites.

SOIL CONST 4 – Ground Contamination: Potential soil and water pollution will be minimised by the implementation of good construction practices. Such practices will include adequate bunding for oil containers, wheel washers and dust suppression on site roads, and regular plant maintenance. The Construction Industry Research and Information Association (CIRIA) provides guidance on the control and management of water pollution from construction sites in their publication *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors* (Masters-Williams et al. 2001), and this shall be reflected in the CEMP. A contingency plan for pollution emergencies will also be developed by the appointed contractor prior to the commencement of works and regularly updated, which would identify the actions to be taken in the event of a pollution incident. The CIRIA document recommends that a contingency plan for pollution emergencies will address the following:

- Containment measures;
- Emergency discharge routes;
- List of appropriate equipment and clean-up materials;
- Maintenance schedule for equipment;
- Details of trained staff, location, and provision for 24-hour cover;
- Details of staff responsibilities;
- Notification procedures to inform the relevant environmental protection authority;
- Audit and review schedule;
- Telephone numbers of statutory water undertakers and local water company; and
- List of specialist pollution clean-up companies and their telephone numbers.

Proposed Abbotstown Pumping Station and the Proposed Wastewater Treatment Plant

Compression of Substrata

SOIL CONST 5 – Excavation Support: 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 to design excavation support measures in accordance with all relevant guidelines and standards.

Loss of Agricultural Land and Solid Geology

SOIL CONST 6 – Material Reuse: All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Project shall be used for other projects where possible.

Earthworks Haulage

SOIL CONST 6 – Material Reuse: All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Project shall be used for other projects where possible.

SOIL CONST 7 – Traffic: Earthworks haulage will be along agreed predetermined routes along existing national, regional and local routes. Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practicable, compaction of any soil or subsoil which is to remain *in situ* along the sites will be avoided.

SOIL CONST 8 – Surface Drainage: Earthworks operations shall be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe runoff and prevent ponding and flooding. Runoff will be controlled through erosion and sediment control structures appropriate to minimise the water impacts in outfall areas. Care will be taken to ensure that the bank surfaces are stable to minimise erosion.

Impact of Surrounding Ground

SOIL CONST 9 – Movement Monitoring: Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations.

SOIL CONST 10 – Ground Settlement Control: Ground settlements will be controlled through the selection of a foundation type and method of construction which are suitable for the particular ground conditions.

Construction of Proposed Pipeline Routes (Terrestrial)

Loss of Agricultural Land

SOIL CONST 5 – Excavation Support: 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 to design excavation support measures in accordance with all relevant guidelines and standards.

SOIL CONST 6 – Material Reuse: All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of

weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Project shall be used for other projects where possible.

Loss of Solid Geology

SOIL CONST 6 – Material Reuse: All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Project shall be used for other projects where possible.

Earthworks Haulage

SOIL CONST 6 – Material Reuse: All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Project shall be used for other projects where possible.

SOIL CONST 7 – Traffic: Earthworks haulage will be along agreed predetermined routes along existing national, regional and local routes. Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practicable, compaction of any soil or subsoil which is to remain *in situ* along the sites will be avoided.

SOIL CONST 8 – Surface Drainage: Earthworks operations shall be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe runoff and prevent ponding and flooding. Runoff will be controlled through erosion and sediment control structures appropriate to minimise the water impacts in outfall areas. Care will be taken to ensure that the bank surfaces are stable to minimise erosion.

Impact on Surrounding Ground

SOIL CONST 9 – Movement Monitoring: Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations.

SOIL CONST 10 – Ground Settlement Control: Ground settlements will be controlled through the selection of a foundation type and method of construction which are suitable for the particular ground conditions.

Impact of Excavation on Surrounding Sediments

SOIL CONST 9 – Movement Monitoring: Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations.

SOIL CONST 10 – Ground Settlement Control: Ground settlements will be controlled through the selection of a foundation type and method of construction which are suitable for the particular ground conditions.

Proposed Outfall Pipeline Route

Loss of Agricultural Land

SOIL CONST 5 – Excavation Support: 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 to design excavation support measures in accordance with all relevant guidelines and standards.

SOIL CONST 6 – Material Reuse: All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Project shall be used for other projects where possible.

Loss of Solid Geology

SOIL CONST 6 – Material Reuse: All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Project shall be used for other projects where possible.

Earthworks Haulage

SOIL CONST 6 – Material Reuse: All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the Proposed Project shall be used for other projects where possible.

SOIL CONST 7 – Traffic: Earthworks haulage will be along agreed predetermined routes along existing national, regional and local routes. Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practicable, compaction of any soil or subsoil which is to remain *in situ* along the sites will be avoided.

SOIL CONST 8 – Surface Drainage: Earthworks operations shall be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe runoff and prevent ponding and flooding. Runoff will be controlled through erosion and sediment control structures appropriate to minimise the water impacts in outfall areas. Care will be taken to ensure that the bank surfaces are stable to minimise erosion.

Impact on Surrounding Ground

SOIL CONST 9 – Movement Monitoring: Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations.

SOIL CONST 10 – Ground Settlement Control: Ground settlements will be controlled through the selection of a foundation type and method of construction which are suitable for the particular ground conditions.

Mobilisation of Sediment

SOIL CONST 11 – Dredging Works: Best practice guidelines such as those outlined in BS6349-5 .- Maritime works – Part 5: Code of practice for dredging and land reclamation (2016) will be adhered to as a minimum for any dredging exercises to be carried out. Measures to minimise disruption to the seabed and mobilisation of sediments will be applied. Seabed conditions to be taken into account when selecting the method of dredging.

Impact of Excavation on Surrounding Sediments

SOIL CONST 9 – Movement Monitoring: Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations.

SOIL CONST 10 – Ground Settlement Control: Ground settlements will be controlled through the selection of a foundation type and method of construction which are suitable for the particular ground conditions.

18.7.3 Operational Phase

Beyond the Construction Phase of the Proposed Project, the main impacts will be noise and odour control issues along with monitoring for leaks. There are no residual issues relating to soils and geology. No specific Operational Phase mitigation measures are required.

18.7.4 Summary of Residual Impacts

Table 18.11 presents the residual impacts following implementation of the mitigation measures identified within this Chapter.

Table 18.11: Summary of Residual Impacts

Feature	Importance		Magnitude of Impact		Significance of Impact	Mitigation Measures	Residual Impact	Residual Significance of Impact
	Ranking	Justification	Ranking	Justification				
Compression of substrata	Low	Boulder clays – poorly drained, low fertility soils.	Small adverse	Removal of soils and replacement with structure will not impact on the characteristics of the soils	Imperceptible	SOIL CONST 1; SOIL CONST 2; SOIL CONST 5; SOIL CONST 6; SOIL CONST 9; SOIL CONST 10	Negligible	Imperceptible
Loss of agricultural land and overburden	High	Well drained and/or high fertility soils	Small adverse	Loss of a small proportion of local high fertility soils	Moderate / Slight	SOIL CONST 2; SOIL CONST 5; SOIL CONST 6; SOIL CONST 9	Negligible	Imperceptible
Loss of solid geology	Low	Attribute has a low value on a local scale	Large adverse	Loss of a small proportion of any possible aggregate reserves	Moderate / Slight	SOIL CONST 2; SOIL CONST 5; SOIL CONST 6; SOIL CONST 9	Moderate adverse	Slight
Earthworks haulage	Low	Volume of material for removal is low on a local scale	Small adverse	Limited excavation and disposal.	Imperceptible	SOIL CONST 2; SOIL CONST 5; SOIL CONST 6; SOIL CONST 7; SOIL CONST 9	Negligible	Imperceptible
Impacts of excavation on surrounding ground	Low	Soils are generally over consolidated glacial tills.	Small adverse	Movements expected to be minimal due to underlying ground conditions	Imperceptible	SOIL CONST 1; SOIL CONST 5; SOIL CONST 6; SOIL CONST 7; SOIL CONST 9; SOIL CONST 10;	Negligible	Imperceptible
Excavation of soft mineral soils	Low	Volume of soft alluvial soil to be excavated is small on a local scale	Small adverse	Requirement to excavate small proportion of soft mineral soils beneath the route	Imperceptible	SOIL CONST 1; SOIL CONST 5; SOIL CONST 6; SOIL CONST 7; SOIL CONST 9; SOIL CONST 10	Negligible	Imperceptible
Contaminated ground: Large recent landfill site for mixed wastes, historic and operational graveyards	High	Excavation and removal of contaminated soil from historic landfills to an appropriate waste licensed facility for mixed wastes	Small adverse	Requirement to excavate small proportion of waste and transport off-site for disposal	Moderate / Slight	SOIL CONST 1; SOIL CONST 2; SOIL CONST 3; SOIL CONST 4; SOIL CONST 5; SOIL CONST 6; SOIL CONST 7; SOIL CONST 8	Negligible	Slight

Feature	Importance		Magnitude of Impact		Significance of Impact	Mitigation Measures	Residual Impact	Residual Significance of Impact
	Ranking	Justification	Ranking	Justification				
Loss of future quarry reserves	High	Loss of future quarry reserves due to location of pipeline within 100m of the Huntstown quarry	Small adverse	Only a small proportion of potential aggregate resources would be lost from the region	Moderate / Slight	SOIL CONST 1; SOIL CONST 5; SOIL CONST 6; SOIL CONST 9	Negligible	Slight
Mobilisation of sediments	High	Sensitive nature of the environment – SAC/pNHA/SPA Attribute has a high quality/significance/value on a European scale.	Small adverse	Based on ground conditions and construction methods, there should be limited mobilisation of those sediments. Sediments were shown to be uncontaminated.	Moderate / Slight	SOIL CONST 2; SOIL CONST 5; SOIL CONST 6; SOIL CONST 11	Negligible	Slight
Contaminated sediments	High	No evidence of contaminated sediments. However, there is the possibility of encountering contamination on a local scale.	Small adverse	Based on ground conditions and construction methods, there should be limited mobilisation of those sediments. Sediments were shown to be uncontaminated.	Moderate / Slight	SOIL CONST 1; SOIL CONST 2; SOIL CONST 3; SOIL CONST 4; SOIL CONST 5; SOIL CONST 6; SOIL CONST 7; SOIL CONST 8; SOIL CONST 11	Negligible	Slight
Impact of excavation on surrounding sediments	High	Sensitive nature of the environment – SAC/pNHA/SPA Attribute has a high quality/significance/value on a European scale.	Small adverse	Based on ground conditions, there should be limited mobilisation of those sediments.	Moderate / Slight	SOIL CONST 1; SOIL CONST 5; SOIL CONST 6; SOIL CONST 7; SOIL CONST 9; SOIL CONST 10	Negligible	Imperceptible

18.8 Monitoring

Any excavation shall be monitored during earthworks to ensure the stability of side slopes and to ensure that the soils excavated for disposal are consistent with the descriptions and classifications according to the waste acceptance criteria testing carried out as part of the site investigations.

The construction of the offshore elements shall follow international best practice in regard to the management of the dredge, the stability of the dredge area and the disposal of any spoil generated from either the dredge or the tunnelling works.

Movement monitoring shall be carried out during any activities which may result in ground movements or movements of any nearby structures.

Ongoing monitoring of the infrastructure for leaks shall be carried out during operation. If leaks are detected, the system should include measures for the management of any resulting contamination of the surrounding soils as presented in SOIL CONST 4.

18.9 Reinstatement

No reinstatement is required. As part of the construction, the proposed construction corridor shall be returned to its original condition with the replacement of excavated materials where appropriate. If the excavated materials are not suitable for reuse, then equivalent materials may be imported for reinstatement. Acceptable materials for import may include materials classified as by-products from excavations in natural soils under Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011).

The excavated area shall be occupied by the proposed pipeline routes, proposed Abbotstown pumping station and proposed WwTP.

18.10 Difficulties Encountered in Compiling Required Information

No specific difficulties were encountered during the writing of this EIAR Chapter.

18.11 References

Apex (2015). Geophysical Report.

British Geological Survey (2018). BGS Geology. [ONLINE]. Available at: http://www.bgs.ac.uk/products/digitalmaps/digmapgb_drift.html. [Accessed 2018].

Environmental Protection Agency (2002). Guidelines on the Information to be Contained in Environmental Impact Statements.

Environmental Protection Agency (2003). Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.

Environmental Protection Agency (2015a). Revised Guidelines on the Information to be Contained in Environmental Impact Statements.

Environmental Protection Agency (2015b). Advice Notes for Preparing Environmental Impact Statements.

Environmental Protection Agency (2017). Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

Geological Survey of Ireland. Quaternary Geology of Ireland.

GSI (2017).(www.dccae.gov.ie) (September 2017)

Teagasc and the EPA (2018). Irish Soil Information System. [ONLINE]. Available at: http://gis.teagasc.ie/isis/about.php. [Accessed 2018].

Teagasc and the EPA (2017). Irish Soil Information System. [ONLINE]. Available at: http://gis.teagasc.ie/soils/index.php. [Accessed September 2017]

Corine Land Cover datasets, (European Environment Agency 2006);

Jacobs Tobin (2013). Greater Dublin Drainage EIS Scoping Stage – Consultation Brief.

Institute of Geologists of Ireland (2013). Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.

The Peatlands of Ireland (An Foras Talúntais 1981);

Irish Soil Information System, 1:250,000, (Teagasc 2014);

Directory of Active Quarries, Pits and Mines in Ireland (GSI, 3rd Edition, 2001);

State Mining and Prospecting Facilities (published twice annually by Exploration and Mining Division of DCENR);

Historic Mine Sites – Inventory and Risk Classification (EPA and GSI);

Concrete Products Directory (Irish Concrete Federation);

Historical Maps (Ordnance Survey of Ireland / National Library of Ireland);

Atlas of Ireland (Royal Irish Academy);

Eirgrid. Dublin North Fringe 220kV Reinforcement Project Site Selection Review of Constraints, April 2011;

Preliminary GIs:

Techworks Marine, Greater Dublin Drainage Scheme, FCC, TW/12/PRJ007, 19 September 2012 (Environmental Monitoring Buoy Deployment);

Techworks Marine, Greater Dublin Drainage Scheme, Hydrographic Survey Report GEO13_GDD, FCC, TW/13/PRJ-012, 30 May 2013;

Techworks Marine, Greater Dublin Drainage Scheme, Sub-bottom Analysis, FCC, TW/13/PRJ-012, 14 June 2013;

Apex Geoservices, Summary Report on the Bathymetric and Geophysical Data Integration for the Greater Dublin Drainage Scheme for Techworks Marine, Report No. AGL13110, 2 August 2013;

IGSL Ltd., Greater Dublin Drainage Scheme Preliminary Ground Investigation Contract – Phase 1, Report No. 16695, August 2013;

Causeway Geotech, Greater Dublin Drainage Ground Investigation – Phase II Terrestrial Investigation, Report No. 14-645, April 2015;

Causeway Geotech, Greater Dublin Drainage – Offshore Site Investigation of Outfall Pipeline, Report No. 15-664, January 2016; and

Apex Geoservices, Report on the Geophysical Investigation for GDDP Portmarnock Golf Course, Dublin for Tobin Consulting Engineers and Irish Waters, Report No. AGL 15247_02, 18 February 2016;

Soil Associations of Ireland and Their Land Use Potential (NSS 1980);

(http://www.bgs.ac.uk/products/digitalmaps/digmapgb_drift.html);

Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (Masters-Williams et al. 2001);

BS6349-5.- Maritime works – Part 5: Code of practice for dredging and land reclamation (2016)

Directives and Legislation

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

Planning and Development Act 2000