13. Soils, Geology, Hydrogeology, Hydrology and Coastal Recession

13.1 Introduction

This chapter of the EIS consists of an assessment of effects on the Soils, Geology, Hydrogeology, Hydrology and Coastal Recession in the proposed development.

The proposed development will consist principally of a waste-to-energy facility (waste incinerator) for the treatment of up to 240,000 tonnes per annum of residual household, commercial and industrial non-hazardous and hazardous waste and the recovery of energy. Of the 240,000 tonnes of waste, up to 24,000 tonnes per annum of suitable hazardous waste will be treated at the facility. The proposed development will maximise the extraction and recovery of valuable material (in the form of ferrous and non-ferrous metals) and energy (in the form of 21 megawatts of electricity) resources from residual waste.

In addition to the provision of the waste-to-energy facility, the proposed development will include an upgrade of a section of the L2545 road, a connection to the national electrical grid, an increase in ground levels in part of the site, coastal protection measures above the foreshore on Gobby Beach and an amenity walkway towards the Ringaskiddy Martello tower.

This chapter has the following structure:

- The methodology for the assessment is set out in **Section 13.2**.
- The baseline environment is described in **Section 13.3**.
- The characteristics of the proposed development which are related to this chapter are outlined in **Section 13.4**.
- The evaluation of the potential effects of the proposed development are described in **Section 13.5**.
- Measures are proposed to mitigate and monitor the effects and are described in **Section 13.6**.
- The cumulative effects of the proposed development are described in **Section 13.8** and the residual effects are described in **Section 13.8**.
- A reference list of documents and resources used for this chapter can be found in **Section 13.9**.

13.2 Methodology

13.2.1 Introduction

The following sections outline the legislation and guidelines considered, and the adopted methodologies for defining the baseline environment and assessing the potential effects of the proposed development in terms of Soils, Geology, Hydrogeology, Hydrology, and Coastal Recession.

The potential effects of the proposed development on this subject have been assessed by classifying the importance of the relevant attributes and quantifying the likely magnitude of any effect on these attributes. The figures which support this chapter are presented in **Figures 13.1** to **13.26**. The appendices which support this chapter are presented in **Volume 4** of this EIS.

13.2.2 Regulations, Legislation and Guidelines

This chapter has been prepared having regard to the following guidelines:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, May 2022;

- European Commission (EC), 2017, Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report;
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA) 2008b);
- EU Directives and national legislation (primary and secondary) concerning Environmental Impact Assessment (especially having due regard to the revised provisions of Directive 2014/52/EU;
- Inland Fisheries Ireland (IFI) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters (2016);
- European Union Environmental Objectives (Surface Water) (Amendment) Regulations 2015 (S.I. No 386 of 2015);
- Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG);
- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI 2013);
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2008a); and
- Groundwater Directives (80/68/EEC) and (2006/118/EC).

13.2.3 Baseline Data Collection

The publicly available datasets reviewed during the assessment of Soils, Geology, Hydrogeology, Hydrology and Coastal Recession are listed in **Table 13.1**. These datasets were consulted throughout this assessment with the baseline environment updated as new versions became available.

Table 13.1: Publicly available datasets

Source	Name	Description
Ordnance Survey Ireland Geohive (OSI) (now called Tailte Éireann)	Current and historical ordnance survey maps	Current and historical survey maps produced by Tailte Éireann
	Aerial photography	Current and historical survey maps produced by Tailte Éireann
Google	Aerial photography	Current aerial imagery produced by Google
	Topography	Topography from transects in Google Earth.
Bing	Aerial photography	Current and historical aerial imagery produced by Bing
Teagasc	Teagasc Soils Data	Surface soils classification and description
University College Cork (UCC) 1988	Geological Map of the Cork District	Bedrock geological map of the proposed development site and surrounding area
Geological Survey Ireland (GSI)	Quaternary Mapping	Bedrock geological maps of the proposed development site area produced by the GSI and available on GSI online map viewer
	Bedrock Mapping	
	Aggregate Potential Mapping	
	Mineral Localities	

Source	Name	Description
	Geotechnical Sites	
	Bedrock Aquifer Mapping	
	Groundwater Vulnerability	
	Groundwater Recharge	
	Groundwater Resources	
	Groundwater Flooding	
	National Landslide Database	
	Karst Database	
	Historic Mine Sites - Inventory and Risk Classification	
	Active Quarries and Pits	
	Historical Quarries and Pits	
	County Geological Sites and Geological Heritage Areas	
Environmental Protection Agency (EPA)	Corine Land Cover 2018	These datasets are based on interpretation of satellite imagery and national in-situ vector data
	River Network Map	
	EPA Licence & Permit Databases	Information on any EPA IE/IPC licences and Permits in the area
	EPA HydroNet	Reports of groundwater level monitoring points
	EPA Water Abstraction Register - December 2023	A register containing water abstractions of 25 cubic meters (25,000 litres) or more per day that have been registered with the EPA
National Parks and Wildlife Service	Designated Natural Heritage Areas (NHA), Special Protection Areas (SPA), Special Areas of Conservation (SAC) Sites	This dataset provides information on national parks, protected sites, and nature reserves
Office of Public Works (OPW)	Flood history of the proposed development site	This dataset provides information on flood history of the proposed development site
	National Flood Hazard Mapping website	This dataset provides information on flood hazard
	Catchment Flood Risk Assessment and Management (CFRAM)	This dataset provides information on Catchment Flood Risk Assessment and Management (CFRAM)
	Preliminary Flood Risk Assessment (PFRA)	This dataset provides information on Preliminary Flood Risk Assessment (PFRA)
	Floodinfo.ie	Draws on data from the 'Irish Coastal Wave and Water Level Modelling Study' (ICWWS, 2018) - aids in the strategic

Source	Name	Description
		assessment of coastal flooding and erosion extents. Other data drawn upon includes Flood Risk Management Plan for Lee, Cork Harbour & Youghal Bay (2018)
	Waterlevel.ie	Relevant water level datasets in vicinity of site (including historical data)
	Irish Coastal Protection Strategy Study - Phase 3 - South Coast	Appendix 7 - Erosion Mapping

13.2.4 Site Investigations and Previous Studies

- Soil and Hydrogeological Investigation undertaken by K.T. Cullen & Co. Ltd 2001 comprising of seventeen trial pits and five boreholes (**Appendix 13.1**);
- Hydrogeological Assessment for Hammond Lane Metal Company, undertaken by O'Callaghan Moran & Associates in 2011 comprising of four boreholes (**Appendix 13.1**);
- Ground investigation undertaken by Soil Mechanics Ltd in 2012 on the glacial till slope along the eastern boundary of the site comprising of four cable percussive boreholes, four trial pits, two hand sampling points and five visual inspection points along the cliff face (**Appendix 13.2**);
- Ground Investigation undertaken by Priority Geotechnical Ltd. in 2019 comprising of ten cable percussive boreholes, eleven rotary core boreholes and seventeen trial pits (**Appendix 13.2**);
- Field surveys to monitor groundwater levels on the site were undertaken by Arup on the 26 February, 16 and 30 April 2025;
- Coastal erosion study completed by Arup as part of the updated EIS (**Appendix 13.3**);
- Flood Risk Assessment completed by Arup as part of the updated EIS (**Appendix 13.4**); and
- Coastal Expert Review of Arup Coastal Erosion Study (2016) (**Appendix 13.5**); and.
- Groundwater Analysis (2025) (**Appendix 13.6**).
- Water Framework Directive Compliance (**Appendix 13.7**)

Walkover Surveys

Walkover Surveys have been undertaken on the proposed development site since 2008 to date. Site walkovers were carried out in February 2025 to inform this updated EIS and identify if there were any changes to the baseline environment.

Consultations

The consultation process which informed the scope of this EIS is described in **Chapter 1** ***Introduction*** and **Appendix 1.2** ***Consultation.*** Additional consultation was carried out with the following relevant bodies during the preparation of this updated EIS:

- Cork City and County Council Roads Design Office was consulted on the M28 Cork to Ringaskiddy Project;
- Cork County Council was consulted in relation to a coastal erosion solution proposed as part of the proposed development; and
- Geological Survey Ireland in relation to Geological Heritage Areas.

13.2.5 Assessment Methodology

An evaluation of the potential significant effects on the Soils, Geology, Hydrogeology, Hydrology and Coastal recession is carried out in this chapter. The assessment of effects is undertaken in accordance with the guidelines outlined in **Section 13.2**. Mitigation measures are identified to mitigate any significant adverse effects, where feasible.

This assessment methodology is in accordance with the guidance outlined in the EPA Guidelines (EPA, 2022) and in Section 5.4 of the TII Guidelines (NRA, 2008a). In accordance with the TII Guidelines (NRA, 2008a), all potential effects of the proposed development must be identified and assessed. Descriptive conditions of the effects to be considered as part of the assessment methodology are outlined in Table 3.4 of the EPA Guidelines (EPA, 2022), which is reproduced in **Table 13.2**.

Table 13.2: Description of Effects (Table 3.4 of the EPA Guidelines (EPA,2022))

Condition	Classification	Description
Quality of Effects	Positive Effects	A change which improves the quality of the environment
	Neutral Effects	No effects or effects that are Imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative / Adverse Effects	A change which reduces the quality of the environment
Significance of Effects	Imperceptible	An effect capable of measurement but without significant consequences
	Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
	Slight Effect	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
	Significant Effects	An effect which, by its character, magnitude, duration, or intensity, alters a sensitive aspect of the environment
	Very Significant	An effect which, by its character, magnitude, duration, or intensity, significantly alters most of a sensitive aspect of the environment
	Profound Effects	An effect which obliterates sensitive characteristics
Extent and Context of Effects	Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect
	Context	Describe whether the extent duration, or frequency will conform or contrast with established (baseline) conditions
Probability of Effects	Likely Effects	The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented
	Unlikely Effects	The effects that can reasonably be expected to not occur because of the planned project if all mitigation measures are properly implemented
Duration and Frequency of Effects	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day
	Temporary Effects	Effects lasting less than a year
	Short-term Effects	Effects lasting one to seven years
	Medium-term Effects	Effects lasting seven to fifteen years

Condition	Classification	Description
	Long-term Effects	Effects lasting fifteen to sixty years
	Permanent Effects	Effects lasting over sixty years
	Reversible Effects	Effects that can be undone, for example through remediation or restoration
	Frequency of Effects	Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Types of Effects	Indirect Effects	Effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway
	Cumulative Effects	The addition of many minor or insignificant effects, including effect on other projects, to create longer more significant effects
	'Do-nothing' Effects	The environment as it would be in the future should the subject project not be carried out
	'Worst-case' Effects	The effects arising from a project in the case where mitigation measures substantially fail
	Indeterminable Effects	When the full consequences of a change in the environment cannot be described
	Irreversible Effects	When the character, distinctiveness, diversity, or reproductive capacity of an environment is permanently lost
	Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents

The significance of effects, as defined in the EPA Guidelines (EPA, 2022) and presented in **Table 13.2** above, has been determined through intermediary steps in accordance with Section 5.4.3 of the TII Guidelines (NRA, 2008a), and Appendix C of the IGI Guidelines (IGI, 2013). The rating criteria for assessing the importance of geological, hydrogeological and hydrological features within the study area are outlined in **Table 13.3** and the rating criteria for quantifying the magnitude of impacts is outlined in **Table 13.4**. The rating of potential environmental effects on the Soils, Geology, Hydrogeology, Hydrology and Coastal Recession are based on the matrix presented in **Table 13.5**, which takes account of both the importance of an attribute and the magnitude of the potential environmental effects of the proposed development on these attributes. The criteria apply to potential effects during the construction and operational phases.

Table 13.3: Criteria for rating the importance of identified geological/hydrogeological/hydrological features (Table C2(IGI,2013) and Box 4.1, 4.2 and 4.3 (NRA, 2008a))

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	• **Soils and Geology:** Not applicable • **Hydrogeology:** Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status • **Hydrology:** River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality, significance, or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and / or soft organic soil underlying route is significant on a national or regional scale.	• **Soils and Geology:** Geological feature rare on a regional or national scale (NHA) Large existing quarry or pit Proven economically extractable mineral resource • **Hydrogeology:** Regionally important aquifer with multiple well fields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation NHA status Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source • **Hydrology:** River, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality, significance, or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and / or soft organic soil underlying route is significant on a local scale.	• **Soils and Geology:** Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site) Well drained and / or highly fertility soils • **Hydrogeology:** Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1000 homes

Importance	Criteria	Typical Example
		Outer source protection area for regionally important water source Inner source protection area for locally important water source • **Hydrology:** Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality, significance, or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and / or soft organic soil underlying route is moderate on a local scale.	• **Soils and Geology:** Contaminated soil on site with previous light industrial usage Small recent landfill site for mixed wastes Moderately drained and / or moderate fertility soils Small existing quarry or pit • **Hydrogeology:** Locally Important Aquifer Potable Water source supplying >50 homes Outer source protection area for locally important water source • **Hydrology:** Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2- 3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Low	Attribute has a low quality, significance, or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and / or soft organic soil underlying route is small on a local scale*.	• **Soils and Geology:** Large historical and / or recent site for construction and demolition wastes Small historical and / or recent landfill site for construction and demolition wastes Poorly drained and / or low fertility soils. Uneconomically extractable mineral resource • **Hydrogeology:** Poor Bedrock Aquifer Potable water source supplying <50 homes • **Hydrology:** Locally important amenity site for small range of leisure activities Local potable water source supplying

Importance	Criteria	Typical Example
		Local potable water source supplying Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

Note: * relative to the total volume of inert soil disposed of and/or recovered

Table 13.4: Criteria for Rating Soil, Geology, Hydrogeology and Hydrology Effects Significance and Magnitude at EIS Stage (Table C4 (IGI,2013) and Box 5.1 (NRA,2008a))

Magnitude of Effect	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves • Irreversible loss of high proportion of local high fertility soils • Removal of entirety of geological heritage feature • Requirement to excavate / remediate entire waste site. • Requirement to excavate and replace high proportion of peat, organic soils and / or soft mineral soils beneath alignment • Loss or extensive change to a waterbody or water dependent habitat • Increase in predicted peak flood level >100 mm • Extensive loss of fishery • Calculated risk of serious pollution incident >2% annually • Extensive reduction in amenity value
Moderate Adverse	Results in effect on integrity of attribute or loss of part of attribute	• Loss of moderate proportion of future quarry or pit reserves • Removal of part of geological heritage feature • Irreversible loss of moderate proportion of local high fertility soils • Requirement to excavate / remediate considerable proportion of waste site. • Requirement to excavate and replace moderate proportion of peat, organic soils and / or soft mineral soils beneath alignment • Increase in predicted peak flood level >50 mm • Partial loss of fishery • Calculated risk of serious pollution incident >1% annually • Partial reduction in amenity value
Small Adverse	Results in minor effect on integrity of attribute or loss of small part of attribute	• Loss of small proportion of future quarry or pit reserves • Removal of small part of geological heritage feature • Irreversible loss of small proportion of local high fertility soils and / or high proportion of local low fertility soils • Requirement to excavate / remediate small proportion of waste site.

Magnitude of Effect	Criteria	Typical Examples
		• Requirement to excavate and replace small proportion of peat, organic soils, and/or soft mineral soils beneath alignment • Increase in predicted peak flood level >10 mm • Minor loss of fishery • Calculated risk of serious pollution incident >0.5% annually • Slight reduction in amenity value
Negligible	Results in an effect on attribute but of insufficient magnitude to affect either use or integrity	• No measurable changes in attributes • Negligible change in predicted peak flood level • Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality	• Minor enhancement of geological heritage feature • Reduction in predicted peak flood level >10 mm • Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Moderate Beneficial	Results in moderate improvement of attribute quality	• Moderate enhancement of geological heritage feature • Reduction in predicted peak flood level >50 mm • Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Major Beneficial	Results in major improvement of attribute quality	• Major enhancement of geological heritage feature • Reduction in predicted peak flood level >100 mm

Table 13.5: Rating of Significant Environmental Effects at EIS Stage (Table C6 (IGI,2013) and Box 5.4 (NRA,2008a))

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

Following the evaluation of potential effects, specific mitigation measures have been developed to avoid, prevent, reduce and, if possible, mitigate any significant adverse effects on Soils, Geology, Hydrogeology, Hydrology and Coastal Recession. The mitigation measures are described in **Section 13.6**. Residual effects, which are the final effects resulting after mitigation measures have been fully established, are described in **Section 13.7**.

13.2.6 Site Description

The site for the proposed development is located approximately 15km to the south-east of Cork City, in the townland of Ringaskiddy on the Ringaskiddy Peninsula in the lower part of Cork Harbour.

The L2545, the main road from Ringaskiddy village to Haulbowline Island forms the northern boundary of the site. The eastern boundary of the site extends to the foreshore of Cork Harbour along Gobby Beach. The lands to the immediate south and west are in agricultural use. The single carriageway from Barnahely to Ringaskiddy element of the M28 Cork to Ringaskiddy project (known as the 'Protected Road Scheme') is currently being constructed within the northwestern boundary of the proposed development site. The site surrounds the Hammond Lane Metal Recycling Co Ltd facility. The site is located approximately 800m east of the village of Ringaskiddy.

The coastline along the eastern boundary of the proposed development consists of a glacial till slope adjoining Gobby Beach. The glacial till slope is very shallow near Gobby Beach carpark (<0.50m) to the north and rises to the south to a maximum height of 10m. There are rock outcrops along the beach to the northeast and southeast of the proposed development site boundary.

The ground levels of the proposed development site vary considerably in both the north-south direction and the east-west direction. The lowest elevation is approximately 2.0 - 3.0m OD along the northern boundary with the local road. The highest point is approximately 41.0m OD along the southern site boundary in the vicinity of the Martello Tower, which is in the adjoining field to the south. There is a steep escarpment in the centre of the proposed development, aligned in a north-east to south-west direction. Anecdotal evidence suggests that the proposed development site was used as a source of material for land reclamation elsewhere in Ringaskiddy, and that this accounts for the escarpment.

A detailed description of the proposed development is provided in **Chapter 4** ***Description of the Proposed Development*** of this EIS.

13.3 Baseline Environment

The existing environment is discussed in terms of geomorphology (landscape and topography), superficial and solid geology, groundwater/hydrogeology, hydrology and coastal erosion. The assessment draws on desk study information, related reports, site history, historic ground investigations and recent site surveys and walkovers.

The study area of geological and hydrogeological conditions covers a zone of 2 km from the proposed development site boundary, as suggested in the IGI guidelines.

13.3.1 Soils and Geology

13.3.1.1 Regional Overview

Cork was covered by ice until approximately 20,000 years ago. The ice sheet originated in the Cork/Kerry mountains and flowed eastwards and southwards into the Celtic Sea. As the ice moved eastwards, it sculpted crushed rock debris, known as boulder clay or till, into streamlined ridges called drumlins or eskers. Glacial till is exposed along the cliff of the eastern coastal boundary of the site. It ranges from 0.5m to 10.0m in height. Coastal glacial till slopes vary in gradient in this area, to the south some are vertical, with some sections appearing concave due to undercutting from the sea.

The soil data from the EPA classifies the upper soil profile as acid brown earths that are glacial in origin and are derived from the parent bedrock of Old Red Sandstone and Carboniferous Limestone (**Figure 13.2**). A review of available information into the regional soils reveals them to be relatively mature, well-drained mineral soils possessing a rather uniform profile, with little differentiation into horizons.

They occur on lime- deficient parent materials and are therefore acid in nature. They possess medium textures of sandy loam, loam and sandy clay loam.

The GSI Quaternary Sediments 50K Mapping shows that the region comprises of till derived from Devonian sandstones, with localised deposits of till derived from Namurian shales and sandstones and till derived from limestones. Along the coastline there are deposits of marine gravel and sands.

The geology of Cork Harbour (**Figure 13.1a**) is characterised by east-north-east to west-south-west trending ridges of Upper Devonian sandstone, silt-mudstones and valleys of carboniferous limestone, sandstone, and mud-siltstones. The Devonian lithologies were deposited sediments on a continental landmass in a progressively deepening hollow called the Munster Basin. At the end of the Devonian period, tectonic activity resulted in a marine invasion of the basin and marked the onset of the Carboniferous period. Shallow marine sandstone, mudstone and limestone replaced the former land-based sediments.

At the end of the Carboniferous period, the Devonian and Carboniferous rocks were subjected to intense folding and faulting, which is known as the Variscan Orogeny. This major phase of folding resulted in the creation of the prominent ridge and trough topography that exists in South Cork today. Regionally, the folds are cut by east-west trending strike slip faults parallel to the strike and north-north-west to south-south-east normal faults.

13.3.1.2 Site Specific Environment

This section discusses the site-specific conditions relating to Soils and Geology within the study area for the proposed development. A full description of the proposed development is provided in **Chapter 4 *Description of the Proposed Development*** and the construction strategy is detailed in **Chapter 5 *Construction Activities***.

A list of figures from the site-specific environment are presented in **Volume 3** of this EIS.

Land Use

The current and historic land use is discussed to give context to any potential changes to land and soil that could influence the importance of a feature and the magnitude of any effects. The current land use is based on current aerial imagery and mapping available from Tailte Éireann (TE) Geohive (2024), and Google (Google 2024). The historic land use is based on the following TE (2024) historic aerial imagery and historic maps:

- 6-inch mapping produced between 1837 and 1842
- 25-inch mapping produced between 1888 and 1913
- 1995 aerial photography
- 1996 to 2000 aerial
- 2001 to 2005 aerial photography
- 2006 to 2012 aerial photography; and
- 2013 to 2016 aerial photography.

According to the TE historical 6" (1837-1842) and 25" (1888-1913) mapping, the site of the proposed development was primarily used for agriculture in the 19th and 20th centuries. A pathway connecting Martello Tower to Gobby Beach ran in northeast-southwest direction through the site up until the 20th Century. From the late 20th Century to date, the majority of the land appears to have fallen to disused scrubland. Hammond Lane Metal Company Ltd was constructed within the centre of the site during the late 20th Century. The remainder of the site was used for agricultural purposes.

The 'Protected Road Scheme' element of the M28 Cork to Ringaskiddy Project began construction through the northwest corner of the proposed development site in 2024 and is visible on the latest satellite imagery.

Agricultural Soils

The Teagasc National Soils data classifies the upper soil profile within the proposed development as acid brown earths in the northern half of the site and lithosols/regosols in the southern half of the site. Marine sands are found in the northeastern corner of the proposed development (Refer to **Figure 13.2**).

A summary of the soils found within the proposed development site are summarised within **Table 13.6**.

Table 13.6: Summary of soil deposits within the proposed development site

Soil Type	Description	Feature Importance Ranking	Justification for Importance rating
Acid brown earths	AminDW – Acid Brown Earths/Brown podzolics	High	Well drained and/or high fertility soils
Lithosols/Regosols	AminSW – Lithosols/Regosols	High	Well drained and/or high fertility soils
Marine Sands	MarSands	Low	Poorly drained and/or low fertility soils

Soils in the context of Soil Health

Topsoil is the top layer of the soil profile that is high in organic matter, micro-organisms and nutrients. Within the overburden profile, topsoil's overlay the subsoils. They are an important non-renewable resource and living ecosystem, which provide key services in regulating the interface between components of the earths systems. As outlined in agricultural soils they service agriculture within the study area and they provide functions such as filtering of contaminants, water storage, support biodiversity, carbon sequestration, a source of engineering materials and preservation of archaeological and cultural heritage.

In this context, the soil types are given a high importance.

Subsoils

According to the GSI, the southern end of the site is underlain by bedrock outcrop or subcrop (Rck). The northern section of the site is underlain by glacial till derived from Devonian sandstones (TDSs). A portion of the northeastern corner of the site is underlain by marine gravel and sands (often raised) (MGs). (Refer to **Figure 13.3a**)

Site investigations revealed the presence of made ground in a localised area immediately east of Hammond Lane Ltd. This material is described as soft brown clay, silt and gravel with medium cobble content. No anthropogenic material or smells were recorded within this material. Made Ground was also recorded at the southeastern end of Area 2, but this is associated with excavations for the now decommissioned gas main in this area.

Table 13.7: Subsoil types found within the proposed development.

Subsoil Type	Description	Importance	Justification for Importance Rating
Made Ground	Varying material	Low	Low value on a local scale
MGs	Marine gravel and sands (often raised)	Low	Low value on a local scale
TDSs	Till derived from Devonian sandstones	Medium	Medium value on a local scale
Rck	Bedrock outcrop or subcrop	Low	Low value on a local scale

Bedrock Geology

The site is located on the northern side of one of the east-north-east to west-south-west trending ridges known as the Ringaskiddy anticline. The site is underlain by Lower Carboniferous marine interbedded grey/brown sandstone, siltstone and mudstone referred to as the Cuskinny Formation of the Kinsale group, according to the Geology of the Cork District Map (1988) (**Figure 13.1a**).

Bedrock outcrops along the coastline northeast and southeast of the development site. It was noted during the walkover survey that the bedrock lithology in the outcrop to the south-east of the site became more mudstone dominant. The bedrock has a strike of north-east to south-west. Measurements taken on this outcrop recorded the bedrock to be dipping 80° to the south-west, and a prominent joint set was noted to be aligned north-west-southeast. According to the Geology of the Cork District Map (UCC 1988) bedrock dips between 35° to 75° to the northwest on the site. The rock outcrops show the rock to be moderately strong to strong, grey/brown and very thinly bedded. Beds could thicken with increasing depth.

The top of bedrock typically follows the topography of the site. It is higher at southern end ranging from 3.5m BGL (22.70m OD) inland to 13m BGL (5.84m OD) towards the coast. At the northern end of the site the bedrock levels range from 8.5m BGL (-5.40m OD) inland to 6.0m BGL (-1.50m OD) towards the coast boundary. The mean high water sea level is at +1.62m OD. The rock is described as weak to strong, fresh to heavily weathered, light grey to grey mudstone.

The GSI Bedrock 100K mapping, indicates that Area 1 and the north-western portion of Area 2 is underlain by the Ballysteen Formation which is comprised of dark muddy limestone and shale. The Geology of the Cork District Map (UCC 1988) does not record limestone in these areas nor did the intrusive ground investigation (refer to **Appendices 13.1** and **13.2** and **Figure 13.1a**). Limestone was also not observed in the M28 rock cut adjacent to Area 1, 3 and 4 during the February 2025 site walkover (refer to **Figure 13.1b**). This rock cut is in the same geological unit as the proposed development. It is likely that the boundary between the sandstone, siltstone, mudstone and the limestone is further north.

Table 13.8: Summary of the bedrock geology found within the proposed development site

Formation	Description	Importance	Justification for Importance Rating
Cuskinny Formation	Carboniferous marine interbedded grey/brown sandstone, siltstone and mudstone	Low	Low value on a local scale

Karst Features

According to the Geological Survey of Ireland, there are no karst features recorded within the site. The closest karst feature is located 500m to the south, described as a superficial solution feature. Two historic boreholes are located 550m to the south and 1.0km to the northwest respectively which both recorded karstic cavities (Refer to **Figure 13.9**).

Geological Heritage Sites

The Geological Survey of Ireland (GSI) in partnership with the Department of Environment, Heritage and Local Government has designed the Irish Geological Heritage Programme, which aims to identify, document and protect the wealth of geological heritage in Ireland. Certain geologically valuable sites are designated as Geological Heritage Sites.

There is a Geological Heritage Site within the proposed development (Refer to **Figure 13.4**). The Ringaskiddy Geological Heritage Area (CK077) is described as a coastal exposure along a beach, and includes prominent boulder, cliffs and outcrops at beach level which is located adjacent to the proposed development along Gobby Beach. This Geological Heritage lies within the site along the eastern coastal boundary. Another Geological Heritage Area is located approximately 630m to the north of the proposed development and is called Haulbowline and Rocky Island (CK053). This Geological Heritage Site is described as two very contrasting small islands at the entrance to Cork Harbour, one which comprises rock outcrop and one split between Irish Navy Headquarters and a parkland amenity.

Table 13.9: Geological heritage sites located around the proposed development

Name (Code)	Description	Importance	Justification for Importance Rating
Ringaskiddy (CK077)	This site comprises a coastal exposure along a beach, and includes a prominent boulder, cliffs and outcrops at beach level.	High	Geological feature of high value on a local scale (County Geological Site)

Name (Code)	Description	Importance	Justification for Importance Rating
Haulbowline and Rocky Islands (CK053)	This site includes two very contrasting small islands at the entrance to Cork Harbour, one which comprises rock outcrop and one split between Irish Navy Headquarters and a parkland amenity	High	Geological feature of high value on a local scale (County Geological Site)

Mineral/Aggregate Resources

According to the GSI, the site of the proposed development and surrounding area is listed as having a very high potential for crushed rock aggregate (Refer to **Figure 13.6**). There is a linear deposit that cuts Area 2 from the eastern boundary of Hammond Lane to the southeastern coastal site boundary. This deposit has a moderate extraction potential (Refer to **Figure 13.5**). This granular deposit is not recorded on the GSI quaternary sediments map nor as a geomorphological feature. The northern and eastern portion of the site has a low and very low potential for sands and gravels extraction respectively.

There are no pits or quarries at the site or adjacent to the site of the proposed development.

A summary of the aggregate potential within the proposed development is provided in **Table 13.10**.

Table 13.10: Summary of GSI Aggregate Potential within the proposed development

Feature	Description	Importance	Justification for Importance Rating
Crush Rock Aggregate Potential	Very High Potential	Very High	Proven economically extractable mineral resource
Granular Aggregate Potential	Medium potential	Medium	Sub-Economic extractable mineral resource
Granular Aggregate Potential	Low potential	Low	Uneconomically extractable mineral resource
Granular Aggregate Potential	Very low potential	Low	Uneconomically extractable mineral resource

Potential Sources of Contamination

A review of EPA data for both existing and historic licensed and illegal waste activities was carried out to identify any potential contamination sources present in the study area, and to identify any potential contaminating activities near the proposed development.

Waste Licences and Permits

The Environmental Protection Agency (EPA) licences certain waste and industrial activities. The National Waste Collection Permit Office (NWCPO) issues Waste Collection Permits. According to the NWCPO records, only one waste permit was issued within a 2 km radius of the proposed development (**Figure 13.7**). This permitted site has since been remediated by Cork County Council and is now a local parkland area. **Table 13.11** summarises the above-mentioned waste permit.

Table 13.11: Waste Licences Issued within a 2 km radius of the Site

Waste Licence No.	Description	Approx. Distance from Site (km)	Licence Status
W0289-01	The East Tip, Haulbowline Island. The site has since been remediated and is now a parkland area.	1.4	Licensed

Industrial Emission (IE) Licences

According to the EPA records, IE licences have been issued within 2 km radius of the proposed development (**Figure 13.7**) and are summarised in **Table 13.12** below.

Table 13.12: IE Licensed sites within a 2 km radius of the Site

IPPC Licence No.	Description	Approx. Distance from Site (km)	Licence Status
P0997-01	The Hammond Lane Metal Company Limited	Adjacent to the site	Licensed
P1114-01	Indaver Ireland Limited	In the site	Applied (2019)
W0186-01	Indaver Ireland Limited	In the site	Ceased
P0010-05	Hovione Limited	0.9	Licensed
P0004-06	Thermo Fisher Scientific Cork Limited (according to EPA records, the licence transferred from SmithKline Beecham Limited in 2019)	1.5	Licensed
P0778-02	Janssen Sciences Ireland UC	1.7	Licensed
P0013-06	Pfizer Ireland Pharmaceuticals Unlimited Company (Ringaskiddy)	1.9	Licensed
P0476-02	Recordati Ireland Limited	1.9	Licensed

As shown in **Table 13.12**, apart from the Hammond Lane Metal Company Ltd site, the remainder of the licensed sites are a considerable distance from the proposed development and are not expected to have any implications for the soil, geology, hydrology and hydrogeology at the proposed development.

Made Ground

Made ground was recorded during the 2019 GI east of Hammond Lane Ltd. This material is described as soft brown clay, silt and gravel with medium cobble content. No anthropogenic material or smells were recorded within this material. Made Ground was also recorded at the southeastern end of Area 2 in TP16 (2019) and BH2 (2019) but this is associated with excavations for the now decommissioned gas main in this area and will not be considered further in this assessment. As part of the 2011 GI within Hammond Lane Ltd, made ground was uncovered in two boreholes which was recorded as fill material, this material will not be affected by the proposed development and will not be considered further.

Potential Illegal Dumping

According to the publicly available EPA publication, *The Nature and Extent of Unauthorised Waste Activities in Ireland* (2012), unauthorised waste activity had been noted in Ovens, Rockchapel, Carrigtwohill Fermoy, and Blackpool in County Cork, all of which are not within the 2 km radius of the site.

Environmental Soil Sampling

An environmental soil baseline study was undertaken as part of the 2000 and 2001 site investigations (K.T. Cullen & Co. Ltd, 2001) (**Appendix 13.1**).

Analytical results for the soil samples are presented in the 2001 Soil and Hydrogeological investigation report prepared by K.T. Cullen & Co. Ltd. (refer to **Appendix 13.1**). The report concluded following detailed sampling and repeat analysis that the soil is free of industrial contaminants and contains concentrations below the Dutch S value (reference for normal uncontaminated soil/groundwater) for the tested parameters.

A summary of potentially contaminated areas within the study area and site are listed in **Table 13.13** and **Table 13.14**.

Table 13.13: Summary of licensed facilities within a 2km radius of the proposed development

Licence ID	Description	Approx. Distance from Site (km)	Feature Importance Ranking	Justification for Importance
Licensed Waste Facilities				
W0289-01	The East Tip, Haulbowline Island. The site has since been remediated and is now a parkland area.	1.4	High	Degree or extent of soil contamination is high on a local scale
IE Licences				
P0997-01	The Hammond Lane Metal Company Limited	In the site	High	Degree or extent of soil contamination is unknown however the feature is considered of high importance on a local scale
P0010-05	Hovione Limited	0.9	High	Degree or extent of soil contamination is unknown however the feature is considered of high importance on a local scale
P0004-06	Thermo Fisher Scientific Cork Limited (according to EPA records, the licence transferred from SmithKline Beecham Limited in 2019)	1.5	High	Degree or extent of soil contamination is high on a local scale
P0778-02	Janssen Sciences Ireland UC	1.7	High	Degree or extent of soil contamination is unknown however the feature is considered of high importance on a local scale
P0013-06	Pfizer Ireland Pharmaceuticals Unlimited Company (Ringaskiddy)	1.9	High	Degree or extent of soil contamination is high on a local scale
P0476-02	Recordati Ireland Limited	1.9	High	Degree or extent of soil contamination is unknown however the feature is considered of high importance on a local scale

Table 13.14: Summary of potentially contaminated land within the proposed development

Description	Location	Feature Importance Ranking	Justification for Importance
Made Ground Described as soft brown clay/silt/gravel with medium cobble content. No anthropogenic material or smells were recorded within this material.	Adjacent to the eastern side of Hammond Lane Metal Company Ltd	High	Degree or extent of soil contamination is unknown however the feature is considered of high importance on a local scale

Geohazards and Landslide Risk

According to the GSI landslide susceptibility mapping, the eastern coastal boundary is classed as having moderately high landslide susceptibility (Refer to **Figure 13.8**). This moderately high landslide risk extends inland at the southern end of the site in Area 2, 3 and 4. Site observations recorded during site walkovers indicate that the eastern coastal boundary slope is actively being eroded by the sea and there are landslides occurring along this slope face (Refer to **Appendix 13.3**). However, there has been no visible slope failure nor ground movement noted within Area 2, 3 or 4.

While the eastern coastal boundary is receding due to the process of coastal erosion, there is an area of the slope at the southern boundary that has undergone a significant amount of failure since Storm Frank in 2015. The failure is more substantial at this location due to the increased height of the slope (10m) and the stratigraphic profile which comprises glacial till with interbedded lenses of sand and silt (refer to **Figure 13.3b**). Toe erosion of the slope from the sea, overland water flow and water seepages which weaken and soften the slope material, heavy windswept rain and freeze thaw conditions contribute to the landslide failure at this location. This landslide is undergoing continuous monitoring (Refer to **Appendix 13.3**).

A summary of geohazards within the proposed development is shown in **Table 13.15**.

Table 13.15: Summary of geohazards within the proposed development

Feature	Description	Importance	Justification for Importance Rating
Coastal Erosion	Eastern section of the proposed development site along the coast with ongoing coastal erosion of the cliff and a recorded landslide	High	Moderately high landslide susceptibility with recorded landslide within this area
Moderately High Landslide Susceptibility	Within the proposed development site	High	Moderately high landslide susceptibility noted on the GSI webviewer but there are no noted failures on the site

13.3.2 Hydrogeology

The proposed development is located within the Ringaskiddy Peninsula, which is part of the lower Cork Harbour, on the western side of the West Channel. The harbour has a twice daily tidal cycle, with a range of approximately 4m in spring tides.

The Ringaskiddy Groundwater Body comprises an area of 16.7 km^2 and occupies an east-west trending valley on the west side of Cork Harbour. Most of the Ringaskiddy Groundwater Body includes urban and industrial areas.

13.3.2.1 Regional Aquifer Type and Classification

The GSI system for classifying the aquifers in Ireland is based on the hydrogeological characteristics, size, and productivity of the groundwater resource and is available on the GSI public data viewer (Geological Survey Ireland, 2025). There are three principal types of aquifers, corresponding to whether they are major, minor, or unproductive resources whereby:

- Regionally Important Aquifers are capable of supplying regionally important abstractions (e.g. large public water supplies), or excellent yields (>400m^3/d).
- Locally Important Aquifers are capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or good yields (100-400m^3/d).
- Poor Aquifers are capable of supplying small abstractions (e.g. domestic supplies), or moderate to low yields (<100m^3/d). The geology across the region is variable and the geological strata are generally aligned in southwest to northeast bands across the region.

The regional area surrounding the proposed development is predominantly underlain by a Locally Important Karstified Aquifer (Lk). This aquifer type includes the hydrogeological rock unit group denominated as Waulsortian Limestone.

Locally Important Bedrock Aquifer which is Moderately Productive only in Local Zones (Ll) underlies the centre and encompasses the edges of the regional area. The Ll aquifer type includes several different hydrogeological rock unit groups such as the Cuskinny Member, Ballysteen Formation, Old Head Sandstone Formation, Gyleen Formation, and the Pigs Cove Member.

The bedrock aquifer beneath the proposed development is classified as a Ll Aquifer (Table 13.16). The hydrogeological rock unit group associated to the Ll aquifer type is the Cuskinny Member, described as a flaser-bedded sandstone and mudstone. It was deposited during the Dinantian series in the Lower Carboniferous.

A summary of the aquifers located within the study area are presented in **Figure 13.12**.

Table 13.16: Aquifer type within the proposed development site

Aquifer Type	Description	Importance	Justification for Importance Rating
Ll	Bedrock which is Moderately Productive only in Local zones	Medium	Locally important aquifer which supplies the local area

13.3.2.2 Regional Groundwater Vulnerability

Groundwater vulnerability is the term used to describe the intrinsic geological and hydrogeological characteristics which determines the ease with which a groundwater body may be contaminated by human activities. The vulnerability is determined by the travel time and the attenuation capacity of the overlying deposits, whether the groundwater vulnerability is determined mainly by the permeability and thickness of the subsoils that underlie the topsoil. For example, bedrock with a thick, low permeability overburden is less vulnerable than bedrock with a thin high permeability, gravel overburden.

Aquifer vulnerability classification guidelines, as published by the GSI, is presented in **Table 13.17**.

Table 13.17: Aquifer vulnerability (DELG, EPA & GSI, 1999)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand / gravel)	Moderate permeability (e.g. sandy subsoil)	Low permeability (e.g. clayey subsoil, clay, peat)	Sand/gravel aquifers only	<30m radius
Extreme (E)*	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-
High (H)	>3.0m	3.0 – 10.0m	3.0 – 5.0m	>3.0m	Not applicable
Moderate (M)	Not applicable	>10.0m	5.0-10.0m	Not applicable	Not applicable
Low (L)	Not applicable	Not applicable	>10.0m	Not applicable	Not applicable

The regional groundwater vulnerability varies significantly across the study area as shown in **Figure 13.13**. The regional area of the proposed development is predominantly classified as Extreme groundwater vulnerability with areas where the bedrock is near or at surface. There are areas of High groundwater vulnerability to the west, north, and south of the proposed development and also a small area within the southern cliffs where the groundwater vulnerability is classified as Moderate (**Figure 13.13**).

Groundwater Vulnerability for the proposed development is predominantly classified as Extreme, with areas where the bedrock is near or at surface (**Figure 13.13**). Towards the southeast portion of the proposed development, there are a few areas where the groundwater vulnerability is classified as High and a small area within the cliffs where the groundwater vulnerability is classified as Moderate.

Following the GSI Database for South Cork, groundwater is not used for public or private water supply in the Ringaskiddy area.

13.3.2.3 Regional Groundwater Recharge Characteristics

The GSI has published Groundwater Recharge Mapping for the majority of Ireland. Actual recharge is the measure of how much rainfall can be assumed to infiltrate the ground and recharge the water table. It is based on the potential rainfall but also takes into account rainwater that does not enter the ground but becomes overland flow and enters streams. This occurs when the soil is saturated or has reached its field capacity, which is common in Ireland.

The regional groundwater recharge for the proposed development predominantly ranges from 151 to 200mm/yr (**Figure 13.14**). The northern and southern regions range from 101 to 200, 401 to 450 mm/yr with a few localised areas with a higher annual recharge rate between 551 and 600 mm/yr.

The proposed development is categorised as having an average groundwater recharge of 200mm/yr, with some parts of the surrounding area yielding an average recharge of up to 627mm/yr and 443mm/yr (**Figure 13.14**). These values influence the amount of recharge the study area receives and will influence the groundwater beneath the proposed development.

13.3.2.4 Groundwater Flooding

The GSI provides mapping of groundwater flood probability with categories of high, moderate, and low. There are no areas of probable flooding mapped within the proposed development or regional area.

The GSI also provide mapping for historical groundwater flooding which show the observed peak flood extents caused by groundwater in Ireland. There are two localised areas within the category Maximum Historic Groundwater/Surface water flooding located approximately 3km to the west of the proposed development.

The Synthetic Aperture Radar (SAR) seasonal flood maps are produced by the GSI and show observed peak flood extents between Autumn 2015 and Summer 2021. There are no areas of SAR seasonal flood maps within the proposed development or regional area. The nearest SAR seasonal flood area is categorised as "*Low Confidence*" and is located approximately 4km west of the proposed development, in Carrigaline East. According to the Flood Risk Assessment (FRA) updated in April 2025 there is a low risk of groundwater flooding on the area of the proposed development. Further details are available in the FRA report (**Appendix 13.4**).

13.3.2.5 Groundwater-Dependent Habitats

The Environmental Protection Agency (EPA) is responsible for the designation of environmentally protected sites in Ireland and maintains a publicly available database of these sites (EPA, 2025). These sites include Special Areas of Conservation (SAC), Special Protection Areas (SPA) Natural Heritage Areas (NHA), and proposed Natural Heritage Areas (pNHA). The purpose of this section is to assess any effects on groundwater-dependent terrestrial ecosystems that may be influenced by any potential changes in the groundwater regime as a result of the proposed development.

The EPA Maps online database was consulted to establish whether any groundwater-dependent terrestrial ecosystems (GWDTEs) are located within the regional area of the proposed development (EPA, 2025). There are two pNHA's and one SPA within 2km of the proposed development (**Figure 13.16**). A screening process was conducted to determine whether the habitats were groundwater dependant using public available information from the GSI, National Parks & Wildlife Service (NPWS), and EPA mapping viewers and relevant guidance (EPA 2013).

Cork Harbour SPA (Site Code: 004030)

- Habitat Types: Intertidal mudflats, saltmarshes, estuarine waters, and some wet grassland areas.
- Conservation Interests: Migratory waterbirds and wetland habitats.
- Hydrological Context: Dominated by tidal and surface water processes. Groundwater may contribute indirectly via baseflow to freshwater inflows.
- Aquifer Setting: Underlain by a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll) and a Locally Important Aquifer – Karstified (Lk). Groundwater vulnerability ranges from Moderate to Rock at Surface and/or Karst.
- Conclusion: Not groundwater dependent. Ecological functioning is primarily driven by tidal and surface water dynamics.

Lough Beg pNHA (Site Code: 001066)

- Habitat Types: Estuarine and transitional habitats, with some saltmarsh and wet grassland.
- Hydrological Context: Located adjacent to the estuarine system; potential for groundwater discharge influencing salinity gradients.
- Aquifer Setting: Locally Important Aquifer – Karstified (Lk) and a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll). Groundwater vulnerability ranges from High to Rock at Surface and/or Karst.
- Conclusion: Potentially groundwater influenced, but not groundwater dependent. No evidence of GWDTEs present.

Monkstown Creek pNHA (Site Code: 001979)

- Habitat Types: Tidal mudflats and saltmarsh.
- Hydrological Context: Tidal system with limited freshwater inflow; possible minor groundwater seepage.
- Aquifer Setting: Locally Important Aquifer – Karstified (Lk) and a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll). Groundwater vulnerability ranges from High to Rock at Surface and/or Karst.
- Conclusion: Potentially groundwater influenced on a minor scale. Ecological processes are primarily surface water and tidal driven.

A summary of the findings for the GWDTEs screening can be found in **Table 13.18**.

Table 13.18: Summary of groundwater-dependant terrestrial ecosystems (GWDTEs) screening for the proposed development

Habitat	Distance from proposed development	Groundwater Dependant Habitat	Justification
Cork Harbour SPA	~500m South and ~2km northwest of the proposed development	No	Tidal and surface water dominated; no GWDTEs identified
Lough Beg pNHA	~500m South of the proposed development	No	Estuarine setting with potential groundwater interaction, but no GWDTEs identified
Monkstown Creek pNHA	~2km Northwest of the proposed development	No	Tidal habitat with minimal groundwater interaction. No GWDTEs identified

Based on the findings in **Table 13.18**, Lough Beg pNHA and Monkstown Creek pNHA possibly have a minor influence by groundwater but are not dependant and will not be affected by the implementation of the proposed development. Therefore, they will not be considered further within this assessment. A full assessment of the ecological features in the study area for the proposed development is outlined in **Chapter 12 *Biodiversity*.**

13.3.2.6 Potential Groundwater Contamination in Surrounding Sites

There are six industrial emissions licensed facilities within the 2km regional area of the proposed development (Registration numbers P0004, P0010, P0013, P0476, P0778, P0997-01) (**Figure 13.17**).

There is one licensed facility located in the centre of the proposed development (outline the redline boundary), which is known as The Hammond Lane Metal Company Limited (Active Licence Number P0997-01).

The EPA provides public documents that can be consulted on the website under the registration number. There is a list of available documents for the Hammond Lane Metal Company Limited site which includes Groundwater Monitoring Reports. The last available report is date from January 2024; the groundwater samples were collected in November 2023, available on the EPA website. There are currently six groundwater monitoring boreholes which have been monitored quarterly per year (MW1, MW2, MW3A, MW4, MW5 and MW6). Following the licence requirements, the following parameters have been tested: pH, conductivity, chemical oxygen demand (COD), chloride, sulphate, nitrate, orthophosphate, metals/ non-metals, total ammonia, ammoniacal nitrogen, total nitrogen, fluoride, hazardous compounds (VOCs), mercury, extractable petroleum hydrocarbons including diesel range organics, polyaromatic aromatic hydrocarbons (PAHs) and BTEX.

The results were screened against the following guidelines:

- Groundwater Regulations SI No 366 of 2016
- Drinking Water Regulations SI No 122 of 2014, and
- EPA Interim Guideline Values (IGV)

The report concluded that exceedances were noted on the following parameters:

- Ammoniacal Nitrogen at MW3A – Exceedance in Groundwater Regulation. MW3A has reported elevated Ammoniacal Nitrogen in three monitoring periods of 2023.
- Phosphate (Ortho as P) at MW3A
- Iron at MW3A – Exceedance in Drinking Water Regulations and EPA IGVs. MW3A has reported elevated iron in all quarterly monitoring periods of 2023.
- Manganese elevated in several locations (MW2, MW3A, MW4, and MW6). Maximum concentration reported at MW3A.
- Total aliphatic and aromatics at MW3A – Exceedance in Groundwater Regulation.
- Potassium in exceedance of the EPA IGVs reported at MW3A and MW5.
- Total PAHS and VOCs were below the limit of detection.

Following the 2016 EIS, the groundwater level at the MW3A installation was recorded at -1.2m OD. The 2025 site data confirms that groundwater at MW3A is downgradient of the Hammon Lane Metal Company Limited site and also confirms that the groundwater at MW3A has a tidal influence.

13.3.2.7 Groundwater Resources - Abstractions

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

The GSI have delineated certain areas nationwide as groundwater Source Protection Areas in order to provide protection for groundwater resources, particularly group water schemes and public water supplies (GSI, 2025). A Source Protection Area is delineated according to the hydrogeological characteristics of the aquifer, the pumping rate, and the recharge in the area. Activities that may impact on groundwater are tightly controlled within the Source Protection Area. There are no Source Protection Areas located within 2km of the proposed development site.

The EPA maintains a register of groundwater abstractions more than 25m^3/d under the Water Environment (Abstractions and Associated Impoundments) Act 2022 and its associated Regulations transpose the Water Framework Directive (2000/60/EC) (Government of Ireland, 2022; European Parliament and Council, 2000). The exact location is not provided for public water supplies, only the townland. The EPA register indicates there are three groundwater abstractions within the study area.

According to the GSI and the EPA, there are 19 groundwater related features located within 2 km of the proposed development: 18 approximately 1km to the south of the proposed development and one approximately 1.6km to the south of the proposed development (**Figure 13.15**). The 18 groundwater features are categorised as "*other use*" and were drilled during site investigations undertaken by Pettits in 1997 and 1998; located in a cluster within the current Hovione Loughbeg Manufacturing.

The additional groundwater feature is an industrial use well and is located in the vicinity of the current Thermo Fisher site in Curraghbinny. Based on the dentification and available information, it is likely that these features correspond to ground investigations boreholes rather than active water abstractions. As such, they will not be considered any further.

The identified groundwater abstractions with location data available are presented in **Figure 13.15**.

13.3.2.8 Site Specific - Groundwater Levels

Several ground investigations were completed within the area of the proposed development, including the installation of groundwater monitoring boreholes. A summary is provided below:

- Five groundwater monitoring boreholes (BH1 to BH5) were installed in both the overburden and the bedrock at selected locations of the proposed development undertaken by K.T. Cullen & Co. Ltd as part of the 2001 ground investigation (**Appendix 13.1**);
- Four groundwater monitoring boreholes (MW1 to MW4) were installed within the Hammond Lane site as part of the 2011 Hammond Lane ground investigation undertaken by O'Callaghan Moran & Associates (**Appendix 13.1**).
- Four groundwater monitoring boreholes were installed as part of the coastal recession mechanisms investigation by Soil Mechanics Ltd in 2012 (BH1 to BH4) (**Appendix 13.2**).
- Four groundwater monitoring boreholes were installed as part of the ground investigation carried out by priority Geotechnical Ltd (PGL) in 2019 (RC03, RC04, RC05, and RC08) (**Appendix 13.2**).

Figure 13.18 shows the location of groundwater monitoring boreholes located within the proposed development.

Four site visits were conducted by Arup engineers between February and April 2025 to collect baseline hydrogeological data in support of the updated EIS for the proposed development. The details of these site visits are outlined below:

- **12 February 2025**: A site walkover was undertaken to the proposed development to look at accessibility to the existing borehole installations. A decision was made to get a landscaper to clear overgrown vegetation to RC03, BH1, BH2, BH3, and BH4.
- **26 of February 2025**: A well condition survey was carried out to determine which existing wells in the proposed development were suitable for groundwater monitoring and sampling. The wells RC03, RC04, RC05, BH2, and BH4 were determined suitable to be monitored and/or sampled to assist in developing the conceptual ground model for the site.
- **16 of April 2025**: Round 1 of the groundwater sampling (RC04 and RC05) and installation of four groundwater level data loggers and one barometric logger (RC03, RC04, RC05, and BH4). Groundwater levels were low in RC03 and BH2 on this date, meaning groundwater samples could not be taken.
- **30 of April 2025**: Round 2 of the groundwater sampling (RC03, RC04, RC05, and BH2) and download of the data loggers.

Table 13.19 presents a summary of the the manual dips taken during the site visits, including information about borehole ground elevation, groundwater levels, response zone, and additional findings.

Table 13.19: Groundwater Levels obtained from manual dips on three site visits in 2025

BHRef.	Ground Level mOD*	Response zone	Groundwater Level mOD			Notes
			26/02/2025	16/04/2025	30/04/2025	
RC03 (2019)	26.16	Bedrock	17.82	13.94	18.19	
RC04 (2019)	6.36	Bedrock	5.21	3.04	4.55	Tidal influence only when groundwater level is below 4.0mOD as observed on hydrograph (**Figure 13.19**)
RC05 (2019)	4.49	Bedrock	1.10	0.46	0.77	Tidal influence as observed from groundwater level hydrograph (**Figure 13.19**)
RC08 (2019)	3.12	Bedrock	0.96	-	-	
BH1 (2012)	7.01	Subsoil	3.26	0.70	-	
BH2 (2012)	8.99	Subsoil	5.14	1.92	2.60	
BH3 (2012)	10.00	Subsoil	7.12	4.93	5.40	
BH4 (2012)	11.60	Subsoil	8.02	6.17	6.14	

*Ground Elevation for the boreholes was taken from the 2012 GI completed by Soil Mechanics Ltd and 2019 GI completed by Priority Geotechnical Ltd

Table 13.20 presents a summary of the groundwater level readings provided by the data logger in the four boreholes identified as RC03, RC04, RC05 and BH4.

Table 13.20: Groundwater Levels recorded on the data loggers*

BHRef.	Ground Level mOD**	Response zone	Groundwater Level m OD*			Notes
			Maximum	Minimum	Average	
RC03 (2019)	26.16	Bedrock	18.91	13.73	14.51	
RC04 (2019)	6.36	Bedrock	4.72	3.04	4.21	Tidal influence only when groundwater level is below 4.0mOD as observed on hydrograph (**Figure 13.19**)
RC05 (2019)	4.49	Bedrock	0.88	0.00	0.45	Tidal influence as observed from groundwater level hydrograph (**Figure 13.19**)
BH4 (2012)	11.60	Subsoil	6.17	6.11	6.13	

*Monitoring period between 16/04/2025 – 30/04/2025

**Ground Elevation for the boreholes was taken from the 2012 GI completed by Soil Mechanics Ltd and 2019 GI completed by Priority Geotechnical Ltd

A hydrograph chart illustrating groundwater level fluctuations is presented in **Figure 13.19** This includes data collected from data loggers and manual dips at monitoring boreholes RC03, RC04, RC05 and BH4 between the 16 to 30 April 2025. Higher groundwater levels generally occur during wintertime with peak groundwater levels generally between January and February, whilst lower groundwater levels occur during summertime, with the lowest groundwater levels occurring between August and September.

The results also show that intense rainfall (storm event) has a more expressive response on the bedrock aquifer recorded by borehole RC03 and RC04 indicating that on these areas the recharge enters the weathered bedrock more rapidly than elsewhere and causes groundwater level to rise. BH4, which monitors the subsoil aquifer, showed a slight and gradual increase in the groundwater levels in response to the intense rainfall.

The RC05 borehole did not show a change in groundwater level in response to the intense rainfall. It showed undulating groundwater levels between approximately 0.0 and 1.0mOD near to sea level and correlating to the tides, suggesting it has a tidal influence.

At RC04, the groundwater level also showed an undulating pattern correlating to tidal influence but only during lower groundwater levels between approximately 3.0 and 4.0mOD. When groundwater levels were higher (> 4.0mOD), the tidal influence was not detected.

Groundwater flow tends to move in a northern to north-eastwards direction across the site as indicated by the groundwater contour maps for the subsoil and bedrock response zones (**Figure 13.20a; Figure 13.20b**). Groundwater also flows towards the eastern coastal boundary slope in the subsoil as observed during the site walkover on the 12 February 2025.

Based on the groundwater level monitoring, there is a small area in the eastern part of the proposed development site, in Area 2, where groundwater may reach the natural ground surface during peak winter groundwater levels. Elsewhere, groundwater levels are anticipated to remain below the natural ground level.

13.3.2.9 Site Specific - Groundwater Quality

Two rounds of groundwater quality sampling were carried out in 2025, the first round on 16 of April and the second round on the 30 of April, as part of the baseline hydrogeological study. Groundwater sampling was undertaken in borehole installations in RC04 and RC05 (2019) in round 1 and in RC03, RC04, RC05 (2019) and BH2 (2012) in round 2. Groundwater samples could not be taken from RC03 and BH2 in round 1 as the groundwater levels were too low (**Table 13.19**). Refer to **Figure 13.10** for the location of exploratory holes.

A total of 187 parameters were tested including metals, polycyclic aromatic hydrocarbons (PAHs), organic compounds and bacterial contaminants such as Total Coliforms and E-Coli to gain a representative baseline for the proposed development. The results were compared to groundwater threshold values (GTV) from the Groundwater Regulations and limit of detection (LOD) from the laboratory. The laboratory tests results are presented in **Appendix 13.6.**

Most of the groundwater test results from the two sampling rounds are below the GTV. Exceedances of Chloride (>24.0 mg/l) were recorded in RC05 (2019) during both sampling rounds (42.9 mg/l, 40.0 mg/l). A slight exceedance of Chloride was recorded in BH2 (2012) on the second sampling round (24.9 mg/l).

Elevated concentrations of Chloride, Sulphate as SO4, Nitrate and Total Dissolved Solids (TDS) can be related to saline intrusion. **Table 13.21** and **Table 13.22** summarises the results of these parameters during both sampling rounds.

Groundwater levels and groundwater analysis results from the RC05 borehole indicate that the Chloride exceedance and the elevated concentrations of the further parameters (**Table 13.21** and **Table 13.22**) are related to saline intrusion. The Chloride exceedance at BH2 may also be related to saline intrusion, however no groundwater level monitoring was undertaken at this location and groundwater sampling was carried out on only one occasion.

Table 13.21: Summary of results for Chloride, Sulphate, Nitrate and TDS – Sampling Round 1 completed on the 16/04/25

Sample ID	RC04	RC05				
			GTV	LOD	Units	Method No.
Chloride	22.3	42.9	24	<0.3	mg/l	TM38/PM0
Sulphate as SO4	16.3	44.0	187.5	<0.5	mg/l	TM38/PM0
Nitrate	15.9	9.4	37.5	<0.2	mg/l	TM38/PM0
Total Dissolved Solids (TDS)	194.0	392.0		<35	mg/l	TM20/PM0

Table 13.22: Summary of results for Chloride, Sulphate, Nitrate and TDS – Sampling Round 2 completed on the 30/04/25

Sample ID	RC03	RC04	RC05	BH2				
					GTV	LOD	Units	Method No.
Chloride	22.3	22.6	40.9	24.9	24	<0.3	mg/l	TM38/PM0
Sulphate as SO4	7.3	14.6	41.7	11.2	187.5	<0.5	mg/l	TM38/PM0
Nitrate	6.0	12.8	7.5	14.6	37.5	<0.2	mg/l	TM38/PM0
Total Dissolved Solids (TDS)	136.0	146.0	374.0	257.0		<35	mg/l	TM20/PM0

Groundwater analysis from the first sampling monitoring round on 16th April 2025 detected concentrations above the LOD for Polycyclic Aromatic Hydrocarbons (PAHs) in borehole RC04. On the same date, three PAHs were slightly elevated in borehole RC05. In the second monitoring round, completed on 30th April 2025, no PAHs were detected above the LOD in any of the sampled boreholes (RC03, RC04, RC05, and BH2).

Table 13.23 shows a summary of the elevated PAH detected during the first sampling round in the boreholes RC04 (2019) and RC05 (2019). Groundwater quality results are presented in the **Appendix 13.6**.

Table 13.23: Summary of the PAH results above the LOD detected on the first sampling round

Sample ID	RC04	RC05			
Sample Date	16/04/2025 12:45	16/04/2025 11:30			
			LOD	Units	Method No.
PAH MS					
Phenanthrene #	0.02	0.01	<0.005	ug/l	TM4/PM30
Anthracene #	0.01	<0.005	<0.005	ug/l	TM4/PM30
Fluoranthene #	0.05	0.01	<0.005	ug/l	TM4/PM30
Pyrene #	0.04	0.01	<0.005	ug/l	TM4/PM30
Benzo(a)anthracene #	0.03	<0.005	<0.005	ug/l	TM4/PM30
Chrysene #	0.02	<0.005	<0.005	ug/l	TM4/PM30
Benzo(bk)fluoranthene #	0.04	<0.008	<0.008	ug/l	TM4/PM30

Sample ID	RC04	RC05			
Sample Date	16/04/2025 12:45	16/04/2025 11:30			
			LOD	Units	Method No.
Benzo(a)pyrene #	0.03	<0.005	<0.005	ug/l	TM4/PM30
Indeno(123cd)pyrene #	0.02	<0.005	<0.005	ug/l	TM4/PM30
Benzo(ghi)perylene #	0.02	<0.005	<0.005	ug/l	TM4/PM30
PAH 16 Total #	0.27	<0.173	<0.173	ug/l	TM4/PM30
Benzo(b)fluoranthene	0.03	<0.008	<0.008	ug/l	TM4/PM30
Benzo(k)fluoranthene	0.01	<0.008	<0.008	ug/l	TM4/PM30

Groundwater sampling tested for the four boreholes ranged between 97.00 to 129.00% for Surrogate Recovery Toulene D8, 4-Bromofluorobenzene, 2-Fluorobiphenyl, and p-Terphenyl-d14.

13.3.2.10 Summary of Feature Importance

The feature importance ranking for hydrogeology are based on the EPA Guidelines (EPA 2022) and Guidelines of Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2008b).

A summary of the hydrogeological features, or receptors, for the proposed development are summarised in **Table 13.24**. Receptors with an importance ranking of low will not be considered further as they will not result in a significant effect according to Box 5.4 of the NRA Guidelines (NRA, 2008b).

The possible effects on features with an importance ranking above medium will be accessed in the following sections (**Section 13.5.3**).

Table 13.24: Summary of Hydrogeology features of importance – Hydrogeology Receptors

Category	Feature	Location	Description	Importance	Justification for Importance Rating
Aquifer	Locally Important Aquifer	Within the proposed development	Bedrock which is Moderately Productive only in Local Zones	Medium	Locally important aquifer which supplies the local area

13.3.3 Hydrology

The main waterbody within the vicinity of the proposed development is the west channel of Cork Harbour, which is adjacent to the eastern boundary of the site. The nearest rivers and streams are the Glounatouig Stream that flows into Monkstown Creek, approximately 3km to the west of the site, and the Owenboy River that flows into Cork Harbour, approximately 2.5km to the south of the proposed development (**Figure 13.21**).

13.3.3.1 Water Framework Directive Waterbodies

The proposed development occurs within the Lee, Cork Harbour and Youghal Bay WFD Catchment. The catchment area of 2 153 km^2 discharges to the River Lee and all streams entering tidal water in Cork Harbour and Youghal Bay and between Knockaverry and Templebreedy Battery.

The largest urban centre in the catchment is Cork City. According to the cycle three catchment assessment (assessment period of 2016-2021: EPA, 2024[1]) a total of 49% of surface waterbodies were not achieving a '*good*' or '*high*' ecological status.

A total of 33% of all waterbodies are '*at risk*' of not meeting their environmental objective in the catchment, with 24% being under '*review*' and 43% are '*not at risk'*. The Cork Harbour and Lough Mahon are two of the five heavily modified waterbodies in the catchment[2].

A Water Framework Directive (WFD) Assessment is included in **Appendix 13.7**.

Status and risk of WFD waterbodies

The proposed development has an indirect hydrological connection with the Cork Harbour, Outer Cork Harbour, and Western Celtic Sea Coastal WFD waterbody; and the Lough Mahon, North Channel and Owenboy Estuary Transitional WFD waterbodies (**Table 13.25**). All the WFD coastal and transitional waterbodies connected to the Cork Harbour, except the Western Celtic Sea, are '*at risk'* of not reaching their goal of '*good*' status by 2027 or earlier. The Cork Harbour and Lough Mahon WFD waterbodies have a goal of reaching '*Good Ecological Potential*'.

The catchment assessment indicated that all the surface WFD waterbodies have a '*moderate*' ecological status, with the exception of the Western Celtic Sea coast WFD waterbody, Lough Beg/Curraghbinny transitional WFD waterbody and Hilltown_010 river WFD waterbody (**Table 13.25**). The proposed development has an indirect hydrological connection with the Ringaskiddy Groundwater WFD waterbody. The Groundwater WFD waterbody is '*not at risk*' and is in a '*good*' status. Current pressures on surface water bodies are mainly through urban wastewater, urban runoff and nutrient inputs from agriculture.

Table 13.25: WFD Waterbodies Risk, Status and Pressures

WFD waterbody type	WFD waterbody	Code	Risk	Status	Pressures	Distance from proposed development
River	Hilltown_010	IE_SW_19H050470	Under review	Good		0km
Coastal	Cork Harbour*	IE_SW_060_0000	At risk	Moderate	Urban Run-off Urban Wastewater	0km
Coastal	Outer Cork Harbour	IE_SW_050_0000	At risk	Moderate	Agriculture	3.3km
Transitional	Lough Beg/Curraghbinny	IE_SW_060_1100	Under review	Good		2km
Transitional	Lough Mahon*	IE_SW_060_0750	At risk	Moderate	Urban Wastewater	2.5km
Transitional	Owenboy Estuary	IE_SW_060_1200	At risk	Moderate	Agriculture	2km
Groundwater	Ringaskiddy	IE_SW_G_072	Not at risk	Good		0km

*Heavily modified waterbody

[1] EPA, 2024. Cycle 3 HA 19 Lee, Cork Harbour and Youghal Bay Catchment Report.

[2] Heavily modified waterbodies have different environmental objectives applied (Good Ecological Potential) which recognise that the modifications may prevent Good Ecological Status from being achieved. However, all Water Framework Directive standards for other elements such as nutrients and chemicals must still be met, and the modifications must be mitigated as far as possible (EPA, 2022)

Hydrologically linked protected areas

Within 5km of the proposed development there are protected areas that are indirectly hydrologically connected to the proposed development site (**Table 13.26**). This includes Drinking Water (**Figure 13.22**), Special Area of Protection (**Figure 13.26**) and Nutrient Sensitive Area (**Figure 13.24**).

Table 13.26: Hydrologically Connected Protected Areas

Protection	Type	Name	Code	Distance from proposed development
Article 7 Abstraction for Drinking Water	Groundwater WFD waterbody	Ringaskiddy	IE_SW_G_072	0km
Birds Directive	SPA	Cork Harbour	IE0004030	2km
Urban Waste Water Treatment Directive Sensitive Area	Within a Transitional WFD waterbody	Lee Estuary / Lough Mahon	IE_SW_060_0750	2.5km

Priority Areas for Action (PAA)

A number of waterbodies have been prioritised through the selection of Areas for Action. There were seven Priority Areas for Action identified for the second river basin management planning cycle in the Lee, Cork Harbour and Youghal Bay Catchment. The report identified agriculture and hydromorphology as the significant pressures in the PAA. Regarding nutrients, high nitrate levels are a cause for concern, diffuse phosphorus is a possible issue, point sources are likely present as indicated by spikes in orthophosphate and ammonium concentration and domestic wastewater treatment plants may be a pressure in the lower reaches of Owenboy (Cork)_010.

Within the Cork Harbour there are additional measures under the Urban Waste Water Treatment Directive to minimise the impact of urban wastewater discharges on receiving waters. Additional investment is targeted to upgrade infrastructure, both treatment plants and collection networks with the objectives of Ireland's National Recovery and Resilience Plan[6] including the Enhanced Ambition Programme to advance priority wastewater treatment plant projects whose discharges have been identified as being significant pressures on water bodies and impacting on WFD objectives. Uisce Éireann identified at least 10 Water Treatment plant upgrades works for inclusion in this programme by Q3 2022. The completion of the upgrades to the selected small wastewater treatment plants will be completed by Uisce Éireann by Q3 2025. The treatment plant for the Ringaskiddy Agglomeration (D0057-01) has an estimated completion date of 2028. The treatment plant for Cobh Agglomeration (D0054-001) has been completed.

Management of urban drainage is closely related and will integrate the urban wastewater drainage in both separate and combined collection systems. The summary of Actions from the third cycle River Basin Management Plan to mitigate urban runoff pressures includes[3] Urban Runoff 5: Additional resources will be provided to Local Authority Waters Programme (LAWPRO) to provide specialist support to local authorities in adopting international best practice on nature-based surface water management within planning and infrastructure project delivery (Two staff members by 2025. Cross reference to action under '*Governance/Implementation*' measures on local authority resources).

13.3.3.2 Water Quality

The EPA dataset was referred to for assessing ecological and chemical water quality for the nearest hydrologically connected to the proposed development (i.e. Cork Harbour coastal WFD waterbody) (**Table 13.27**).

[3] Water Action Plan 2024, A River Basin Management Plan for Ireland –P Appendix 1: Programme of Measures: Further information on the environmental measures to 2027 (2024)

Under the third catchment assessment the Cork Harbour WFD waterbody had a '*moderate*' ecological status or potential and was failing to achieve '*good*' status for chemical surface water status due to Polybrominated diphenyl ethers (PBDE) - unspecified isomers. Trends from the EPA monitoring indicate that:

- Chlorophyll for winter and summer have a high indicative quality
- Dissolved Inorganic Nitrogen (as N) for winter was of moderate and in summer was high indicative quality.
- Orthophosphate (as P) – unspecified for winter was of good and in summer was high indicative quality.

Table 13.27: Ecological status or potential for Cork Harbour coastal WFD waterbody

Status	Value		
Ecological Status or Potential	Moderate		
Biological status or potential	Good	Phytoplankton status or potential	Good
		Invertebrate status or potential	Good
Hydromorphological conditions	Moderate		
Supporting chemistry conditions	Moderate		
General conditions	Moderate		
Oxygenation conditions	Moderate		
Dissolved oxygen (%sat)	Moderate		
Nutrient conditions	Good		
Nitrogen conditions	Good		
Specific pollutant conditions	Pass		

Two coastal EPA stations CW05003150LE8004 (data from 2012 to 2018 and 2021) and CW05003150LE8001 (data from 2013 to 2021) are in the vicinity of the proposed development (**Figure 13.28**). Only Site CW05003150LE8001 is part of the WFD monitoring program (**Table 13.28**).

Table 13.28: Water Quality Summary - CW05003150LE8001

CW05003150LE8001 - Water Quality Summary							
Water Quality Parameter	Unit	Max	Min	Average	95%ile	Count	Date Ranges
Ammonia-Total (as N)	mg/l	0.65	0.01	0.077	0.1595	111	2013-2025
BOD - 5 days (Total)	mg/l	3.6	1	1.567	3.335	34	2013,2014,2016-2024
Salinity	PSU	35.4	16.8	31.13	34.19	98	2014-2025
ortho-Phosphate (as P)	mg/l	0.5	0.005	0.025	0.04	59	2013-2025
pH	pH units	8.4	7.8	8.059	8.245	112	2013-2025

CW05003150LE8001 - Water Quality Summary							
Temperature	°C	19.6	5.9	13.146	17.58	98	2013, 2015-2025

13.3.3.3 Flooding

The proposed development was assessed to determine whether the site was at risk with respect to flooding (Refer to **Appendix 13.4 *Flood Risk Assessment***). Potential sources of flooding considered included:

- Fluvial Flooding
- Tidal/Coastal Flooding
- Groundwater Flooding
- Pluvial/Urban Drainage Flooding

A summary of the findings of the flood risk assessment is as follows:

- Given the absence of any significant watercourse in the vicinity of the proposed development, the risk of fluvial flooding is very low.
- The site is not indicated as being within the design 1000-year tidal floodplain. Consequently, the site is classified as lying within Flood Zone C.
- There is a low risk of groundwater flooding of the site.
- Based on a review of all available information, the 1 in 200-year design tidal level at the site has been estimated as 2.87m OD. Sections of the road close to Gobby Beach car park are below this level and are therefore at risk of tidal flooding during a 1 in 200-year tidal event.
- Small areas of the site along the northern boundary are also below the predicted 1 in 200-year design tidal level (2.87m OD). The majority of the site is above 2.87m OD.
- There is a risk of pluvial flooding to the L2545 and the low-lying areas of the site during periods of heavy rainfall due to tide locking of the existing drainage outfall. This is described further below.

The existing storm water drainage system along the road was recently upgraded as part of the recently completed Ringaskiddy urban realm and active travel scheme.

The invert level of the outfall is -0.28m OD. As the level of the tide rises above this elevation the drainage system can become tide locked if there is insufficient differential head at the outfall. When this occurs, the surface water which has reached the pipe is unable to discharge through the outfall and collects in the drainage pipe. The discharge pipe becomes surcharged and any subsequent rain water falling on that area of the road normally drained by the existing gullies cannot drain away and causes the road to flood. This area of the road is located adjacent to the entrance to the public car park at Gobby Beach.

13.3.3.4 Site Specific Drainage

Surface water within the site boundary appears to drain through naturally occurring channels along the field boundaries following the natural topography of the landscape which falls from 41m OD in the south of the site to 2 to 3m OD at the northern boundary with the road. The relatively flat and low-lying areas in the northern parts of the site adjacent to the road, to the east and west of the Hammond Lane facility, are poorly drained due to the gradient and possibly due to the presence of the thicker glacial deposits. Ponding of water has been noted in these areas during winter months. The potential for flooding of the low-lying parts of the site is further discussed in the following **Section 13.4.3.5** below and in **Appendix 13.4 *Flood Risk Assessment***.

13.3.3.5 Existing Water Services

The primary water supply plant servicing Ringaskiddy, Cork, is the Inniscarra Water Treatment Plant. This facility supplies a reliable and sustainable water supply to Cork City and the surrounding areas, including Cork Harbour and Ringaskiddy.

The direct discharge from the Ringaskiddy Village agglomeration was decommissioned in September 2018. Flows from the agglomeration are pumped to the new WWTP at Shanbally.

13.3.4 Coastal Recession

The coastline along the eastern boundary of the proposed development consists of a glacial till slope adjoining Gobby Beach. The glacial till slope is very shallow near the public car park to the north and steepens to the south to a maximum of 10 m high.

From 2008 to 2025 a series of studies and surveys were carried out to get an understanding of coastal erosion patterns in the area with a view to assess if any coastal protection measures were needed for the coastal boundary of the site. In November 2008, Arup carried out an assessment of coastal retreat and coastal flooding at the site of the proposed development. The coastline, which forms the eastern boundary of the site, was found to have eroded over the past 100 years at a varying rate, with the most significant erosion occurring along the southeastern boundary of the site. It was also noted that some accretion or increase in levels by natural growth of sediment had occurred along a section of the beach to the northeast of the site.

In May 2012, Arup carried out site investigations of the proposed development site and Gobby Beach. The scope of works included an investigation of soil conditions at the base of the slope and of areas that will be exposed to erosion in the future, ground water levels in the cliff and sea water levels, wave climate and its interaction with the beach and cliff along the eastern boundary of the site. From the investigations it was concluded that the sea was likely to frequently reach the base of the cliff at the site when extremely high-water levels or extremely high waves are caused by storms. In addition, it was noted that the slope was susceptible to erosion due to wave action, ground water seepage and surface water overland flow. It was recommended that the coastal evolution of the area be monitored, and that a comprehensive topographical and bathymetric survey be carried out.

In 2014, Arup was commissioned by Indaver to provide consultancy services for the development of the Indaver site at Ringaskiddy. The services included:

- Topographic survey for the beach and cliffs at the eastern boundary of the proposed development site, in the area necessary to assess the coastal erosion processes which may have an effect on the proposed development
- Bathymetric survey in the nearshore area adjacent to the eastern boundary of the proposed development site, to be used as an input for the numerical wave model to assess the coastal erosion processes in the area
- Coastal erosion study (included as Appendix 13.3 to the 2016 EIS), which included:
  - Assessment of the retreat rate based on historical information and the new surveys;
  - Numerical wave model and assessment of beach sediment transport;
  - Assessment of expected coastal retreat;
  - Appraisal of potential impacts of expected coastal retreat on the proposed Ringaskiddy Resource Recovery Centre; and
  - Mitigation measures to minimise potential impacts.

In March 2016, Arup undertook a site investigation of Gobby Beach following several localised slope failures triggered by a season of extreme rainfall and winter storms. The investigation assessed the size, causes, and impacts of the failures to evaluate their effects on the site and its surroundings. The report was included as an addendum to the 2016 EIS.

In 2016, An Bord Pleanála commissioned an independent marine hydrodynamic consultant (Aqua Vision BV) to carry out a review of the proposed marine works as detailed in the pre application consultation (Refer to **Appendix 13.5 *Coastal Expert Review of Arup Coastal Erosion Study*).** This report also addressed the conclusions and recommendations of the independent review of the proposed works associated with the development as presented by An Bord Pleanála.

In 2025, Arup has prepared an updated EIS for the proposed development, which had been requested by An Bord Pleanála. This 2025 EIS builds on previous submissions by incorporating the 2016 Coastal Erosion Study and new data and findings collected up to 2025. Key updates include:

- A new topographic survey of cliffs and beach at the site and adjoining coastal areas carried out on the 3rd March 2025;
- Site investigation carried out in 2019. Refer to **Appendix 13.2**;
- A site walkover conducted in May 2025. Refer to Appendix B *Gobby Beach Site Visit Report (Arup, 2025)* in **Appendix 13.3 *Coastal Erosion Study;***
- A revised assessment of cliff evolution, including an updated estimate of retreat rates based on historical records, additional topographic surveys, and most recent site walkover;
- An evaluation of the potential effects of projected coastal retreat on the proposed development;
- Updates to the beach sediment transport analysis, which now incorporates a SHINGLE-B model to support cliff erosion modelling;
- Additional climate change considerations in relation to expected sea level rise following the Statutory Climate Change Adaptation Plan for the Transport Sector (T-SAP II) for Public Consultation released in June 2025 by the Department of Transport, Climate Adaptation Research and Energy Division [3]; and
- Proposed mitigation measures designed to minimise potential effects on the proposed development site.

The assessment indicated that the cliff is eroding due to a combination of cliff toe erosion, softening of the weaker till in the upper cliff section due to water seepages and overland surface water flow, and weathering of the cliff due to rain, wind and freeze thaw action. Each of these processes ensure that the cliff face will continue to recede inland. The removal of glacial till at the base of the slope undermines the overlying weakened material and causes the slope to slip and fail. The slumped debris at the base of the slope is eroded by sea water ingress, removing protection from the base of the slope and causing the process to begin again and the slope to recede.

A detailed coastal erosion study is provided in **Appendix 13.3 *Coastal Erosion Study*** of this EIS. The details provided in this chapter summarise **Appendix 13.3**.

13.3.4.1 Baseline Retreat Rates

It was necessary to make an estimate of coastal erosion rate along the eastern side boundary in order to assess whether the proposed development could be impacted by coastal erosion.

An initial estimate of the coastal erosion rate was made using historical data sets collected from various sources including the Geological Survey of Ireland (GSI) and the Ordnance Survey of Ireland (OSI). Historical retreat rates, identified from these historical datasets over the period 1897-2008 were estimated to be up to 0.36 to 0.53m per year. However, cliff retreat occurs through intermittent events rather than being a linear continuous processes given the variable and episodic nature of cliff recession. The selected assessment period significantly influences the calculated retreat rates. Refer to Section 2.1 (Assessment of historical retreat) of **Appendix 13.3 *Coastal Erosion Study*** for further details.

The level of uncertainty associated with this prediction was high due to different factors including:

- Significant variation in the coastal retreat over the assessed 110 year period;
- Large gaps between available survey data and their limited precision, and

- Inability to verify the accuracy of historical mapping to the same standard as modern surveying/monitoring techniques.

Therefore, to validate the retreat rate assessed from the historical datasets, a campaign of topographic surveys was undertaken between 2008 and 2025 as discussed in Section 2.2 (Topographic survey assessment) of **Appendix 13.3** ***Coastal Erosion Study***.

Two representative timeframes were chosen to assess the cliff erosion: the global monitoring period (2008–2025) and the latest period (2016–2025). The latest period between 2016 and 2025 was chosen to assess any potential accelerated retreat trends in any of the cross-sections of the cliffs in the most recent period monitored when compared with the global monitoring period.

Cliff behaviour was assessed by considering the evolution of two reference lines: the top and toe of the cliff. A plan comparison of these lines for 2008, 2016, and 2025 is provided in Appendix C *Historical Cliff Evolution – Comparative Plan* of **Appendix 13.3** ***Coastal Erosion Study***.

The cliff top at Gobby Beach has experienced measurable retreat between 2008 and 2025 with an average annual retreat value below 0.5m per year except at one location in the south (between cross-sections F and G). Retreat of the cliff has not occurred as a uniform, linear process, but rather through discrete, localised failure events that result in episodic setbacks to the cliff line. For example, a major local cliff failure between Sections F and G resulted in a maximum cliff top retreat of approximately 12m since 2008 and 7.5m since 2016. Several other minor failures were also identified throughout the site, during site walkovers in 2016 and 2025.

The rate of cliff top retreat decreased in the latest monitoring period (2016–2025) compared to the global monitoring period (2008–2025). However, this observed reduction should be interpreted with caution given the episodic nature of the cliff retreat. Reduced retreat rate could reflect variable metocean conditions during this period or temporary protection afforded by previously eroded material accumulating at the cliff base.

Furthermore, it was observed, that retreat rates are not uniform along the site boundary, as the northern sections (A1 to E) have experienced lower retreat of the top of cliff line (less than 0.25m/year 2008 -2025) when compared to the southern sections (F and G) (generally less than 0.45m/year 2008-2025). It can be concluded that an overall retreat rate of 0.5m/year reflects the past evolution of cliff in the proposed development site.

The findings confirm that cliff retreat at Gobby Beach is an active and ongoing process, influenced by a combination of cliff toe erosion, softening of the weaker till in the upper cliff section due to water seepages and overland surface water flow, and weathering of the cliff due to rain, wind and freeze thaw action. Local exceedances, such as the collapse between Sections F and G, underscore the episodic and unpredictable nature of cliff failure, reinforcing the importance of ongoing monitoring and future risk management.

Based on the assessment of the topographic surveys carried out between 2008 and 2025, a conservative predicted retreat rate of 0.5m/year will be used to forecast the evolution of cliff retreat during the design life of the proposed development. This approach is consistent with retreat rates based on the assessment of historical maps, surveys and aerial photographs (1897-2008) which showed values within a similar range (36- 55m over 110 years).

This retreat rate will be applied to the entire length of the top of the cliff line adjacent to the site taking year 2025 as a baseline and is subsequently used to obtain the predicted retreat in 30 years and 40 years' time (construction and operation period of proposed development). Refer to **Figure 13.26** which shows the estimated retreat lines and the proposed development.

13.3.5 Summary of Features of Importance

As part of the appraisal of the receiving environment, the importance of the following features has been ranked, based on NRA 2008 criteria.

Table 13.29: Summary of the importance of features

Category	Feature	Description	Location	Importance	Justification for Importance Rating
Soils and Geology					
Agricultural Soils	Acid Brown Earths	AminDW – Acid Brown Earths/Brown podzolics	Northern half of the proposed development	High	Well drained and/or high fertility soils
	Lithosols/Regosols	AminSW – Lithosols/Regosols	Southern half of the proposed development	High	Well drained and/or high fertility soils
Soils	Topsoil	Topsoil is the top layer of the soil profile that is high in organic matter, micro-organisms and nutrients	Widespread across the study area	High	Attribute has a high quality, significance or value on a local scale
Subsoils	TDS	Till derived from Devonian sandstones	Northern half of the proposed development	Medium	Medium value on a local scale
Geological Heritage Site	Ringaskiddy (CK077)	This site comprises a coastal exposure along a beach, and includes a prominent boulder, cliffs and outcrops at beach level.	Located adjacent to the eastern boundary of the proposed development	High	Geological feature of high value on a local scale (County Geological Site)
	Haulbowline and Rocky Islands (CK053)	This site includes two very contrasting small islands at the entrance to Cork Harbour, one which comprises rock outcrop and one split between Irish Navy Headquarters and a parkland amenity	Located approximately 630m to the north of the proposed development	High	Geological feature of high value on a local scale (County Geological Site)
Mineral/Aggregate Resources	Crushed Rock Aggregate Potential	Very high potential	Widespread throughout the proposed development	Very high	Extractable mineral resource
	Granular Aggregate Potential	Medium potential	Southern portion of the proposed development	Medium	Sub-Economic extractable mineral resource
Potential Sources of Contamination	Waste Licence (W0289-0)	The East Tip, Haulbowline Island	1.4km from the Proposed Devlopment	High	Degree or extent of soil contamination is unknown however the feature is considered of high on a local scale

Category	Feature	Description	Location	Importance	Justification for Importance Rating
	P0997-01	The Hammond Lane Metal Company Limited	Within the site of the proposed development	High	Degree or extent of soil contamination is unknown however the feature is considered of high on a local scale
	P0010-05	Hovione Limited	0.9km from the proposed development	High	Degree or extent of soil contamination is high on a local scale
	P0004-06	Thermo Fisher Scientific Cork Limited	1.5km from the proposed development	High	Degree or extent of soil contamination is unknown however the feature is considered of high on a local scale
	P0778-02	Janssen Sciences Ireland UC	1.7km from the proposed development	High	Degree or extent of soil contamination is high on a local scale
	P0013-06	Pfizer Ireland Pharmaceuticals Unlimited Company (Ringaskiddy)	1.9km from the proposed development	High	Degree or extent of soil contamination is unknown however the feature is considered of high on a local scale
	P0476-02	Recordati Ireland Limited	1.9km from the proposed development	High	Degree or extent of soil contamination is unknown however the feature is considered of high on a local scale
	Made Ground	Described as soft clay/silt/gravel with medium cobble content	Adjacent to the eastern side of Hammond Lane Metal Company Ltd	High	Degree or extent of soil contamination is unknown however the feature is considered of high on a local scale
Geohazards and Landslide Risk	Landslide Susceptibility	Moderately High	Entire Eastern Coastal Boundary	High	Moderately high landslide susceptibility. Actively eroding coastline
	Landslide Susceptibility	Moderately High	The southern area of the site (Area 2, 3 and 4)	High	Moderately high landslide susceptibility
Hydrogeology					

Category	Feature	Description	Location	Importance	Justification for Importance Rating
Aquifer Bedrock Type and Classification	Locally Important Aquifer (Ll)	Bedrock which is Moderately Productive only in Local Zones	Widespread throughout the proposed development	Medium	Locally important aquifer which supplies the local area
IE Licences					
	P0997-01	The Hammond Lane Metal Company Limited	Within the site of the proposed development	High	Medium aquifer sensitivity, but elevated risk due to potential contaminant source
Hydrology					
River WFD waterbody	Hilltown_010	Glounatouig Stream is within the catchment of Hilltown_010, which is classed as being at risk of reaching a goal of Good ecological status by 2027.	Within the proposed development	High	The proposed development is within the catchment of the Hilltown_010 river WFD waterbody. The waterbody has a 'good' status. The waterbody discharges into the Cork Harbour SPA. Fluvial and pluvial flood risk.
Groundwater WFD waterbody	Ringaskiddy	Ringaskiddy is classed as not being at risk of reaching a goal of Good ecological status by 2027. Drinking water area.	Within the proposed development	High	Hydrologically connected to Ringaskiddy Drinking Water Area
Coastal WFD waterbody	Cork Harbour	Cork Harbour is a heavily modified waterbody. It is classed as being at risk of not reaching a goal of Good ecological potential by 2027. Cork Harbour SPA.	Adjacent to the proposed development	High	Hydrologically connected to Cork Harbour SPA. Coastal flood risk.
	Outer Cork Harbour	Outer Cork Harbour is classed as being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Hydrologically connected to Cork Harbour, Cork Harbour SPA
Transitional WFD waterbody	Lough Beg/Curraghbinny	Lough Beg/Curraghbinny is classed as not being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Hydrologically connected to Cork Harbour, Cork Harbour SPA
	Lough Mahon	Lough Mahon is classed is a heavily modified waterbody.	Hydrologically connected to the proposed development	High	Hydrologically connected to Cork Harbour, Owennacurra Estuary / North Channel Nutrient Sensitive

Category	Feature	Description	Location	Importance	Justification for Importance Rating
		It is classed as being at risk of not reaching a goal of Good ecological potential by 2027. Is a nutrient sensitive area			Area, Great Island Channel SAC, Cork Harbour SPA, Lee Estuary / Lough Mahon Nutrient sensitive area
	Owenboy Estuary	Owenboy Estuary is classed as being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Hydrologically connected to Cork Harbour, Cork Harbour SPA
Coastal Recession	Coastal Recession	The eastern coastal boundary of the site is being actively eroded by the sea	Within the site but external to the proposed development	High	Attribute has a high quality, significance or value on a local scale

13.3.6 Conceptual Site Model

13.3.6.1 Soils and Geology

A conceptual site model (CSM) for the site has been developed, using the site investigation data for the site. It is summarised in **Table 13.30** below. Geological cross sections for the site are presented in **Figure 13.11a**, **Figure 13.11b** and **Figure 13.11c**. Refer to **Figure 13.10** for the location of these cross-sections. The site investigation factual reports are presented in **Appendix 13.1** and **13.2**.

Seventeen trial pits (TP1 to TP17) and five monitoring boreholes (BH1 to BH5) were completed during the 2000 and 2001 investigations (K.T. Cullen & Co. Ltd, 2001). The trial pits reached depths ranging between 1.0m and 5.6m below ground level (BGL) and the boreholes reached depths between 7.6m and 15.0m BGL respectively.

Four trial pits (TP1-2012 to TP4-2012) and four boreholes (BH1-2012 to BH4-2012) were excavated during the 2012 site investigation (Soil Mechanics, 2012). The trial pits reached depths of between 3.6m and 4.0m BGL and the boreholes reached depths between 9.0m and 10.2m BGL respectively.

As part of the 2019 site investigation (Priority Geotechnical, 2019), a further ten cable percussion boreholes (BH01-2019 to BH11-2019), eleven rotary core boreholes (RC01-2019 to RC11-2019) and seventeen trial pits (TP01-2019 to TP16-2019 and TPBH02-2019) were undertaken. The cable percussion boreholes ranged in depth from 3.1m to 10.4m BGL, the rotary core boreholes ranged from 7.2m to 15.2m BGL and the trial pits ranged from 1.2m to 5m BGL.

A review of the ground investigation exploratory hole data undertaken on the site revealed a stratigraphic profile of topsoil over varying layers of glacial till comprising of firm light brown sandy gravelly clay/silt stratum with interbedded sand, gravel and silt lenses. The localised granular material lenses are possibly fluvioglacial in origin and deposited within the till. Underlying this stratum is a very stiff/hard brown sandy very gravelly clay with many cobbles and occasional boulders. This is an over consolidated glacial lodgement till. It was noted during site walkovers that this lodgement till is present at ground level along the beach between bedrock outcrops. A localised deposit of made ground was noted adjacent to the eastern side of Hammond Lane and is described as brown clay/silt/gravel with medium cobble content.

Weak to strong, fresh to heavily weathered, light grey to grey mudstone bedrock was encountered at 3.5m BGL (22.70m OD) at the southern end of the site falling to 8.5m BGL (-5.40m OD) at the northern end of the site. Sandstone bedrock also likely underlies parts of the proposed development as it was observed outcropping along Gobby Beach during site walkovers. The bedrock also dips in elevation towards the eastern coastal boundary from 13m BGL (5.84m OD) at the southern end to 6.0m BGL (-1.50m OD) at the northern end.

As part of the proposed development, excavations will be undertaken on the site (refer to **Chapter 5 *Construction Activities*).** It is anticipated from reviewing all ground investigation information, that both soil and rock will be excavated. Bedrock is expected to be encountered during construction primarily in the southwest corner of Area 2 of the proposed development.

Table 13.30: Summary of strata from previous site investigations

Stratum	Depth and level to top of Stratum (m)	Thickness of Stratum (m)
Topsoil	Ground level	0.1 – 0.4
Made Ground	Ground level - 0.2	0.6 – 2.3
Firm brown sandy gravelly clay/silt stratum with interbedded sand, gravel and silt lenses (Glacial Till)	Ground level – 0.3	0.8- 13.0
Very stiff/hard brown sandy very gravelly clay with many cobbles and occasional boulders (Glacial Lodgement Till)	7 - 9.3	Approximately 0.9 – 1.3
Mudstone/Sandstone bedrock	3.5-13 (22.70 to -5.40m OD)	NA

13.3.6.2 Hydrogeology

A Conceptual Site Model (CSM) was developed for the proposed development, based on the 2016 EIS, publicly available geological and hydrogeological information, and the site investigation data. The CSM summarises the proposed development underlying geological conditions and identifies key hydrogeological features.

The CSM is summarised as follows:

- The proposed development is primarily topsoil/made ground and glacial till underlain by the Cuskinnny Member, described as a marine interbedded sandstone and mudstone. This is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll). Groundwater movement within the bedrock aquifer is primarily through a poorly connected network of fissures, resulting in a low fissure permeability tending to decrease with depth (GSI 2017).
- Groundwater flow tends to move in a northern to north-eastwards direction across the site as indicated in the subsoil and bedrock groundwater contour figures. Groundwater also flows towards the eastern coastal boundary in the subsoil. Groundwater levels range from approximately 18m OD in the south to 1m OD in the north within the bedrock aquifer and from 8m OD in the south to 1m OD in the north within the subsoil aquifer. Groundwater contour maps are shown in **Figure 13.20a** and **Figure 13.20b**.
- Groundwater level monitoring was undertaken in boreholes RC03, RC04, RC05, and BH4 between the 16th to 30th of April 2025 using data loggers.
- The groundwater level monitoring results indicate that groundwater levels in the subsoil and bedrock respond differently to storm events/intense rainfall. The groundwater present in the subsoils had a weak response to rainfall events which is likely related to the low porosity and permeability of this overburden material. Groundwater present in the bedrock aquifer showed a strong response to rainfall events, indicating a higher recharge rate causing groundwater levels to rise.
- The groundwater level monitoring results also indicated a tidal influence shown by undulating groundwater levels correlating with the tides. The groundwater levels in RC05, located in the northeast area of the proposed development, had an undulating pattern between 0.0 and 1.0 mOD, indicating a tidal influence. RC04 showed an undulating pattern in groundwater levels only below 4.0 mOD, relating to a tidal influence. At higher groundwater levels the pattern was not observed.
- Elevated concentrations of Chloride, Sulphate as SO4, Nitrate and Total Dissolved Solids (TDS) can be related to saline intrusion. **Table 13.21** and **Table 13.22** summarises the results of these parameters during both sampling rounds.
- Groundwater quality testing was undertaken in boreholes RC04 and RC05 on the 16th of April (round 1) and in boreholes RC03, RC04, RC05, and BH2 on the 30th of April (round 2). Elevated concentrations of Chloride, Sulphate as SO4, Nitrate and Total Dissolved Solids (TDS) in RC05 confirmed the saline influence at this location, which was also observed by the undulating pattern of the groundwater levels.
- Isolated exceedances of PAHs (above the LOD) were recorded in groundwater analysis at boreholes RC04 and RC05. These concentrations were only detected in these two boreholes and only during the first sampling round completed on 16th April 2025. This was not observed on the following sampling round and groundwater analysis for any of the sampled boreholes, including RC04 and RC05.

13.3.7 Environment Type

From the Conceptual Site Model (CSM) presented in **Section 13.3.6** above, the proposed development site is categorised as a Type A environment. According to the IGI 2013 Guidelines, the definition of this is:

"Type A: Passive geological/hydrogeological environments e.g. areas of thick low permeability subsoil, areas underlain by poor aquifers, recharge areas, historically stable geological environments."

The other categories from the IGI 2013 Guidelines are also described below:

"Type B – Naturally dynamic hydrogeological environments e.g. groundwater discharge areas, areas underlain by regionally important aquifers, nearby spring rises, areas underlain by permeable subsoils

Type C – Man-Made dynamic hydrogeological environments e.g. nearby groundwater abstractions, nearby quarrying or mining activities below the water table, nearby waste water discharges to ground, nearby geothermal systems

Type D – Sensitive geological/hydrogeological environments e.g. potentially unstable geological environments, groundwater source protection zones, karst

Type E – Groundwater dependent eco systems e.g. wetlands, nearby rivers with a high groundwater component of base flow"

13.4 Characteristics of the proposed development

A detailed description of the proposed development and construction activities are provided in **Chapter 4** ***Description of the Proposed Development*** and **Chapter 5** ***Construction Activities***. Key design features associated with Soils, Geology, Hydrogeology, Hydrology and Coastal Recession are outlined below.

13.4.1 Soils and Geology

This section of the report outlines the key design features and the construction, operation characteristics and activities of the proposed development that are of relevance to the Soils and Geology assessment. The potential effects related to such construction and operation activities are provided in **Section 13.5**.

13.4.1.1 Key Design Features

Key works that will be required as part of the proposed development that could potentially affect soils and geology are listed below (refer to **Figure 4.7**):

- Diversion of existing services including the overhead power lines;
- Stripping vegetation and topsoil;
- Bulk excavation for the proposed development, underground services and drainage, general site re-grading;
- Raising the level of Area 1 (the western field) to 4.55m OD;
- Bulk filling in Area 2;
- Construction of retaining structures and retention systems;
- Construction of foundations, including piling for the administration building, tipping hall, process building, turbine and fire water pump house; and
- Road upgrade works will include the following:

- Raising a section of the road to a maximum height of 3.495m OD,
- Upgrading the road drainage by installing additional large diameter pipes under the road and new road gullies in the road,
- Diversion of some existing services in the road.
- Construction of a two-way, temporary 250m long road.

- Site Landscaping

13.4.1.2 Construction Activities

The construction activities involved in the proposed development relevant to soils and geology are listed below and further discussed in the subsequent sub-sections. The construction activities relevant to soils and geology include:

- Excavation of soils, subsoils and rock;
- Importation, exportation and disposal of materials;
- Haulage of earthworks materials;
- Reuse of site won material;
- Construction of foundations for structures;
- Construction of retaining structures and retention systems;
- Bulk filling; and
- Dewatering of excavations.

For detailed descriptions refer to **Chapter 5 *Construction Activities***.

Excavation of Soils, Subsoils and Rock

Where the proposed design level is below the existing ground level, existing material will require excavation and removal. These cut areas will require the removal of soils, subsoils and bedrock. Soils and subsoils will be removed by an excavator. It is anticipated that the upper 0.5m to 1.0m of bedrock will be weathered and can be removed by a large excavator. It is expected the remainder of bedrock will be removed by using a chisel or hammer-operated rock breaker. Existing slopes in the southern part of the waste-to-energy facility will be re-profiled to accommodate the proposed development.

In the event that soft soils are encountered that will not support the applied loads, or risk settlement over time, additional excavations may be required. This might be to either bedrock or a sufficient depth within the soil where more competent soils are encountered.

It is expected that the bulk excavation will take approximately 6 months to complete.

Importation, Exportation and Disposal of Materials

In order to achieve the desired levels for the proposed development, approximately 30,261m^3 of engineering fill and crushed stone will be imported onto the site. These materials will be sourced from local quarries. Their traffic movements associated have been included in the construction traffic impact assessment. Refer to **Chapter 7 *Roads and Traffic***.

As a result of the excavations as described above, it is anticipated that approximately 74,664m^3 of surplus material will be exported from the site (including material from the road upgrade works). Where a re-use for the material cannot be found, the material may be sent to suitably permitted waste facilities or licensed soil recovery facilities in accordance with relevant waste legislation or disposed at suitable authorised waste facilities. The effect of the traffic movements associated with exportation of materials can be found in the construction traffic impact assessment in **Chapter 7 *Roads and Traffic***.

Where made ground is encountered on the site, these deposits will be excavated and subject to a detailed geo-environmental assessment in accordance with '*Best Practice Guidelines for the preparation of resource and waste management plans for construction and demolition projects*' (EPA 2021) to classify it for offsite disposal to an appropriate facility.

Haulage of Earthworks Materials

The excavated soils, subsoils and rock on the site that are suitable for reuse will be used to regrade the site levels in accordance with the design. Site won or imported fill material will be transported within the site along designated haul routes. Unsuitable material will be exported off site to an appropriate licensed facility.

Reuse of Site Material

Excavated soils will be stored in temporary stockpiles at the site and will be reused for landscaping.

Subsoils and rock suitable for reuse from cuttings, will where possible be reused on the site.

Not all excavated material will be reusable in particular where materials consist of high fines content and wet weather is experienced during the excavation activities, such materials may become unusable.

Construction of Foundations for Structures

Construction of foundations for structures will take place after the site regrading, landscaping, construction of earth retaining structures, and structural platforms. The proposed foundation levels will be in stepped levels across the site, ranging from circa -1m OD to 10m OD and will require excavations of up to 10m BGL.

In-situ reinforced concrete will be used to form foundations. In the parts of the site where the ground levels are raised, or where the bearing strata does not have the required geotechnical properties, foundations will be piled. In-situ reinforced concrete will be used to form ground bearing floor slabs, upper floor suspended slabs and earth retaining structures. For further details, refer to **Chapter 5** ***Construction Activities***.

Construction of Retaining Structures and Retention Systems

As part of the proposed development, retaining structures will be constructed in areas where soil and/or rock must be restrained at steep slope angles. Soil nailing or rock anchors may be used to retain cut slopes where appropriate. For further details, refer to **Chapter 5** ***Construction Activities***.

Their construction will happen in tandem with bulk excavations and general site re-grading.

Bulk Filling

Bulk filling of the site will be required to achieve the proposed levels for the development. Bulk filling will be required under the proposed buildings and site infrastructure where the ground level is required to be raised and graded in accordance with the design. The finished floor levels of the buildings range from 5m OD to 11m OD. It is proposed to use imported Class 6F2 and site won material where appropriate for bulk filling. For further details, refer to **Chapter 5** ***Construction Activities***.

Dewatering of Excavations

The ground investigation data suggests that groundwater will be encountered for a number of excavations. Dewatering is required where significant ingress of water will occur during construction.

The potential effects of this dewatering and dewatering limitations are assessed and presented in **Section 13.5.2.1**.

13.4.1.3 Operational Activities

The features of the proposed development along the eastern boundary of the site will require periodic monitoring and maintenance due to the ongoing recession of the coastline.

13.4.2 Hydrogeology

13.4.2.1 Construction Activities

Where the proposed design level is below the existing ground level, existing material will require excavation and removal. Depending on the depth of the excavation levels, this might reach the groundwater aquifer (subsoil/bedrock).

The underlying aquifer is classified as a Locally Important Aquifer (Ll), which is Generally Unproductive except for Local Zones.

The groundwater monitoring and the groundwater contour map shows the groundwater levels range from approximately 8m OD to 1m OD in the subsoil and from 18m OD to 1m OD in the bedrock aquifer.

The finish floor level for the proposed development is as follows:

- 5m OD for the admin building and for the process building
- 7m OD for the bottom ash hall
- 10m OD for the tipping hall; and
- 11m OD for the turbine hall

Based on this information, the excavation levels are anticipated to reach the groundwater levels in the southwestern section of Area 2 of the proposed development. It is expected that temporary construction dewatering will be required to maintain dry working conditions during the construction of the Process Building, Bottom Ash Hall, Service Yard and Access Road.

13.4.2.2 Operational Activities

The finished levels in the south region of the proposed development include permanent excavation of the existing topography. The finished landscape levels in the part of the proposed development are expected to intersect groundwater levels, particularly during the winter when groundwater levels are higher. Permanent drainage measures will be required to accommodate these inflows.

It is recommended that the existing groundwater monitoring boreholes are incorporated into the environmental monitoring system during the operational of the proposed development. This should include both groundwater level and groundwater quality monitoring.

13.4.3 Hydrology

13.4.3.1 Key Design Features

Key works that will be required as part of the proposed development that could potentially affect hydrology and flooding are listed below:

- Surface water drainage
- Fire water management
- Surrounding road drainage upgrades
- Access to water services

13.4.3.2 Construction Activities

Construction activities may result in surface water pollution to surrounding coastal and surface waterbodies. Consideration for groundwater is presented in **Section 13.5.2.1.**

13.4.3.3 Operational Activities

Surface water will be collected in underground drainage systems. All of the underground drainage systems will be designed and constructed as a minimum to comply with the Building Regulations 2010, BS EN 752-4 Drain and Sewer Systems outside Buildings.

Surface Water Drainage from the Waste-to-energy Facility

All of the underground drainage systems will be designed and constructed as a minimum to comply with the Building Regulations 2010, BS EN 752-4 Drain and Sewer Systems outside Buildings.

The eastern part of the resource recovery facility, when constructed, will form a rainwater catchment area of 3ha consisting of roofed areas, roads and hard standings. The storm water runoff will be discharged to the Local Authority sewer located in the L2545 road to the north of the site.

In order to prevent flooding of the local sewers the rate of discharge from the site will be controlled to the greenfield rate, based on the SUDS Design Guidelines. The site will be provided with attenuation to store and control the storm water discharge. The attenuation storage capacity will be sufficient for a 1 in 30-year storm over a 24-hour period allowing for 10% for climate change, having a greenfield discharge rate of 18l/s.

The storm water from all of the roads and hard standings will be conveyed via a class 1 hydrocarbon interceptor to the fire water retention tank, which is indicated as tank No. 1 on the drainage drawings. The fire water retention tank will have a capacity of 1,690m^3.

The storm water from the roofs of all of the buildings will be conveyed to the surface water attenuation tank, which is indicated as tank No. 2 on the drainage drawings. The surface water attenuation tank will have a capacity of 1,250m^3.

The tanker unloading area (for aqueous ammonia and fuel oil), which is located adjacent to the fuel tank, will be provided with cut off drains to collect any spillage that may occur during loading or unloading. A local holding tank with a 2m^3 capacity will be provided. The outlet valve of the local holding tank will be closed during any tanker unloading operation.

If a spillage occurs during a loading or unloading operation, the spilled liquid will be collected in the local holding tank. The contents of the tank will then be pumped out and dealt with appropriately. When the unloading operation has finished, if no spillage has occurred, the valve will be opened, and the contents of the tank will drain via a forecourt interceptor to the fire water retention tank.

A separate fully contained unloading area for aqueous waste deliveries will be located adjacent to the aqueous waste storage tank. This area will act as a bund in the event that there is a loss of the full contents of an aqueous waste delivery (25m^3) and will not be connected to the main storm water drainage network in this area.

The surface water attenuation tank and the fire water retention tank will be constructed from reinforced concrete and will be located beside each other beneath the staff car park, which is adjacent to the administration building.

Fill will be placed in the western field to raise the ground level. The surface finish to the fill will be crushed stone which is very porous. Rainwater will pass down through the stone before infiltrating into the ground matching the existing drainage regime in the Western Field.

A new infiltration trench will be located at the toe of the embankment for the raised surface to aid with the infiltration.

Storm Water Monitoring

The outlet from the fire water retention tank (Tank 1), into which the storm water run-off from the hardstanding areas and roads will drain, will be continuously monitored. If the monitoring detects that the contents of the tank are within the limits set by the operating licence, the contents will drain to the surface water attenuation tank (Tank 2). Monitoring of all surface water runoff will then take place in the final manhole, SW MH 50, prior to discharge to the public sewer. If the monitoring station at this final manhole detects contamination, the outlet pumps will be shutoff, and the contaminated water will not be discharged from Tank 2. The contaminated water may be conveyed by tanker to the aqueous waste tank for injection into the process or removed off site for appropriate disposal.

In the event of the activation of the fire alarm the pumps from Tank 2 will be shut off stopping any surface water discharge from the site. In this scenario both tanks combine to provide the fire water retention volume required for the site of 2,930m^3.

It is expected that monitoring will normally show the storm water to be uncontaminated.

Fire Water Management

Fire water retention, for the retention and control of contaminated water generated when fighting a fire, will be provided for the waste-to-energy facility area.

In the event of a fire in the bunker, the water used to fight the fire will be captured in the bunker where it will be stored for disposal. The bunker will have more than adequate capacity for the volume of water used to fight the fire as well as for the waste which will be in it. If there is a fire in any other part of the waste-to-energy facility, the water used to fight the fire will be captured in the recovered water tanks or clean water tank which are located below the building floor. The bunker and the recovered water tanks will be designed as water retaining structures. The fire-fighting water from any fire in an outdoor area will be captured in the storm water drainage system for the yards and roads and will be collected in a combination of the fire water retention and surface water tanks, in which case it can be stored for disposal. The outlet valve from the fire water retention tank will close if there is a trigger level reached by the in-line monitoring equipment. If the fire water retention tank has insufficient capacity, the water will overflow to the surface water attenuation tank using the combined volume for fire water retention.

L2545 Road Drainage Upgrade

The storm water drainage in the L2545 road will be improved as part of the road upgrade works. The proposed L2545 upgrade works will include raising a 190m section of the road to a maximum height of 3.495m OD between the car park and the eastern end of the Hammond Lane Metal Company. This is approximately 0.9m above the existing road level. This will elevate the road to above the 1 in 200 year design tidal water level plus an allowance for climate change. This will offer a high level of protection to the road from tidal flooding. The road will be raised over a length of approximately 190m in order to ensure a smooth transition down to existing road levels, in accordance with road design standards. The recently constructed footpath on the northern side of the road will also be raised to the new road level.

The proposed road drainage network upgrade will extend along the entire northern boundary of the proposed development. It has been designed to cater for a 7 hour period when the storm water outfall is tide locked during a 200 year tidal event and a 1 in 30 year rainfall event plus an allowance for climate change. The increased storage will be in the form of 2No. 1500mm oversized pipes placed underneath the road. This is described further below.

A 260-metre length of new linear concrete surface water channel will extend from the western boundary of the Western Field site and will run along the southern edge of the L2545 until it meets the entrance to the Hammond Lane Metal Company. This section of the L2545 is currently super-elevated – i.e. the camber on the road falls from north to south, therefore surface water drains to the south.

This section of the L2545 will not be raised as the existing levels are already above the predicted 1 in 200 year design tidal level (2.87m OD). The new surface water channel will be drained at regular intervals by gullies which will outfall to the existing 450mm diameter surface water sewer beneath the road.

The raised section of the L2545 between the car park and the eastern end of the Hammond Lane Metal Company will be drained by a kerb and gully sealed drainage system which will be connected to two new surface water pipes underneath the road. The two 1500mm diameter pipes will be approximately 190m in length and will provide 660m^3 of surface water storage. There will be three large concrete chambers constructed on the line of the twin surface water pipes at the start, middle and end of the run. The first two chambers will be situated in the road and the terminal chamber will be constructed at the entrance to the car park by Gobby Beach. The recently constructed surface water drainage system on the Haulbowline road will be diverted into the terminal chamber. This chamber will be connected to the existing 450mm diameter surface water sewer via a short length of new 450mm diameter pipe, a new Class 1 bypass hydrocarbon interceptor and a new manhole constructed on the line of the existing pipe. This will allow the upgraded surface water drainage system to discharge to sea via the existing 450mm surface water outfall at Gobby Beach. The design of the new drainage system will cater for a 7 hour period when the storm water outfall is tide locked by a 200-year tidal event combined with a 1 in 30-year rainfall event plus an allowance for climate change.

The upgrade works to the L2545 are confined to lands under the ownership of Indaver, except for a narrow strip of land owned by Hammond Lane Metal Recycling Co. Ltd, and a regraded entrance area on lands owned by the Port of Cork.

Development flood defence level

The minimum design flood defence level of the proposed development has been calculated as 3.42m OD. However, a more conservative flood defence level of 4.55m OD has been selected for the proposed development. This level will offer a high standard of flood protection to the proposed development. Refer to **Appendix 13.4** ***Flood Risk Assessment*** for further details. This measure will ensure that the risk of flooding to the proposed development is very remote. The finished floor level of the buildings on the proposed development will be set at even more conservative levels, all above 5m OD.

Sanitary Drainage

Untreated sanitary (foul) water will be pumped directly to the Irish Water sewer located east of Ringaskiddy Village, which will then be pumped to the Lower Harbour wastewater treatment facility at Shanbally.

13.4.4 Coastal Recession

The topographical beach surveys carried out between 2008 and 2025 have confirmed that the erosion rates found based on the topographical, survey and photographic evidence from the period 1897 to 2003 were within a similar range. Using the surveys since 2008, a conservative retreat rate of 0.5m/year for the entire length of the top of the cliffs line is established.

The proposed resource recovery centre has a design life of 30 years. In view of the complexity of the proposed development, licensing requirements and the need for the advance agreement of all conditions, Indaver is applying for a 10-year planning permission to commence and complete the construction phase.

The **Appendix 13.3** ***Coastal Erosion Study*** found that the waste-to-energy facility section of the proposed development has been located far enough away from the edge of the cliff to ensure that the waste-to-energy facility will not be impacted by the predicted retreat rates over the design life of the planning permission. Refer to **Figure 13.26** which shows the estimated retreat lines and the proposed development.

However, the study found that there could be a risk of an impact on a small section of the proposed development after 40 years however this would be confined only to the amenity walkway and viewing platform outside of the security fence line.

Given the concerns raised by An Bord Pleanála (now An Coimisiún Pleanála) during the previous planning application in 2008 and given the low risk that the amenity walkway and viewing platform could be impacted in 40 years' time, coastal protection measures have been included in this planning application as a precautionary measure so as to reduce the rate of erosion of the glacial till face.

After consideration of various '*hard*' and '*soft*' coastal protection options, Arup has recommended two '*soft*', less-invasive solutions:

- The placement of approximately 1150m^3 of sacrificial material (shingle of appropriate size and rounded shape with high density and resistance to abrasion) above the foreshore on Gobby Beach along the eastern boundary of the proposed development site. This will be a '*soft*' solution which will reduce erosion rates by increasing beach levels i.e. reducing near shore water depth and wave heights and will protect the glacial till face from breaking waves.
- Annual monitoring of the proposed development coastal boundary.

The main aim of placing the material is to act as a proactive measure for the coastal area adjacent to the proposed development site only.

It is proposed that the additional sacrificial material is placed during the construction period of the proposed development site. Thereafter, it is proposed that the placement of further additional sacrificial material is carried out if the cliff top retreat rate averaged over the entire length is more than 0.5m per year measured over a period of six years, which would indicate some acceleration in the current retreat rate, or when the cliff top has retreated locally by approximately 3m, whichever is sooner. There is also an option to proactively place shingle to maintain a healthy margin between the cliff top and the proposed development. For this reason, the coastal boundary of the proposed development site will be monitored for erosion on an annual basis.

Refer to **Appendix 13.3** ***Coastal Erosion Study*** for further details.

13.5 Potential Effects

13.5.1 'Do-Nothing' Scenario

In the scenario where the proposed development did not proceed, there would be no resulting effects on the soils, geology or hydrogeology of the area. The effect would therefore be neutral.

If the proposed development did not go ahead, there would be no effect on hydrology. There is a risk that a 1 in 200 year tidal flood event, combined with sea level rise as a result of climate change, would cause flooding to a small area of the site adjacent to the road.

In the scenario where the proposed sacrificial beach material was not to be undertaken, coastal recession would continue as it is at present.

13.5.2 Soils and Geology

The following section details the potential effects of the construction and operational phases of the proposed development on soils and geology.

13.5.2.1 Construction Phase

The summary of the construction phase effects can be viewed in **Table 13.31**. The potential effects during the construction phase on geological features include the following:

- Threats to soils and subsoil;
- Loss or damage of future quarry or pit reserves;
- Loss or damage to Geological Heritage Area;
- Potential Ground Contamination; and
- Geohazards and Landslide Susceptibility.

Threats to Soils and Subsoils

Soil is a non-renewable resource which if removed or damaged can result in a permanent negative effect. While soil is an important geological feature, the underlying subsoil is important in supporting the functions of the overlying topsoil.

The functions that soil and subsoil provide to ecosystem services in the proposed development study area are the following:

- maintain the agricultural grasslands for cattle grazing
- infiltrate and store water
- regulate soil nutrients
- support biodiversity
- source of materials
- sequester carbon.

If the excavation, storage and management of soils and subsoils on the proposed development are not given consideration during construction, the likelihood of threats such as erosion, compaction and loss of organic matter occurring will increase. Sealing of topsoil will occur under haul roads and construction compounds.

The erosion of soils and subsoils will occur if earthworks formations are left open for extended periods of time, where stockpiles are poorly constructed and managed and where topsoiled slopes and landscaped areas are left unplanted.

Soils and subsoils underlying highly trafficked haul roads and construction compounds within the site can become over compacted resulting in a breakdown in the structure of the soils which hinders them from infiltrating and storing water, maintaining grass cover, supporting biodiversity and sequestering carbon.

The structure of the soil will get damaged during excavation but will undergo further damage if the management of stockpiles is poor. Moving stockpiles multiple times over the duration of the construction phase will lead to degradation of the soils.

When the structure of a soil and subsoil is damaged and air and water can no longer circulate within the material, the organic matter content will diminish. The loss of organic matter will lead to a nutrient deficient degraded soil that will not support ecosystem services.

Sealing of the soils will occur in the temporary case under haul roads and construction compounds. As topsoils will be excavated it is only subsoils that will be sealed in the permanent case under the footprint of the proposed development. The effect of sealing in the permanent case results in loss of that feature.

The potential effects of these threats on the agricultural practices in the study area, namely grassland pastures, will result in loss of grassland under the footprint of the proposed development and a reduction in soil quality within the proposed development boundary due to construction activities.

Where topsoil and subsoils are stripped to accommodate the works outlined above, all the above effects have the potential to occur.

The magnitude of the potential effects on soils and subsoils ranges from negligible to moderate adverse as it results in the permanent loss of grassland and subsoil under the footprint of the proposed development and a reduction in soil quality within the proposed development boundary. Hence, the significance of this effect ranges from imperceptible to significant / moderate (Refer to **Table 13.31**).

Loss or Damage to Future Quarry or Pit Reserves

The sterilisation of land through development or the excavation of soil and rock during construction can diminish future quarry and pit reserves.

Crushed Rock Aggregate Potential

A large proportion of the proposed development is indicated as having a very high crushed rock aggregate potential. Rock will be excavated as part of the bulk earthworks excavations for the proposed development. This will result in a loss of this feature at those locations however, there may be opportunities to reuse this rock onsite.

The magnitude of the potential effect is negligible as it will likely be a relatively small proportion of rock that will be excavated. This results in a significance rating of imperceptible.

Granular Aggregate Potential

There is a linear granular deposit that cuts across Area 2 of the proposed development. It is listed as having a moderate granular aggregate potential which designates it as a medium importance. Excavations as part of the proposed development will result in a loss of this feature however if encountered there could be opportunities for this material to be reused.

The magnitude of the potential effect is negligible as it will likely be a relatively small proportion of the granular material excavated. This results in a significance rating of imperceptible.

Loss or Damage to Geological Heritage Area

As described in **Section 13.3**, the Ringaskiddy Geological Heritage Area is within the proposed development. During construction, the proposed development will have a direct effect on the Geological Heritage Area, as sacrificial material will be deposited above the foreshore (refer to **Section 13.6.4.1**).

The magnitude of the potential effect of the proposed development on the Ringaskiddy Geological Heritage Area is small adverse as it is proposed that approximately 1,150m^3 of sacrificial material will be placed in a relatively small area spanning from the car park at the northern end to the southern boundary of the of the proposed development with the aim to reduce erosion rates by limiting the exposure of the toe of the cliff from direct wave action. Considering this, the significance is moderate/slight.

For the Haulbowline and Rocky Island Geological Heritage Area, the magnitude of the potential effect is negligible, and the significance is imperceptible as this Geological Heritage Area site will not be affected by the proposed development.

Earthworks

The potential effects during the earthworks/excavations as described in **Section 13.4.1** are listed as the following:

- Disturbance of Natural Ground
- Degradation of Material for Reuse
- Washout of Fines/Sediment Runoff

Disturbance of Natural Ground

During construction of the proposed development, there will be significant haulage of earthwork material which will in turn generate noise, dust and vibration. This will cause disturbance of the natural ground present within the site but will only be a short-term effect.

Hence the magnitude of the potential effect is moderate adverse, and the significance is significant/moderate.

Washout of Fines/Sediment Runoff

During construction as the new excavations are exposed and as material is stockpiled, there is a possibility of sediment runoff because of rainfall which can in turn infiltrate in to local waterways.

The magnitude of the potential effect is moderate adverse, and the significance is significant/moderate.

Degradation of Material for Reuse

Poor earthworks practices/management when excavating, hauling and storing of subsoils suitable for reuse could result in the materials becoming unacceptable. This scenario has the potential to affect the earthworks material balance for the site, the volume of material that is to be imported/exported.

The magnitude of the potential effect is moderate adverse, and the significance is significant/moderate.

Potential Ground Contamination

As discussed in **Section 13.3.1.2**, there are multiple sites within a 2km radius of the proposed development that are potential sources of contamination. As outlined, most of these sites are not located close to the proposed development and will thus not be considered further.

The Hammond Lane Metal Company Ltd (Licence Number P0997-01) is located adjacent to the proposed development. The Hammond Lane Metal Company Ltd site operates as a scrap metal processing facility, which could cause potential ground contamination. The Hydrogeological Assessment for Hammond Lane Metal Company, undertaken by O'Callaghan Moran & Associates in 2011 (Refer to **Appendix 13.1**), found that the impermeable hardstanding and buildings prevent infiltration of rainfall to the subsoils and the surface water drainage system was functioning properly. Groundwater quality monitoring also found that the groundwater beneath the Hammond Lane Metal Company Site Ltd site had not been impacted by either historical or current use of the site. Considering this, the magnitude of the potential effect is negligible, and the significance is imperceptible.

Made ground was recorded within the proposed development, as discussed in **Section 13.3.1** along the eastern boundary of Hammond Lane Metal Company Ltd comprising of brown clay/silt/gravel with medium cobble content. No anthropogenic material or smells were recorded within this material. The magnitude of the potential effect for the excavation of this deposit of made ground is small adverse, and the significance is moderate/slight.

During construction there is potential for leakage or spillage of construction related materials, contaminating the subsoils present. The magnitude of the potential effect of ground contamination is small adverse, and the significance is moderate/slight.

Geohazards and Landslide Susceptibility

The eastern coastal boundary is being actively eroded by coastal processes and is receding. (Refer to **Appendix 13.3** ***Coastal Erosion Study***). A larger scale slope failure is present at the southeastern boundary of the site. The effect the proposed development will have on the geohazard, and landslide susceptibility at this location and over the extent of the coastal boundary is negligible, and the significance is imperceptible. The design life of the development is 30 years, and it has been forecasted that in 30 years the recession of the coastline will not impact the proposed development.

A moderately high landslide risk has been identified in Area 2, 3 and 4 on the site, where bulk excavations are to be undertaken. The effect the proposed development will have on the geohazard, and landslide susceptibility at this location is small adverse, and the significance is moderate / slight.

Coastal Recession

The proposed development will not increase the current rate of cliff retreat. The proposed coastal protection mitigation measures of placing beach nourishment material will reduce the rate of coastal recession.

The closest area of the Cork Harbour Special Protection Area (SPA) is located to the southwest of the site. Since the net movement of beach nourishment shingle is from south to north, the sacrificial material will not impact on this part of the SPA. Other sections of the SPA which are to the north of the site are more than two kilometres from the site and these are too remote from the site to receive any significant quantities of beach nourishment material.

The solution will have no negative effects on the adjoining areas. However, there will be benefits associated with the works as well as the provision of an environmentally friendly solution.

The effect that the proposed development, including the beach nourishment is small beneficial, and the significance is moderate / slight.

Table 13.31: Summary of the predicted construction phase effects

Feature/Construction Activity	Impact Assessment at Construction Phase							
	Description	Importance	Effect	Quality	Duration	Scale	Magnitude	Significance
Threats to Soils and Subsoils								
Agricultural Soils	Acid Brown Earths (AminDW)	High	Reduction in soil quality	Negative	Permanent	Local	Small Adverse	Moderate / Slight
	Acid Brown Earths (AminDW)	High	Loss of feature	Negative	Permanent	Local	Negligible	Imperceptible
	Lithosols/Regosols (AminSW)	High	Reduction in soil quality	Negative	Permanent	Local	Small Adverse	Moderate / Slight
	Lithosols/Regosols (AminSW)	High	Loss of feature	Negative	Permanent	Local	Negligible	Imperceptible
Soil Health	Soil (Brown Earths)	High	Erosion, compaction	Negative	Permanent	Local	Small Adverse	Moderate / Slight
	Soil (Brown Earths)	High	Sealing	Negative	Permanent	Local	Moderate Adverse	Significant/Moderate
	Soil (Brown Earths)	High	Loss of organic matter	Negative	Medium-Term	Local	Small Adverse	Moderate / Slight
	Soil (Brown Earths)	High	Loss of feature	Negative	Permanent	Local	Negligible	Imperceptible
	Subsoil (Till derived from Devonian Sandstones)	Medium	Erosion, compaction	Negative	Permanent	Local	Small Adverse	Slight
	Subsoil (Till derived from Devonian Sandstones)	Medium	Sealing	Negative	Permanent	Local	Moderate Adverse	Moderate
	Subsoil (Till derived from Devonian Sandstones)	Medium	Loss of organic matter	Negative	Medium-Term	Local	Negligible	Imperceptible
	Subsoil (Till derived from Devonian Sandstones)	Medium	Loss of feature	Negative	Permanent	Local	Negligible	Imperceptible

Feature/Construction Activity	Impact Assessment at Construction Phase							
	Description	Importance	Effect	Quality	Duration	Scale	Magnitude	Significance
Loss or Damage of Future Quarry or Pit Reserves								
Mineral/Aggregate Resources	Crushed Rock Aggregate Potential	Very high	Irreversible loss / damage of future quarry reserve	Negative	Permanent	Local	Negligible	Imperceptible
	Granular Aggregate Potential	Medium	Irreversible loss / damage of future quarry reserve	Negative	Permanent	Local	Negligible	Imperceptible
Loss or Damage to Geological Heritage Area								
Geological Heritage Site	Ringaskiddy (CK077)	High	Irreversible loss / damage of geological heritage area due to the placement of sacrificial material	Negative	Permanent	Local	Small Adverse	Moderate / Slight
	Haulbowline and Rocky Islands (CK053)	High	Irreversible loss / damage of geological heritage area	Negative	Permanent	Local	Negligible	Imperceptible
Earthworks								
Soils and Subsoils	Noise, dust and vibrations caused from excavation and haulage of earthworks materials	High	Disturbance of natural ground	Negative	Short Term Effect	Local	Moderate Adverse	Significant/Moderate
Soils and Subsoils	Sediment run off from cuttings, excavations and stockpiles	High	Wash out of fines/sediment runoff	Negative	Short Term Effect	Local	Moderate Adverse	Significant/Moderate
Subsoils	Poor earthworks practices/management will result in decreasing the % reuse of site won acceptable material for reuse	High	Degradation of material for reuse	Negative	Permanent	Local	Moderate Adverse	Significant/Moderate
Potential Ground Contamination								
P0997-01	The Hammond Lane Metal Company Ltd	High	Potential Source of Contamination	Negative	Permanent	Local	Negligible	Imperceptible
Made Ground	Described as soft to firm clay/silt/gravel with medium cobble content	High	Potential Source of Contamination	Negative	Permanent	Local	Small Adverse	Moderate / Slight

Feature/Construction Activity	Impact Assessment at Construction Phase							
	Description	Importance	Effect	Quality	Duration	Scale	Magnitude	Significance
Potential Ground Contamination	Potential for leakage or spillage of construction related materials, contaminating the subsoils present	High	Potential Source of Contamination	Negative	Permanent	Local	Small Adverse	Moderate / Slight
Geohazard and Landslide Risk								
Coastal Erosion	Eastern coastal boundary of the proposed development that is actively eroding and slope failures are occurring	High	Failure of slope causing a landslide	Negative	Permanent	Local	Negligible	Imperceptible
Landslide Susceptibility	Landslide risk in Area 2, 3 and 4 of the proposed development	High	Failure of slope causing a landslide	Negative	Permanent	Local	Small adverse	Moderate / Slight

13.5.2.2 Operational Phase

The potential effects on soils and geology during the operational phase will be limited to accidental spillage of potentially polluting substances including fuel, oils, paints, incoming wastes, raw materials such as lime, hydrochloric acid, caustic soda or ammonia/urea, activated carbon or clay and residues. The significance of this potential effect is imperceptible.

13.5.3 Hydrogeology

13.5.3.1 Construction Phase

The potential hydrogeology effects during the construction phase are presented in this section, along with their effect significance. These potential effects also relate and interact with other environmental factors which are described within the EIS.

The magnitude of the potential effects is expressed in accordance with the criteria for rating impact significance and magnitude as set out in Table C4 and Table C5 of the IGI Guidelines (IGI 2013) and Box 5.1 of the NRA Guidelines (NRA, 2008a). The rating of significant environmental impacts is expressed in accordance with the Table C6 of the IGI Guidelines (IGI 2013) and Box 5.4 (NRA 2008a).

The potential effects on hydrogeology as discussed below and summarised in **Table 13.32**. The effects are addressed under the following potential activities:

- Loss or damage of proportion of aquifer
- Change to groundwater regime
- Potential effects on groundwater quality
- Groundwater contamination sites
- Potential effects to groundwater abstractions
- Potential effects to groundwater dependent habitats.

Loss or Damage of Proportion of Aquifer

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

The underlying aquifer is classified as a Locally Important Aquifer (Ll), which is Generally Unproductive except for Local Zones.

The excavation levels are anticipated to reach the groundwater levels in the main process building of the proposed development. Dewatering will be necessary where significant ingress of water occur during construction activities.

The magnitude of this impact is considered to be small adverse. Given that the aquifer is of medium importance, the resulting significance of this effect is Slight.

Change to groundwater regime

Dewatering may be required for the construction phase to allow works to be carried out in dry excavations. This could lead to a small change in the groundwater levels and flow within the Locally Important Aquifer underlying the proposed development. Since the excavations are anticipated to go through the subsoil, weathered rock and bedrock, temporary construction dewatering is expected to be needed in the southwestern section of Area 2 of the site where excavations shall lower the ground level.

The magnitude of this impact is considered to be of small adverse. Given that the aquifer is of medium importance, the resulting significance of this effect is Slight.

Potential effects on groundwater quality

The quality of groundwater is potentially at-risk during construction and activities on site are managed in accordance with guidelines to ensure that this potential risk achieved appropriately. Risk to groundwater quality is associated with any accidental spills or contamination from materials used during construction, such as fuels or chemicals.

- Groundwater vulnerability

Based on previous ground investigations, the overburden thickness ranges from 0.2 to 9.3m. Therefore, the groundwater vulnerability within the proposed development is classified as High, due to this shallow thickness of overburden over the bedrock in a few areas of the proposed development. The removal of overburden during excavation works increases the vulnerability.

The quality of groundwater is potentially at-risk during construction if activities on site are not managed in accordance with guidelines and best practices.

The magnitude of this impact will be small adverse, as it will result in a temporary potential medium risk of pollution to groundwater. Given the medium importance of the aquifer, the effect will be Slight.

- Existent Groundwater Contamination

The first groundwater monitoring round completed on 16th April 2025 registered exceedances (concentrations above the LOD) for PAHs within the RC04 and RC05 boreholes. These elevated concentrations were not detected for any of the sampling boreholes, including RC04 and RC05, during the second monitoring round completed on 30th April 2025.

Earthworks excavation levels underlying the main process building are likely to result in the excavation of bedrock. Exploratory hole RC04 is located in the vicinity of the main process building and RC05 is located in proximity of the proposed bunker within the main process building. Therefore, there is a potential risk of encountering groundwater with elevated PAH concentrations in these areas of cut. There is a potential of cross contamination of this groundwater with uncontaminated groundwater.

The magnitude of this impact will be small adverse, as it will result in a temporary potential medium risk of pollution to groundwater. Given the medium importance of the aquifer, the effect will be Slight.

Groundwater contamination sites

Groundwater discharges and emissions have the potential to affect groundwater quality, which result in a potential risk to groundwater receptors including aquifers and groundwater dependent habitats. The importance of the potential contamination site is dictated by the potential extent of contamination and the likely contaminant types based on the historical or current site usage and the potential impact is assessed in accordance with consideration of the Source-Pathway-Receptor framework.

Based on the available Groundwater Monitoring Reports as listed on Item 13.3.2.6 there are registers of a few exceedances (ammoniacal nitrogen, orthophosphate, iron, manganese, total aliphatic and aromatics and potassium) within the MW3A monitoring point, located in the southeast corner of the Hammond Lane Metal Company Limited property. These exceedances are expected to be confined to the adjacent property and there is currently no evidence to suggest that it would be extended through the proposed development area.

The magnitude of this impact is considered negligible, as it will result in no measurable change that could affect the integrity of the underlying aquifer. Given that the aquifer is of low importance, the resulting significance of this effect is Imperceptible and will not be considered further.

Potential effects to groundwater abstractions

The underlying aquifer, classified as a Locally Important Aquifer, has not been identified as a source of public or private water supply in the vicinity.

On this basis the potential effects to groundwater abstractions are Imperceptible.

Potential effects to groundwater dependent habitats

Groundwater dependent habitats are not located within the region of the proposed development.

On this basis the potential effects to groundwater dependant habitats are Imperceptible.

Table 13.32: Summary of potential effects on groundwater during the Construction Phase

Feature	Description	Location	Importance	Effect	Quality	Duration	Scale	Magnitude	Significance
Loss or Damage of Proportion of Aquifer									
Locally Important Aquifer (Ll)	Bedrock which is Generally Unproductive except for Local Zones	Throughout the proposed development and surrounding areas	Medium	Loss or damage of proportion of aquifer through excavation.	Negative	Permanent	Local	Small Adverse	Slight
Change to groundwater regime									
Locally Important Aquifer (Ll)	Bedrock which is Generally Unproductive except for Local Zones	Throughout the proposed development and surrounding areas	Medium	Change in the groundwater levels	Negative	Temporary	Local	Small Adverse	Slight
Potential Effects on Groundwater Quality									
Locally Important Aquifer (Ll)	Groundwater Contamination related to accidental spillage	Throughout the proposed development and surrounding areas	Medium	Effects on Groundwater Quality	Negative	Temporary	Local	Small adverse	Slight
Locally Important Aquifer (Ll)	Groundwater Contamination related to elevated PAH observed in one round of groundwater sampling in boreholes RC04 and RC05	In the location of RC04 and RC05 boreholes	Medium	Effects on Groundwater Quality	Negative	Temporary	Local	Small adverse	Slight
Groundwater Contamination Sites									
Locally Important Aquifer (Ll)	Groundwater Contamination	Exceedances in a few parameters analysed for the MW3A - groundwater installation located in an adjacent facility	Medium	Effects on Groundwater Quality	Negative	Temporary	Local	Small adverse	Slight

13.5.3.2 Operational Phase

The operational phase has the potential for accidental spillage of fuel, oils, paints, incoming wastes, raw materials such as lime, hydrochloric acid, caustic soda or ammonia/urea, activated carbon or clay and residues. While the likelihood of an accidental spillage may increase in comparison to the Do-Nothing Scenario, the magnitude of the effect is negligible.

It is expected that there may be interception of groundwater levels in the southwestern section of the Area 2 where there is permanent excavation into the original topography. In this area the local groundwater may be intercepted, and these inflows and seepages will need to be manged by drainage.

The risk of effect from the proposed development to groundwater quality from accidental spillages and localised groundwater interception, are Imperceptible in relation to the groundwater environment.

In terms of predicted specific effects during site operation the following points are of note:

- There is no likely effect on any sensitive groundwater receptors or groundwater supplies in the vicinity of the proposed development.
- There will be no direct discharges to groundwater or soil environment during the operational phase.

The operational phase of the proposed development will have an overall imperceptible long-term effect on the groundwater.

13.5.4 Hydrology

13.5.4.1 Construction Phase

Surface water could potentially become polluted by spillages such as hydrocarbon leaks from construction machinery or by siltation as a result of runoff, during construction.

The construction phase of the proposed development will have an overall slight short-term effect on the hydrology.

13.5.4.2 Operational Phase

There will be no discharges of process effluent from the site to surface water.

Potential sources of pollution during the operational phase of the proposed development would be the accidental spillage or leakage of process materials or wastes, particularly during unloading or loading operations, which could then enter the surface water drainage system.

Other potential sources of pollution that may have an effect on surface water during the operational phase could be oil/fuel leaks from parked cars, trucks and service vehicles.

A fire on site during operations could cause water use for fire-fighting to become contaminated, with the potential for this contaminated water to be discharged to the surface water system.

During operation, untreated sanitary (foul) water will be pumped directly to the Irish Water sewer located east of Ringaskiddy Village, which will then be pumped to the Lower Harbour wastewater treatment facility at Shanbally.

The operational phase of the proposed development will have an overall imperceptible long-term effect on the hydrology. There will be a slight permanent effect on flooding.

Table 13.33: Summary of potential effects on hydrology during the Construction Phase

Feature	Description	Location	Importance	Effect	Quality	Duration	Scale	Magnitude	Significance
Potential Effects to surface water quality									
Hilltown_010	Glounatouig Stream is within the catchment of Hilltown_010, which is classed as being at risk of reaching a goal of Good ecological status by 2027.	Within the proposed development	High	Pollution of surface water body	Negative	Temporary	Local	Small Adverse	Slight
Potential Effects on WFD waterbody status									
Hilltown_010	Glounatouig Stream is within the catchment of Hilltown_010, which is classed as being at risk of reaching a goal of Good ecological status by 2027.	Within the proposed development	High	Change in WFD status	Negative	Temporary	Local	Negligible	Not significant
Ringaskiddy	Ringaskiddy is classed as not being at risk of reaching a goal of Good ecological status by 2027. Drinking water area.	Within the proposed development	High	Change in WFD status	Negative	Temporary	Local	Negligible	Not significant
Cork Harbour	Cork Harbour is a heavily modified waterbody. It is classed as being at risk of not reaching a goal of Good ecological potential by 2027. Cork Harbour SPA.	Adjacent to the proposed development	High	Change in WFD status	Negative	Temporary	Local	Negligible	Not significant
Outer Cork Harbour	Outer Cork Harbour is classed as being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Change in WFD status	Negative	Temporary	Local	Negligible	Not significant
Lough Beg/Curraghbinny	Lough Beg/Curraghbinny is classed as not being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Change in WFD status	Negative	Temporary	Local	Negligible	Not significant
Lough Mahon	Lough Mahon is classed is a heavily modified waterbody. It is classed as being at risk of not reaching a goal of Good ecological potential by 2027. Is a nutrient sensitive area	Hydrologically connected to the proposed development	High	Change in WFD status	Negative	Temporary	Local	Negligible	Not significant
Owenboy Estuary	Owenboy Estuary is classed as being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Change in WFD status	Negative	Temporary	Local	Negligible	Not significant

Table 13.34: Summary of potential effects on hydrology during the Operations Phase

Feature	Description	Location	Importance	Effect	Quality	Duration	Scale	Magnitude	Significance
Potential Effects to surface water quality									
Hilltown_010	Glounatouig Stream is within the catchment of Hilltown_010, which is classed as being at risk of reaching a goal of Good ecological status by 2027.	Within the proposed development	High	Pollution of surface water	Negative	Permanent	Local	Negligible	Not significant
Potential increase in flood risk									
Hilltown_010	The catchment of Hilltown_010.	Within the proposed development	High	Increase in fluvial, pluvial or coastal flooding	Negative	Permanent	Local	Small Adverse	Slight
Potential Effects on WFD waterbody status									
Hilltown_010	Glounatouig Stream is within the catchment of Hilltown_010, which is classed as being at risk of reaching a goal of Good ecological status by 2027.	Within the proposed development	High	Change in WFD status	Negative	Permanent	Local	Negligible	Not significant
Ringaskiddy	Ringaskiddy is classed as not being at risk of reaching a goal of Good ecological status by 2027. Drinking water area.	Within the proposed development	High	Change in WFD status	Negative	Permanent	Local	Negligible	Not significant
Cork Harbour	Cork Harbour is a heavily modified waterbody. It is classed as being at risk of not reaching a goal of Good ecological potential by 2027. Cork Harbour SPA.	Adjacent to the proposed development	High	Change in WFD status	Negative	Permanent	Local	Negligible	Not significant
Outer Cork Harbour	Outer Cork Harbour is classed as being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Change in WFD status	Negative	Permanent	Local	Negligible	Not significant
Lough Beg/Curraghbinny	Lough Beg/Curraghbinny is classed as not being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Change in WFD status	Negative	Permanent	Local	Negligible	Not significant

Feature	Description	Location	Importance	Effect	Quality	Duration	Scale	Magnitude	Significance
Lough Mahon	Lough Mahon is classed is a heavily modified waterbody. It is classed as being at risk of not reaching a goal of Good ecological potential by 2027. Is a nutrient sensitive area	Hydrologically connected to the proposed development	High	Change in WFD status	Negative	Permanent	Local	Negligible	Not significant
Owenboy Estuary	Owenboy Estuary is classed as being at risk of reaching a goal of Good ecological status by 2027	Hydrologically connected to the proposed development	High	Change in WFD status	Negative	Permanent	Local	Negligible	Not significant

13.5.5 Coastal Erosion

13.5.5.1 Construction Phase

As discussed above, the works associated with the placing of sacrificial beach material, acting as beach nourishment, will consist of the deposition of shingle at the base of the glacial till slope, above the foreshore on Gobby Beach. The shingle will be confined to the beach adjacent to the site within Indaver ownership. It will be necessary for tracked machines to access the beach, above the high water mark line to spread the shingle.

Access to the recreational amenity of Gobby Beach shoreline and nearby car park will be a temporarily impacted (for approximately 3 weeks) during the placement of sacrificial beach material. The sacrificial material consists of imported shingle which will be temporarily deposited on the car park. To ensure the safety of the general public, it is envisaged that the area of the beach, in which the construction works will taking place and the area of the car park in which the materials will be stored, and which will be used by the machinery, will be closed to the public for the duration of the proposed works. However, access to other sections of the beach will be maintained for the duration of the works.

The temporary loss of public access to the beach and car park is considered a slight adverse effect.

The construction of the proposed waste to energy plant in the development is not expected to have any negative effect on the rate of coastal retreat. The placement of beach nourishment material is predicted to result in a reduction in the rate of cliff recession, considered a slight positive effect. It is noted that the construction effects experienced during the placement of the shingle will be repeated when the shingle is reapplied in the future. See **Section 13.5.4.2** below.

13.5.5.2 Operational Phase

The operation of the proposed development is not expected to have any negative effect on the rate of coastal retreat.

The closest area of the Cork Harbour Special Protection Area (SPA) is located to the southwest of the site. The net coastal sediment transport goes from south to north according to wind conditions and swell and therefore, the beach nourishment material is likely to move towards the north in the medium and long term. Therefore the sacrificial material will not impact on this part of the SPA. Other sections of the SPA which are to the north of the site are more than two kilometres from the site and these are too remote from the site to receive any significant quantities of beach nourishment material.

It is in principle expected that the material will reshape but mostly remain in place during regular weather conditions. However, it is acknowledged that the beach is a dynamic system and therefore sacrificial material may move seasonally and also as a result of storm events. Even if the material on the beach is displaced from the cliffs toe, it may continue to provide a protective function as long as it remains within Gobby Beach as it will increase beach levels locally. This would affect the nearshore wave dynamics by decreasing water depth and causing waves to break further from the toe of the cliffs helping to lower the erosion rates within the site. The proposed placing of sacrificial material on the beach is predicted to will result in a slight positive effect on the reduction of erosion of the of glacial till line at site due to wave action.

It is noted that the construction effects experienced during the placement of the shingle will be repeated when the shingle is reapplied in the future.

13.6 Mitigation Measures

13.6.1 Soils and Geology

13.6.1.1 Construction Phase

Threats to soil and *subsoil*

The threats of erosion, compaction and loss of organic matter on soils and subsoils during construction will be mitigated by pre-construction design and soil management in accordance with the Defra (2009) guidance document.

All earthworks will be undertaken in accordance with a project-specific earthworks specifications ensuring that all excavated material and imported material is classified appropriately to allow maximum opportunity for the reuse of materials on the proposed development.

Where compaction of the soils and subsoils has occurred under trafficked areas, haul roads and construction compounds, decompaction of the soils and subsoils is required. Where practical, compaction of any soil or subsoil which is not part of the works or to remain in-situ within the site will be avoided.

The area that will result in sealing of the soil should be minimised in the detailed design.

Loss or damage of future quarry or pit reserves

The excavated rock will be re-used as general fill onsite where feasible minimising the loss of the feature. The Contractor will ensure acceptability of the material for re-use within the proposed development boundary with appropriate handling, processing and segregation of the material.

Disturbance of natural ground

Earthworks haulage will be along predetermined routes within and outside the proposed development boundary. The identified haulage routes are along existing national, regional, and local routes or within the proposed development boundary extents.

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 with the proposed development will be avoided.

Washout of Fines / Sediment Runoff

The design and construction of pre-earthworks drainage on the proposed development will control the surface water runoff on the site. The pre-earthworks drainage design will incorporate sediment control measures such as silt fences, straw wattles, sediment traps and water filtration. Care will be undertaken in earthworks activities to minimise dust generation, groundwater infiltration, and generation of run-off.

Sediment control methods are outlined in the Construction Environment Management Plan (CEMP) in **Appendix 5.1** in **Volume 4** of this EIS.

Degradation of material for reuse

The earthworks will be undertaken in accordance with a project-specific earthworks specifications ensuring that the excavated and imported material is classified appropriately to allow maximum opportunity for the reuse of materials on the proposed development. Overburden and rock excavated on the site will be assessed for re-use. The excavation, management, stockpiling and placement of engineering fill shall be undertaken in accordance with best practice to retain the existing structure and integrity of the excavated materials. Processing of marginal or unacceptable material should be considered where possible. Material that is not suitable for reuse will be exported off site for disposal or recovery at appropriately licensed or permitted sites.

Earthworks operations will be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe run-off and prevent ponding and flooding and degradation of formation.

Geological Heritage Area

The Geological Survey of Ireland (GSI) was consulted on the effect the proposed development on the Ringaskiddy County Geological Site (CK077). The GSI state that machinery accessing Gobby Beach to place the beach nourishment material above the foreshore should aim to minimise damage to limestone boulder erratics and bedrock outcrops within the heritage area. Appropriate mitigation measures should be put in place to minimise or mitigate potential effects. The GSI is to be consulted on these mitigation measures in advance of any on-site works and will require a site visit to confirm these measures are being undertaken.

Potential Ground Contamination

It is proposed to excavate areas of made ground and export this material offsite to an appropriate licensed facility. The material shall undergo assessment in accordance with EPA guidance (2021) and the material shall be categorised in accordance with the Waste Framework Directive (2008) to classify the material for export offsite.

Geohazards and Landslide Risk

Bulk excavations for foundations on the site will be undertaken in accordance with best practice to ensure stability of open excavations and cut slopes on the site. It is proposed to construct retaining structures and retention systems in Area 2 while excavating and regrading the site to ensure a safe working environment for construction workers.

Ongoing coastal processes are causing failure on the cliff face of the eastern coastal boundary but the proposed development has been located a sufficient distance from the eastern coastal boundary to ensure that the waste-to-energy facility will not enhance or accelerate the natural process of coastal retreat at this location (Refer to **Appendix 13.3** ***Coastal Erosion Study***).

The proposed placement of sacrificial beach nourishment material above the foreshore will mitigate the coastal erosion process of the cliff face.

13.6.1.2 Operational Phase

All substances that would have the potential to cause a negative effect on the soils and geology will be stored in appropriate containers and, if required, placed within bunded areas in the proposed development. All storage tanks for chemicals will be fully bunded or double skinned. Raw materials for the process will be stored in containers or silos within the process building. Residues will be stored in the bottom ash hall and silos within the process building.

All waste entering the facility will be stored in fully contained structures. All waste storage facilities will be rendered impervious to the materials stored therein. All concrete underground storage structures whether for waste or liquid (as there is a possibility that firewater run-off may enter any of the tanks) will be constructed as watertight structures in accordance with the requirements of relevant Codes of practice such as EN 1992-3:2006 Eurocode 2 – Design of Concrete Structures – Part 3: Liquid retaining and containment structures.

Typically, these structures will be reinforced concrete with minimum wall and base thicknesses of 250 mm or greater depending on the structural requirements. The construction of these tanks will comply with the requirements of the Eurocode. The structures will be integrity tested to confirm that they are watertight. This will be demonstrated to the satisfaction of the EPA following installation and prior to use for storage.

Similarly, the storm water attenuation tank (which could also contain fire-water run-off) will be a watertight unit, which will be tested and demonstrated to be watertight to the satisfaction of the EPA.

The waste bunker will be constructed in accordance with the requirements of relevant Codes of practice such as EN 1992-3:2006 Eurocode 2 – Design of Concrete Structures – Part 3: Liquid retaining and containment structures. This will prevent any potential leakage of leachate from the waste to soil or groundwater.

All underground process piping or process drains, which will contain liquids which could cause contamination, will be double contained and regularly maintained and inspected for integrity.

Rainwater run-off from fire-fighting in external areas, which could be contaminated, will drain to the surface water drainage system and will be collected in the storm water holding tank. Run-off from fire-fighting in the bunker area will be collected in the bunker. Run-off from fire-fighting in other parts of the waste-to-energy facility will be collected by the floor drains and held in the recovered water tank. Refer to **Chapter 4** ***Description of the Proposed Development*** of this EIS, for a description of the firewater containment systems.

Roads, hard standings and yard areas will be paved to prevent any contamination of groundwater or soil. Storm water run-off from these areas will drain via hydrocarbon interceptors and will be collected in the storm water holding tank where it will be sampled to ensure that contaminated surface water will not be discharged from the site.

Tanker loading and unloading operations in the waste-to-energy facility will be undertaken in a dedicated tanker loading/unloading bay which will have a local collection system and holding tank to contain any spillage.

13.6.2 Hydrogeology

13.6.2.1 Construction Phase

Good construction management practices, as outlined in the CIRIA guidance Control of Water Pollution from Construction Sites Guidance for consultants and contractors (Masters-Williams *et al*., 2001) will be employed by the appointed contractor to minimise the risk of transmission of hazardous materials as well as pollution of groundwater. The construction management of the site will take account of these recommendations to minimised as far as possible the risk of groundwater contamination.

Measures to be implemented to minimise the risk of spills and contamination of waters include:

- Employing only competent and experienced workforce, and site-specific training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures.
- Ensure that all areas where liquids (including fuel) are stored, or cleaning is carried out, are in designated impermeable areas that are isolated from the surrounding area and within a secondary containment system, e.g., by a roll-over bund, raised kerb, ramps or stepped access.
- Good housekeeping at the site (daily site clean-up, use of disposal bins, etc.) during the entire construction phase.
- Potential pollutants to be adequately secured against vandalism.
- Provision of proper containment of potential pollutants according to codes of best practice.
- Thorough control during the entire construction phase to ensure that any spillage is identified at early stage and subsequently effectively contained and managed.

Appendix 5.1 ***CEMP*** also addresses good construction management practices that will be employed to prevent the risk of pollution of the existing groundwater and to manage any groundwater dewatering during construction.

To mitigate any potential risks regarding groundwater contamination, groundwater monitoring campaigns are recommended.

13.6.2.2 Operational Phase

Roads, hard standings and yard areas in the eastern part of the site will be paved. Surface water run-off from such areas and from the roofs of the buildings will be collected in the surface water drainage system. This will reduce the infiltration of surface water into the groundwater, in the western part of the site, and have a minor effect on the groundwater flow regime. The levels of the western field will be raised but the area will not be paved. This will allow the infiltration of surface water into the groundwater.

Regular monitoring of groundwater levels and groundwater quality analysis are recommended. This will detect any possible changes in groundwater level and quality during the operational phase of the proposed development.

13.6.3 Hydrology

13.6.3.1 Construction Phase

There are no existing watercourses on site. Cork Harbour, with associated protected areas, lies adjacent to the eastern boundary of the site. The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, seawater or groundwater. In general, storm water will be infiltrated to ground via managed soakaways. The laydown areas will be suitably drained and any areas which will involve the storage of fuel and refuelling will have paved areas with bunding and hydrocarbon interceptors to ensure that no spillages will get into the surface water or groundwater systems.

The proposed placement of sacrificial material on the beach will be undertaken above the foreshore on Gobby Beach. Clean material will be used. Refuelling of equipment will not be allowed on the beach.

13.6.3.2 Operational Phase

During operation, as described above, surface water will be contained within the site. The surface water discharge will be monitored prior to discharge and if an out of specification reading is detected the pumps will be shut off and all contaminated runoff will be contained within the retention tank system i.e. both surface water tanks.

In the event of a fire on site, the water used for fire-fighting will be retained.

As discussed above, the levels of the low-lying parts of the site will be raised to 4.55m OD. This development level will offer a very high standard of flood protection to the site. Refer to **Appendix 13.4 *Flood Risk Assessment*** for further details. This measure will ensure that the risk of flooding to the site is very low. The finished floor level of the buildings on the site will be set at even more conservative levels, all above 5m OD.

It is proposed to upgrade the L2545 to address the risk of flooding of the road. The upgrade works will include raising a 190m section of the road to a maximum height of 3.495m OD between the car park adjacent to Gobby Beach and the eastern end of the Hammond Lane Metal Company site. This is approximately 1.0m above the existing road level. This will elevate the road to above the 200-year design tidal water level plus an allowance for climate change. This will offer a high level of protection to the road from tidal flooding and ensure that access and egress routes are maintained during extreme flood events.

A new dedicated surface water drainage system will also be installed as part of the upgrade works to collect, convey and attenuate the runoff from the road before connecting back into the existing drainage to discharge to the foreshore.

These measures are sufficient to ensure that the risk of flooding of the site and L2545 is extremely low.

13.6.4 Coastal Recession

13.6.4.1 Construction Phase

Access to the recreational amenity of Gobby Beach shoreline and nearby car park will be temporarily impacted (for approximately 3 weeks) during the placement of sacrificial beach material. The sacrificial material consists of imported shingle which will be temporarily deposited on the car park. To ensure the safety of the general public, it is envisaged that the area of the beach, in which the construction works will taking place and the area of the car park in which the materials will be stored, and which will be used by the machinery, will be closed to the public for the duration of the proposed works. However, access to other sections of the beach will be maintained for the duration of the works.

13.6.4.2 Operational Phase

Refer to **Section 13.6.4.1** above. No other mitigation measures are proposed.

13.7 Residual Effects

It is expected that, with the implementation of the mitigation measures described above, the construction and operation of the proposed development will not result in significant negative effects on soils, geology, hydrology or hydrogeology and coastal recession (Refer to **Table 13.35)**. There will be a positive effect on the L2545 due to the improvement in drainage.

The placing of the sacrificial material, acting as beach nourishment on Gobby Beach above the foreshore, will reduce the rate of recession of the glacial till slope along the eastern site boundary. It is noted that the construction effects experienced during the placement of the shingle will be repeated when the shingle is reapplied in the future.

The proposed development will not increase the current rate of retreat. Coastal protection mitigation measures are not required for the waste-to-energy facility element of the proposed development. However, given the concerns raised by An Bord Pleanála during the previous planning application in 2008 and given the low risk that the amenity walkway and viewing platform could be impacted in 40 years' time, coastal protection measures have been included in this planning application as a precautionary measure so as to reduce the rate of erosion of the glacial till face.

The waste-to-energy facility will not be impacted by the predicted retreat rates over the design life of the planning permission (30 years). However, there could be a risk of an impact on a small section of the proposed development after 40 years however this would be confined only to the amenity walkway and viewing platform outside of the security fence line.

The coastal protection measures will have no negative effects on the adjoining areas. However, there will be benefits associated with the works as well as the provision of an environmentally friendly solution. The net coastal sediment transport goes from south to north according to wind conditions and swell, therefore the material is likely to move towards the north in the medium and long term. The closest area of the Cork Harbour Special Protection Area (SPA) is located to the southwest of the site. Since the net movement of beach nourishment shingle is from south to north, the sacrificial material will not impact on this part of the SPA. Other sections of the SPA which are to the north of the site are more than two kilometres from the site and these are too remote from the site to receive any significant quantities of beach nourishment material.

The proposed development will have no negative effects on the M28 Cork to Ringaskiddy Motorway Scheme.

Table 13.35: Residual Effects for Construction and Operational Phase

Feature	Description	Importance	Magnitude	Effect	Significance	Mitigation Measure	Residual Effect (construction and operational)
Soils and Geology							
Threats to Soils and Subsoils							
Agricultural Soils	Acid Brown Earths (AminDW)	High	Small Adverse	Reduction in soil quality	Moderate / Slight	Refer to **Section 13.6.1**	Imperceptible
	Acid Brown Earths (AminDW)	High	Negligible	Loss of feature	Imperceptible	Refer to **Section 13.6.1**	Imperceptible
	Lithosols/Regosols (AminSW)	High	Small Adverse	Reduction in soil quality	Moderate / Slight	Refer to **Section 13.6.1**	Imperceptible
	Lithosols/Regosols (AminSW)	High	Negligible	Loss of feature	Imperceptible	Refer to **Section 13.6.1**	Imperceptible
Soil Health	Soil (Brown Earths)	High	Small Adverse	Erosion, compaction	Moderate / Slight	Refer to **Section 13.6.1**	None
	Soil (Brown Earths)	High	Moderate Adverse	Sealing	Significant/Moderate	Refer to **Section 13.6.1**	None
	Soil (Brown Earths)	High	Small Adverse	Loss of organic matter	Moderate / Slight	Refer to **Section 13.6.1**	Imperceptible
	Soil (Brown Earths)	High	Negligible	Loss of feature	Imperceptible	Refer to **Section 13.6.1**	Imperceptible

Feature	Description	Importance	Magnitude	Effect	Significance	Mitigation Measure	Residual Effect (construction and operational)
	Subsoil (Till derived from Devonian Sandstones)	Medium	Small Adverse	Erosion, compaction	Slight	Refer to **Section 13.6.1**	None
	Subsoil (Till derived from Devonian Sandstones)	Medium	Moderate Adverse	Sealing	Moderate	Refer to **Section 13.6.1**	None
	Subsoil (Till derived from Devonian Sandstones)	Medium	Negligible	Loss of organic matter	Imperceptible	Refer to **Section 13.6.1**	Imperceptible
	Subsoil (Till derived from Devonian Sandstones)	Medium	Negligible	Loss of feature	Imperceptible	Refer to **Section 13.6.1**	Imperceptible
Loss or Damage of Future Quarry Reserves							
Mineral/Aggregate Resources	Crushed Rock Aggregate Potential	Very high	Small Adverse	Irreversible loss / damage of future quarry reserve	Imperceptible	Refer to **Section 13.6.1**	None
	Granular Aggregate Potential	Medium	Negligible	Irreversible loss / damage of future quarry reserve	Imperceptible	Refer to **Section 13.6.1**	None
Loss or Damage to Geological Heritage Areas							
Geological Heritage Site	Ringaskiddy (CK077)	High	Small Adverse	Irreversible loss / damage of geological heritage area due to the placement of sacrificial material	Moderate / Slight	Refer to **Section 13.6.1**	Imperceptible
	Haulbowline and Rocky Islands (CK053)	High	Negligible	Irreversible loss / damage of geological heritage area	Imperceptible	Refer to **Section 13.6.1**	None
Earthworks							

Feature	Description	Importance	Magnitude	Effect	Significance	Mitigation Measure	Residual Effect (construction and operational)
Soils and Subsoils	Noise, dust and vibrations caused from excavation and haulage of earthworks materials	High	Moderate Adverse	Disturbance of natural ground	Significant/Moderate	Refer to **Section 13.6.1**	Imperceptible
	Sediment run off from cuttings, excavations and stockpiles	High	Moderate Adverse	Wash out of fines/sediment runoff	Significant/Moderate	Refer to **Section 13.6.1**	Imperceptible
Subsoils	Poor earthworks practices/management will result in decreasing the % reuse of site won acceptable material for reuse	High	Moderate Adverse	Degradation of material for reuse	Significant/Moderate	Refer to **Section 13.6.1**	None
Potential Ground Contamination							
P0997-01	The Hammond Lane Metal Company Ltd	High	Negligible	Potential Source of Contamination	Imperceptible	Refer to **Section 13.6.1**	None
Made Ground	Described as soft to firm clay/silt/gravel with medium cobble content	High	Small Adverse	Potential Source of Contamination	Moderate / Slight	Refer to **Section 13.6.1**	None
Potential Ground Contamination	Potential for leakage or spillage of construction related materials, contaminating the subsoils present	High	Small Adverse	Potential Source of Contamination	Moderate / Slight	Refer to **Section 13.6.1**	None
Geohazard and Landslide Susceptibility							
Coastal Erosion	Eastern coastal boundary of the proposed development that is actively eroding and slope failures are occurring	High	Negligible	Failure of slope causing a landslide	Imperceptible	Refer to **Section 13.6.1**	Imperceptible
Landslide Susceptibility	Landslide risk in Area 2, 3 and 4 of the proposed development	High	Small adverse	Failure of slope causing a landslide	Moderate / Slight	Refer to **Section 13.6.1**	Imperceptible
Hydrogeology							
Loss or Damage of Proportion of Aquifer							

Feature	Description	Importance	Magnitude	Effect	Significance	Mitigation Measure	Residual Effect (construction and operational)
Locally Important Aquifer (Ll)	Bedrock which is Generally Unproductive except for Local Zones	Medium	Small Adverse	Loss or damage of proportion of aquifer through excavation.	Slight	Refer to **Section 13.6.2**	Imperceptible
Change to groundwater regime							
Locally Important Aquifer (Ll)	Bedrock which is Generally Unproductive except for Local Zones	Medium	Small Adverse	Change in the groundwater levels	Slight	Refer to **Section 13.6.2**	Imperceptible
Potential Effects on Groundwater Quality							
Locally Important Aquifer (Ll)	Groundwater Contamination related to accidental spillage	Medium	Small adverse	Effects on Groundwater Quality	Slight	Refer to **Section 13.6.2**	Imperceptible
Locally Important Aquifer (Ll)	Groundwater Contamination related to existing high PAH levels in a few areas	Medium	Small adverse	Effects on Groundwater Quality	Slight	Refer to **Section 13.6.2**	Imperceptible
Groundwater Contamination Sites							
Locally Important Aquifer (Ll)	Groundwater Contamination	Medium	Small adverse	Effects on Groundwater Quality	Slight	Refer to **Section 13.6.2**	Imperceptible

13.8 Cumulative Effects

The potential for cumulative effects as a result of the construction and operation of the proposed development and the following projects has been evaluated (full details on these projects are included in **Chapter 16 *Cumulative Impacts, Other Impacts and Interactions***)

Proposed Projects

- **Port of Cork (Planning Ref. No. OA04.321875)** - Ringaskiddy Port Redevelopment
- **Port of Cork (Planning Ref. No. 224356)** New Vehicular Entrance and Temporary Use of Lands for Open Storage of Port Related Cargo
- **Janssen Sciences Ireland UC (Planning Ref. No. 254704) –** Permission for an upgrade and extension to the existing biomedicines manufacturing facility
- **Pfizer Ireland Pharmaceuticals (Planning Ref. No. 235834) –** Permission for construction of Bld. 124 – Site Lab Building
- **Electricity Supply Board (ESB) (Planning Ref. No. 235104) –** Construction/installation of an open cycle gas turbine (OCGT) generating unit and associated plant and equipment.

13.8.1 Soils and Geology

The M28 Cork to Ringaskiddy Motorway Scheme between the proposed Ringaskiddy and Loughbeg roundabout intersects the northwestern boundary (Area 1) of the proposed development. The project is currently at Phase 6 Construction and Implementation and construction is due to finish by Q3 2028. Planning drawings for this section of the M28 in the M28 Cork to Ringaskiddy Project Environmental Impact Statement reveal the cut to be 11m deep at the centreline. Observations made during a site walkover undertaken in February 2025 revealed the southern cut face to be >11m in depth as the topography rises in this area. The stratigraphic profile of the southern cut face comprises of glacial till overlying mudstone/sandstone bedrock.

It is proposed to raise the existing ground levels in Area 1 (western field) to 4.55m OD using site won material. This activity could induce instability in the M28 cut slope face and therefore its effect is moderate adverse resulting in a significant/moderate effect. The potential effect can be mitigated in the earthworks design for Area 1.

It is not expected that the remaining projects as outlined above will have significant cumulative effects on soils, geology, hydrogeology, hydrology.

13.8.2 Coastal Recession

Future marine traffic due to Port of Cork Redevelopment may cause additional wave action due to vessels which might impact the wave erosion effects on cliffs in the future. However, compared with wave action from storms, any increased effect from shipping is expected to be negligible.

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